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Waste Isolation Pilot Plant Biennial Environmental Compliance Report - AMENDED

United States Department of Energy
Waste Isolation Pilot Plant

Carlsbad Field Office
Carlsbad, New Mexico

Revision 0

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ACRONYMS, ABBREVIATIONS, AND UNITS OF MEASURE

AEA	Atomic Energy Act
ALARA	as low as reasonably achievable
AQB	Air Quality Bureau
BECR	Biennial Environmental Compliance Report (this document)
BLM	Bureau of Land Management
BTU	British thermal unit
C of C	Certificate of Compliance
CAA	Clean Air Act
CAAA	Clean Air Act Amendments of 1990
CAP88	Clean Air Act Assessment Package-1988
CBFO	Carlsbad Field Office
CCA	Compliance Certification Application
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	chlorofluorocarbon
CFO	(BLM) Carlsbad Field Office
CFR	Code of Federal Regulations
CH	contact-handled
CMR	Central Monitoring Room
COA	Conditions of Approval
CRA	Compliance Recertification Application
CX	categorical exclusions
CY	calendar year (when used with a specific year)
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOT	U.S. Department of Transportation
DP-831	discharge permit 831
DSA	Documented Safety Analysis
EA	environmental assessment
EDE	effective dose equivalent
EIS	environmental impact statement
EMS	environmental management system
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ESA	Endangered Species Act
FAS	fixed air sampler
Fed. Reg.	Federal Register
FEIS	WIPP Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act

FLPMA	Federal Land Policy and Management Act
FONSI	Finding Of No Significant Impact
gpd	gallons per day
GWPA	Ground Water Protection Act
GWQB	Ground Water Quality Bureau
HalfPACT	half package transporter
HAP	hazardous air pollutant
HCIA	Hazardous Chemicals Information Act
HEPA	high efficiency particulate air
HMTA	Hazardous Materials Transportation Act
HSWA	Hazardous and Solid Waste Amendments of 1984
HWA	Hazardous Waste Act
HWDU	hazardous waste disposal unit
ICRP	International Commission on Radiological Protection
ISO	International Organization for Standardization
kg	kilogram(s)
LEPC	Local Emergency Planning Committee
LDRs	Land Disposal Restrictions
LMP	Land Management Plan
LWA	Land Withdrawal Act
MEI	maximally exposed individual
MeV	megaelectron-volt
µm	micrometer
mg/l	milligram(s) per liter
MOC	Management and Operating Contractor
MOU	Memorandum of Understanding
mrem	millirem
MSDS	Material Safety Data Sheet
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFA	no further action
NHPA	National Historic Preservation Act
NMAC	New Mexico Administrative Code
NMDG&F	New Mexico Department of Game and Fish
NMDHS	New Mexico Department of Homeland Security
NMED	New Mexico Environment Department
NMSA	New Mexico Statutes Annotated
NOI	notice of intent
NRC	U.S. Nuclear Regulatory Commission

NSPS	New Source Performance Standards
NWP	Nuclear Waste Partnership LLC
NWPA	Nuclear Waste Policy Act
PA	public address
PAAA	Price-Anderson Amendments Act of 1988
PCB	polychlorinated biphenyl
pCi/l	picocuries/liter
Permit	Hazardous Waste Facility Permit
PMR	permit modification request
PSD	prevention of significant deterioration
Pub. L.	Public Law
QA	quality assurance
QAP	quality assurance program
QAPD	Quality Assurance Program Description
RCRA	Resource Conservation and Recovery Act
RH	remote-handled
ROD	record of decision
RQ	reportable quantity
SA	Supplement Analysis
SAA	satellite accumulation area
SAR	safety analysis report
SARA	Superfund Amendments and Reauthorization Act of 1986
SDWA	Safe Drinking Water Act
SEIS	supplemental environmental impact statement
SERC	State Emergency Response Commission
SHPO	State Historic Preservation Officer (or Office)
SPEP	Salt Pile Evaporation Pond
SSA	Salt Storage Area
SSE	Salt Storage Extension
SSEB	Salt Pile Extension Basin
SSP	site sustainability plan
SWIC	storm water infiltration control (ponds)
SWMR	Solid Waste Management Regulations
SWMU	solid waste management unit
TDS	total dissolved solids
TE	transportation engineer
TKN	total Kjeldahl nitrogen
tpy	tons per year
TPQ	threshold planning quantity
TRANSCOM	Transportation Tracking and Communications System
TRAMPAC	Transuranic Waste Authorized Methods for Payload Control
TRU	transuranic
TRUPACT	transuranic package transporter

TSCA	Toxic Substances Control Act
TSDF	treatment, storage, and disposal facility
TSR	technical safety requirement
U.S.	United States
U.S.C.	United States Code
USFWS	U.S. Fish and Wildlife Service
USQ	unreviewed safety question
UST	underground storage tank
VOC	volatile organic compound
WAC	Waste Acceptance Criteria
WAP	Waste Analysis Plan
WHB	Waste Handling Building
WIPP	Waste Isolation Pilot Plant
WQSP	Water Quality Sampling Program

1.0 INTRODUCTION

This Biennial Environmental Compliance Report (BECR), the eleventh to be issued, documents United States (U.S.) Department of Energy (DOE) compliance with environmental regulations applicable to the Waste Isolation Pilot Plant (WIPP), a facility designed and authorized for the safe disposal of transuranic (TRU) radioactive mixed waste. TRU waste is radioactive waste that contains alpha-emitting radionuclides of atomic number greater than 92, with half lives longer than 20 years, and which are present in concentrations greater than 100 nanocuries per gram of waste.

The BECR meets the requirements of the WIPP Land Withdrawal Act (LWA) (Public Law [Pub. L.] 102-579, as amended by Pub. L. 104-201, Subtitle F, WIPP Land Withdrawal Act, Amendments of 1996). Specifically, the BECR documents DOE compliance at the WIPP facility with environmental regulations and permits issued pursuant to the following:

- Title 40 *Code of Federal Regulations* (CFR) Part 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," Subpart A, "Environmental Standards for Management and Storage"
- Clean Air Act (CAA) (42 *United States Code* [U.S.C.] §§7401, et seq.)
- Solid Waste Disposal Act (42 U.S.C. §§6901-6992, et seq.)
- Safe Drinking Water Act (SDWA) (42 U.S.C. §§300f, et seq.)
- Toxic Substances Control Act (TSCA) (15 U.S.C. §§2601, et seq.)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. §§9601, et seq.)
- New Mexico Hazardous Waste Act (HWA) (74-4-1 through 74-4-14 New Mexico Statutes Annotated [NMSA])
- All other applicable federal laws pertaining to public health and safety or the environment
- All regulations promulgated, and all permit requirements, under the laws listed above

This BECR addresses the reporting period of April 1, 2012, through March 31, 2014, with the exception of annual radiation doses. These must be calculated for each calendar year (CY) as required by DOE reporting requirements; this BECR includes annual radiation doses for CY 2012 and 2013.

1.1 Organization of the Report

Sections in this BECR correspond to federal or state laws, or in the absence of a law, regulatory programs that are relevant to the WIPP facility. Federal laws are addressed first, followed by New Mexico state laws. Each section summarizes the law and its implementing regulations and applicability to the WIPP facility. Requirements are noted in tables. The italicized text may be a direct quote from the regulation cited or, in cases where the requirements are lengthy, a summary. Italicized text is followed by an explanation of how the WIPP facility is compliant.

Local laws or ordinances that apply to the WIPP facility are limited to those under the authority of the Eddy County Commission, Eddy County, New Mexico. County ordinances are not environmental in scope and are not included in the report.

For the WIPP Hazardous Waste Facility Permit (Permit), the DOE and its management and operating contractor (MOC) are collectively referred to as the Permittees. For all other permits, the DOE is the Permittee.

1.2 Compliance Management at the WIPP Facility

The DOE and its MOC are fully committed to conducting operations at the WIPP facility in compliance with applicable regulations and permit conditions, and to protecting public health and the environment.

The WIPP environmental management system (EMS) provides a framework for ensuring compliance with environmental requirements. The WIPP EMS is an International Organization for Standardization (ISO) 14001 certified system and, as such, is based on the Plan-Do-Check-Act cycle. Compliance management is incorporated throughout the four phases of the cycle as described below.

Plan

- Potential environmental impacts and permit or regulatory requirements are identified and addressed when planning for proposed projects or changes in equipment, operations, and procedures.
- Changes in existing regulations and new regulations are evaluated for applicability to operations.
- Objectives and targets are set annually to improve environmental performance.

Do

- Compliance is incorporated into daily work activities through implementation of programs, plans, and procedures, including a rigorous Conduct of Operations program.
- An in-depth training and qualification program is in place to ensure competence of WIPP employees.

- Expectations for compliance are clearly communicated to all employees and contractors.

Check

- Ongoing checks of compliance and protection of public health and the environment are performed via the *WIPP Environmental Monitoring Plan* (DOE/WIPP-99-2194) (DOE, 2013a) and the Carlsbad Field Office (CBFO) Integrated Evaluation Plan described in the CBFO Contractor Oversight Plan (DOE, 2012a).

- The *WIPP Environmental Monitoring Plan* (DOE/WIPP-99-2194) (DOE, 2013a) directs the programs that monitor for radiological and non-radiological impacts and compliance with land management requirements.

- As part of the Integrated Evaluation Plan, assessments, surveillances, and audits of the WIPP facility compliance status are performed by both the CBFO and the MOC. The plan provides a comprehensive system to assess project compliance with applicable environmental laws, regulations, and procedural requirements and determine the adequacy, implementation, and effectiveness of the WIPP facility compliance programs.

- Rigorous processes are employed for implementing corrective actions and verifying their effectiveness.

- Certification to the ISO 14001 management system standard is maintained. This requires routine audits of the EMS to ensure it continues to meet the standard.

Act

- Annual reviews of the EMS, environmental performance and compliance status are performed by senior management.

- Enhancements to the EMS are directed from management review.

1.3 Events for Reporting Period

On February 5, 2014, the Permittees reported a fire in the WIPP facility underground. Waste shipments from generator sites were suspended. On February 14, 2014, a radiological event occurred in the WIPP facility underground. The facility remained in "stand down" mode as of the end of this BECR reporting period.

More details on these events are provided in sections 2.2, 3.2, 6.2, 9.2, 13.2, and 25.2.3 of this report.

1.4 Compliance Issues for Reporting Period

On February 27, 2014, an Administrative Order (NMED, 2014) was issued by the New Mexico Environment Department (NMED) that required the commencement of weekly reporting no later than 15 days after the issuance of the Order. The weekly reports are available online at http://www.wipp.energy.gov/library/Information_Repository_A/IR_2014.htm. The Administrative Order was issued to address a schedule of compliance for some permit-required actions. WIPP has complied with the NMED's Administrative Order requirements to maintain a compliant status.

1.5 Background of the Waste Isolation Pilot Plant Project

The WIPP facility was authorized by the DOE National Security and Military Applications of Nuclear Energy Authorization Act of 1980 (Pub. L. 96-164; 93 Stat. 1259, 1265). This legislation mandated that the DOE provide a research and development facility to demonstrate the safe disposal of radioactive waste resulting from U.S. defense activities and programs.

In January 1981, the DOE announced its decision to proceed with phased development of the WIPP facility, located in Eddy County in southeastern New Mexico, 26 miles east of the city of Carlsbad. The decision called for the facility to be built to accommodate 6.2 million cubic feet of contact-handled (CH) TRU waste and 0.25 million cubic feet of remote-handled (RH) TRU waste. The LWA subsequently limited the total WIPP capacity to 6.2 million cubic feet of TRU waste.

After completion of the site and preliminary design validation phase, the construction phase at the WIPP site began in 1983. The largest surface building is the Waste Handling Building (WHB), which includes areas for the receipt, inspection, storage, and transfer of waste to the underground. The WIPP underground consists of four shafts, the waste disposal area, an area for equipment and maintenance, an experimental area, and connecting tunnels 2,150 feet below the land surface in a 2,000-foot-thick bedded salt formation.

Originally, the construction phase was to be followed by the pilot plant phase. Following the preparation of DOE/EIS-0026-FS, *Final Supplement Environmental Impact Statement for the Waste Isolation Pilot Plant* (SEIS-I) (DOE, 1990a) in 1990, the DOE decided that the construction phase was to be followed by a test phase, during which tests with TRU waste were to be conducted in the WIPP underground. On October 21, 1993, the DOE announced its decision not to conduct the TRU waste tests underground, but instead to conduct enhanced laboratory tests.

DOE/EIS-0026-S-2, *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (SEIS-II) (DOE, 1997a) was issued in September 1997. The SEIS-II analyzed the environmental impacts of disposal phase operations at the WIPP facility in light of additional information and circumstances that

had changed since 1990, and also assessed alternatives for disposing of TRU waste at the WIPP facility.

Requirements for 40 CFR Part 191, Subparts B and C were addressed in the Compliance Certification Application (CCA) (DOE, 1996a) submitted to the U.S. Environmental Protection Agency (EPA) in 1996. The EPA certified DOE compliance in 1998.

The Record of Decision (ROD) for the SEIS-II (*Record of Decision for the Department of Energy's Waste Isolation Pilot Plant Disposal Phase*, 63 Federal Register [Fed. Reg.] 3623-3629) was issued January 23, 1998 (DOE, 1998). The selected alternative from the SEIS-II analysis was to dispose of defense-related TRU waste meeting the requirements in the WIPP waste acceptance criteria (WAC), and to transport waste to the WIPP facility by truck, with a future option of transportation by rail.

The receipt and disposal of the first TRU waste shipment in March 1999 initiated the disposal phase, which continues through this reporting period. Currently, waste is being disposed of in Panel 7.

The disposal phase will be followed by closure, which includes the decontamination and decommissioning phase for support structures.

2.0 RESOURCE CONSERVATION AND RECOVERY ACT AND SOLID WASTE DISPOSAL ACT

2.1 Summary of the Law

The Resource Conservation and Recovery Act (RCRA), enacted in 1976, is a statute designed to provide “cradle-to-grave” control of hazardous waste by imposing management requirements on generators and transporters of hazardous wastes and on the owners and operators of treatment, storage, and disposal facilities (TSDFs).

In 1965, Congress enacted the Solid Waste Disposal Act (42 U.S.C. §§3251, et seq.). This act dealt with solid waste disposal and gave the states the responsibility for developing solid waste management plans. In 1970, Congress passed the Resource Recovery Act to provide the EPA with funding for resource recovery programs. The RCRA amended the Solid Waste Disposal Act and incorporated the intent of the Resource Recovery Act of 1970. The Hazardous and Solid Waste Amendments of 1984 (HSWA) (42 U.S.C. §6924[b][4]) reauthorized RCRA, expanded its scope significantly, and altered many of its provisions. The Federal Facilities Compliance Act of 1992 (Pub. L. 102-386) amended the RCRA, subjecting federal agencies to all substantive and procedural requirements of federal, state, and local solid and hazardous waste laws. The term “RCRA” is used throughout this document to refer to the reauthorized law as amended.

There are two major objectives of the RCRA. The first is to promote the protection of human health and the environment and to conserve material and energy resources. This objective is to be accomplished through such means as ensuring that hazardous

waste management practices are conducted to protect human health and the environment, minimize the generation of hazardous waste, prohibit open dumping on the land, and require existing open dumps to be converted to facilities that pose no danger to the environment or human health. The second objective is to set national policy to reduce or eliminate the generation of hazardous waste as expeditiously as possible and to ensure that any hazardous waste generated be treated, stored, or disposed of to minimize the present and future threat to human health and the environment.

The EPA implements RCRA primarily through 40 CFR Parts 260 through 282. 40 CFR Parts 260 through 279 consist of requirements and standards pertaining to hazardous waste generation, management and disposal, including hazardous waste underground storage tanks (USTs), and 40 CFR Parts 280 through 282 pertain to the management of USTs containing petroleum products or hazardous chemicals.

Congress intended for the RCRA program to be implemented by the states. Consequently, the EPA has defined a process through which states may apply for and receive authorization to administer the RCRA program. New Mexico received authorization for the base RCRA program in January 1985, and for its mixed waste program in July 1990. The EPA granted authorization for the corrective action component of the HSWA program to the State of New Mexico in a notice that appeared in the Federal Register on October 17, 1995 (effective date: January 2, 1996). The HWA (74-4-1 through 74-4-14 NMSA 1978) is the state statute that governs hazardous waste management activities in New Mexico. New Mexico implements its hazardous waste program by way of 20.4.1 New Mexico Administrative Code (NMAC) through 20.4.3 NMAC. By virtue of this authorization, New Mexico has primary responsibility for permitting, implementation, and enforcement of most aspects of the RCRA program. The DOE received the WIPP Permit from the NMED in 1999 (NMED, 1999). The WIPP Permit was renewed in 2010 (NMED, 2010a). The requirements and compliance status for each requirement of the HWA are presented in section 25.0.

The HSWA also provides for regulations to be promulgated by the EPA that become effective and enforceable immediately by the EPA in states authorized to administer the RCRA regulations until the state subsequently adopts and is authorized to administer the new regulation. During this reporting period, there have been no new or changed regulations authorized under the HSWA in this category.

Subchapter IX of the RCRA governs the management of USTs. This portion of the RCRA and the regulations specified under 40 CFR Parts 280 and 281 (20.5 NMAC) address USTs containing petroleum products or hazardous chemicals. Requirements for UST management pertain to their design, construction, installation, and operation, as well as notification and corrective action requirements in the event of a release and actions required for out-of-service USTs. New Mexico has been authorized by the EPA to regulate USTs. The state UST requirements and compliance status for each requirement are presented in section 25.0.

Congress has specifically addressed the applicability of RCRA to the WIPP on five separate occasions. In 1984, as part of the HSWA, Congress exempted the WIPP

project from a provision that prohibited disposal of some hazardous waste in salt beds. In 1996, Congress amended the LWA and exempted waste designated by the Secretary of Energy for disposal at the WIPP facility from these land disposal restrictions (LDRs). In response to the inclusion of the RCRA Financial Assurance Requirements in the October 1999 WIPP Permit by the NMED, section 201 of the Military Construction and Appropriations Act of 2001 (Pub. L. 106-246) prohibited the use of federal monies to post a bond fulfilling the financial assurance requirements relating to closure or post-closure care and monitoring of the WIPP facility. The provision further stated that any financial responsibility requirement in a permit or license for the WIPP facility on the date of enactment of Section 201 may not be enforced against the United States or its contractors or subcontractors at WIPP. In 2003 and 2004, respectively, Congress clarified the applicability of RCRA to general waste analysis requirements for waste disposed of at the WIPP facility in the following:

- Section 311 of the Energy and Water Development Appropriations Act of 2004 (Pub. L. 108-137), enacted on December 1, 2003
- Section 310 of the Consolidated Appropriations Act of 2005 (Pub. L. 108-447), enacted on December 8, 2004

2.2 Status of Compliance with the Regulatory Requirements

Table 1 provides general information on RCRA requirements and the EPA regulations implementing those requirements.

On February 5, 2014, a vehicle fire occurred in the WIPP underground, resulting in suspension of normal waste operations and shipments from generator sites. On February 14, 2014, a Continuous Air Monitor detected airborne radiation in the underground, causing the ventilation exhaust to automatically shift to high efficiency particulate air (HEPA) filtration mode. The ventilation system remained in filtration mode through the reporting period. Entries into Panel 7 in the underground confirmed that one container from a nitrate salt bearing waste stream from Los Alamos National Laboratory was breached. Cleanup of the contamination event and investigation as to its cause are ongoing as part of the recovery process. Presently, shipments of waste to the WIPP facility remain suspended and the underground is unaccessible to normal activities. No shipments have been received at WIPP since February 6, 2014.

As of this reporting period, NMED issued one Administrative Order (NMED, 2014) to address WIPP Permit requirements that could not be met due to inaccessibility to the underground for normal activities. The Administrative Order, issued on February 27, 2014, provides requirements for monitoring and reporting to the NMED the status of recovery from the two events. It required weekly reporting on above-ground compliance and permitted surface-related requirements. The weekly reports are available online at http://www.wipp.energy.gov/library/Information_Repository_A/IR_2014.htm.

Due to the fire and radiological events occurring in the underground, impacts to human health and the environment were minimized in accordance with 40 CFR §264.31. The

Permittees are in the process of developing a WIPP Recovery Plan, that will provide the safe and environmentally sound approach for bringing the WIPP facility back to an operational state.

Table 1: Status of Compliance with the Regulatory Requirements of the Resource Conservation and Recovery Act and Solid Waste Disposal Act

Regulatory Requirement	WIPP Project Compliance
1. Compliance with the RCRA	Most of the requirements specified in RCRA are covered in more detail in the implementing regulations. The exception is RCRA §3016 (42 U.S.C. §§6937, et seq.), which requires each federal agency to provide a biennial inventory of each TSDF, as follows: *Each federal agency shall compile, publish, and submit to the EPA Administrator (and the state, if its hazardous waste program has been authorized by the EPA) an inventory of each site which the agency owns or operates at which hazardous waste is stored, treated, or disposed of at any time. The inventory shall be submitted every two years beginning January 31, 1986.* In January 2010, the EPA ruled that the RCRA 3016 report must be submitted only if significant changes have occurred at the WIPP site. This notwithstanding, the DOE CBFO submitted a RCRA 3016 Report to DOE Headquarters in January 2014.
2. Compliance with the Land Disposal Restrictions, 20.4.1.800 NMAC (40 CFR Part 268)	The LWA, as amended, exempts waste designated by the Secretary of Energy for disposal at the WIPP facility from the treatment standards of RCRA. By virtue of this exclusion, the DOE is not required to demonstrate compliance with the LDRs of 40 CFR Part 268 for TRU mixed waste designated by the Secretary of Energy for disposal at the WIPP facility. For on-site generated waste, LDR notifications have been made in accordance with requirements during this reporting period.
3. Compliance with Biennial Hazardous Waste Reporting, 40 CFR 262, 264, 265, 267, and 270	RCRA requires that large quantity generators and TSDFs submit a biennial hazardous waste report for all hazardous waste received and/or generated. The WIPP facility both receives and is a large quantity generator of hazardous waste. The 2013 Biennial Hazardous Waste Report was sent to the NMED Hazardous Waste Bureau in February 2014 (DOE, 2014a).

3.0 COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT

3.1 Summary of the Law

The CERCLA, or "Superfund," and the *Superfund Amendments and Reauthorization Ac*t of 1986 (SARA) establish a comprehensive federal strategy for responding to, and establishing liability for, releases of hazardous substances from a facility to the environment. Because the WIPP site is not a CERCLA remediation site and is not expected to become one, most of the requirements of this act do not apply. The Emergency Planning and Community Right-to-Know Act (EPCRA) (40 CFR Parts 350 through 399) was enacted as a stand-alone portion under SARA, Title III. It is described in further detail in section 4.0.

Any spills of reportable quantities (RQs) of hazardous substances must be reported to the National Response Center under the provisions of 42 U.S.C. §9603, "Notification Requirements Respecting Released Substances," and the implementing regulations in 40 CFR Part 302, "Designation, Reportable Quantities, and Notification." The Permittees are responsible for reporting and managing any release of hazardous substances at WIPP as defined in 42 U.S.C. §9601, "Definitions," in quantities equal to or greater than the RQs outlined in 42 U.S.C. §9602, "Designation of Additional Hazardous Substances and Establishment of Reportable Released Quantities; Regulations," and specified in 40 CFR Part 302. In the event of a release of a hazardous substance to the environment in an amount that meets or exceeds the RQ for that substance, a notification of the release as defined in 40 CFR §302.3 will be made to the National Response Center and other appropriate agencies by Permittee personnel as required by 42 U.S.C. §9603. Title 42 U.S.C. §9620(c), "Federal Agency Hazardous Waste Compliance Docket," establishes a docket that provides information regarding federal facilities that manage hazardous waste or from which hazardous substances may be or have been released. This information is to be submitted to the EPA by federal agencies under 42 U.S.C. §9603 or under RCRA §§3005, 3010, or 3016. Facilities listed under the docket must prepare a preliminary assessment and submit it to the EPA in accordance with CERCLA.

Under 40 CFR Part 300, "National Oil and Hazardous Substances Pollution Contingency Plan," the organizational structures and procedures are provided for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants. The *National Oil and Hazardous Substances Pollution Contingency Plan* is required by CERCLA Part 105, as well as the Clean Water Act (33 U.S.C. §1321(d), as amended by the Oil Pollution Act of 1990 (Pub. L. 101-380)).

3.2 Status of Compliance with the Regulatory Requirements

Table 2 provides general information on CERCLA requirements and the EPA regulations implementing those requirements.

Table 2: Status of Compliance with the Regulatory Requirements of the Comprehensive Environmental Response, Compensation, and Liability Act

Regulatory Requirement	WIPP Project Compliance
1. Designation of Hazardous Substances, 40 CFR §302.4	*The elements and compounds and hazardous wastes appearing in Table 302.4 are designated as hazardous substances under Section 102(a) of the Act. A solid waste, as defined in 40 CFR §261.2, which is not excluded from regulation as a hazardous waste under 40 CFR §261.4(b), is a hazardous substance … if it exhibits any of the characteristics identified in 40 CFR §§261.20 through 261.24.* Listed and characteristic hazardous wastes generated by WIPP project participants have been identified. A waste stream profile is maintained for each identified site-generated waste stream. The WIPP Waste Data System contains the listed and characteristic hazardous waste numbers, and radionuclide concentrations for waste

Table 2: Status of Compliance with the Regulatory Requirements of the Comprehensive Environmental Response, Compensation, and Liability Act

Regulatory Requirement	WIPP Project Compliance
	received from off-site generators for disposal at the WIPP facility. For materials and substances other than wastes, WIPP facility personnel maintain a system containing Material Safety Data Sheets (MSDSs). The MSDSs contain information necessary to identify any compounds included in Table 302.4.
2. Determination of Reportable Quantities, 40 CFR §302.5	*The quantity listed in the column "Final RQ" for each substance in Table 302.4 or in Appendix B to Table 302.4 is the RQ for that substance.* Reportable quantities listed in Table 302.4 and Appendix B to 40 CFR §302.4 are used to determine if releases of pure materials or hazardous substances in mixtures are reportable.
3. Notification Requirements, 40 CFR §302.6(a)	*Any person in charge of a vessel or an offshore or an onshore facility shall, as soon as he or she has knowledge of any release … of a hazardous substance … in a quantity equal to or exceeding the reportable quantity … in any 24-hour period, immediately notify the National Response Center (1-800-424-8802 or 1-202-267-2675).* There were no releases of hazardous substances that exceeded an RQ at the WIPP facility during this reporting period.
4. Releases of Mixtures or Solutions, 40 CFR §302.6(b)(1)(i) and (ii)	*If the quantity of the hazardous constituent(s) of the mixture or solution is known, notification is required where an RQ or more of any hazardous constituent is released; If the quantity of one or more of the hazardous constituents of the mixture or solution is unknown, notification is required where the total amount of the mixture or solution released equals or exceeds the RQ for the hazardous constituent with the lowest RQ* The reportable releases of hazardous constituents in mixtures are determined and reported as required in 40 CFR §§302.5 and 302.6(a). During this reporting period, there were no releases of mixtures or solutions that exceeded the RQs of any hazardous constituents.
5. Notification of Releases of Radionuclides, 40 CFR §302.6(b)(2)	*Radionuclides are subject to this section's notification requirements only in the following circumstances:* - *If the identity and quantity (in curies) of each radionuclide in a released mixture or solution is known, the ratio between the quantity released (in curies) and the RQ for the radionuclide must be determined for each radionuclide. The only such releases subject to this section's notification requirements are those in which the sum of the ratios for the radionuclides in the mixture or solution released is equal to or greater than one.* - *If the identity of each radionuclide in a released mixture or solution is known but the quantity released (in curies) of one or more of the radionuclides is unknown, the only such releases subject to this section's notification requirements are those in which the total quantity (in curies) of the mixture or solution released is equal to or greater than the lowest RQ of any individual radionuclide in the mixture or solution.* - *If the identity of one or more radionuclides in a released mixture or solution is unknown (or if the identity of a radionuclide released by itself is unknown), the only such releases subject to this section's notification requirements are those in which the total quantity (in curies) released is equal to*

Table 2: Status of Compliance with the Regulatory Requirements of the Comprehensive Environmental Response, Compensation, and Liability Act

Regulatory Requirement	WIPP Project Compliance
	or greater than either one curie or the lowest RQ of any known individual radionuclide in the mixture or solution, whichever is lower. The February 14, 2014, radiological event did not result in a release of radionuclides in excess of an RQ from the WIPP facility. See chapter 6 for further discussion of this event.
6. Notification of the Release of Heavy Metals, 40 CFR §302.6(d)	*Except for releases of radionuclides, notification of the release of an RQ of solid particles of antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, or zinc is not required if the mean diameter of the particles released is larger than 100 micrometers (μm).* There were no releases of an RQ of solid particles of heavy metals from the WIPP facility during this reporting period.

4.0 EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW ACT

4.1 Summary of the Law

Title III of the SARA, otherwise known as the EPCRA (42 U.S.C. §§11001, et seq.), authorizes a nationwide program of emergency planning as protection against accidents involving hazardous chemicals and extremely hazardous substances. The act requires a comprehensive body of information about hazardous substances to be submitted to various state and local groups. Under Subtitle A, “Emergency Planning and Notification,” facilities are required to make various notifications to the State Emergency Response Commission (SERC) and the Local Emergency Planning Committee (LEPC).

These include notification of applicability under EPCRA, designation of a facility Emergency Coordinator, and notification of extremely hazardous substance releases to the environment. Subtitle B, “Reporting Requirements,” requires the submittal of information such as inventories of specific hazardous chemicals used or stored within a facility to the SERC, LEPC, and the fire department that have jurisdiction over the facility. Within Subtitle B, the following sections outline specific reporting requirements: (1) section 311, “Material Safety Data Sheets,” directs the submission of an MSDS for each hazardous chemical present or a list of hazardous chemicals present that require an MSDS; (2) section 312, “Emergency and Hazardous Chemical Inventory Forms,” directs the annual submission of an inventory of hazardous chemicals present during the preceding year; and (3) section 313, “Toxic Chemical Release Forms,” outlines requirements for facilities to submit a toxic chemical release report to the EPA and the resident state if toxic chemicals are used at that facility in excess of established threshold amounts.

The regulations under 40 CFR Part 355, “Emergency Planning and Notification,” established the list of extremely hazardous substances, the threshold planning

quantities (TPQs), and facility notification responsibilities necessary for the development and implementation of state and local emergency response plans.

The regulations of 40 CFR Part 370, “Hazardous Chemical Reporting: Community Right-to-Know,” established reporting requirements that provide the public with vital information on the hazardous chemicals in their communities, with the intent of ensuring enhanced community awareness of chemical hazards and facilitating the development of state and local emergency response plans.

In order to inform the public and surrounding communities of releases of toxic chemicals, 40 CFR Part 372, “Toxic Chemical Release Reporting: Community Right-to-Know,” established requirements for the submission of information relating to the release of toxic chemicals under section 313.

4.2 Status of Compliance with the Regulatory Requirements

Table 3 provides general information EPCRA requirements and the EPA's regulations implementing those requirements.

Table 3: Status of Compliance with the Regulatory Requirements of the Emergency Planning and Community Right-to-Know Act

Regulatory Requirement	WIPP Project Compliance
1. Emergency Planning, 40 CFR §355.10(a)	*The requirements of this section apply to any facility at which there is present an amount of any extremely hazardous substance [as defined in 40 CFR Part 355] equal to or in excess of its TPQ…* The WIPP facility is subject to the emergency planning requirements due to the use of sulfuric acid in lead acid batteries. Lead acid batteries are used in the underground and the surface in electric carts, electric forklifts, other vehicles, and the uninterruptible power supply system.
2. Emergency Planning Notification, 40 CFR §355.20(a)	*The owner or operator of a facility subject to this section shall provide notification to the Commission that it is a facility subject to the emergency planning requirements of this part.* In 1987, the DOE made the one-time notification to the SERC that the WIPP facility is subject to emergency planning requirements.
3. Facility Emergency Coordinator, 40 CFR §355.20(b)	*The facility shall designate a facility representative who will participate in the local emergency planning process as a facility emergency response coordinator.* The Permittees have representatives on the LEPC, which was formed in 1994. The LEPC meets once a month. The Permittees are responsible for the emergency response and preparedness programs at the WIPP facility.
4. Changes Relevant to Emergency Planning, 40 CFR §355.20(c)	*The owner or operator of a facility will inform the LEPC of any changes occurring at the facility that may be relevant to emergency planning.* The DOE provides information to the LEPC regarding changes at the facility that may be relevant to emergency planning. There were no changes at the facility during this reporting period that required reporting.

Table 3: Status of Compliance with the Regulatory Requirements of the Emergency Planning and Community Right-to-Know Act

Regulatory Requirement	WIPP Project Compliance
5. Emergency Release Notification, 40 CFR §355.42	*The owner or operator of a facility shall immediately notify the community emergency coordinator for the LEPC of any area that is likely to be affected by the release and the SERC of any state likely to be affected by the release.* There were no releases from the WIPP facility that required notification to the SERC or to the LEPC during this reporting period.
6. Material Safety Data Sheet Reporting, 40 CFR §370.30 through §370.33	*The owner or operator of a facility shall submit an MSDS for each hazardous chemical present at the facility according to the minimum threshold schedule to the committee, the commission, and the fire department with jurisdiction over the facility. In lieu of the submission of an MSDS, the owner or operator may submit a list of hazardous chemicals for which an MSDS is required.* The list of hazardous chemicals is updated when new chemicals in excess of the TPQ, or 10,000 pounds, or additional hazard information for existing chemicals are received at the WIPP facility. The last updated list of hazardous chemicals that are present at the WIPP facility in amounts that exceed the TPQs was submitted on August 23, 1999 (Westinghouse Electric Corporation, Waste Isolation Division, 1999). This list also included the common name of the chemical and the hazardous components. There were no changes during this reporting period that required updating the list of hazardous chemicals.
7. Inventory Reporting, 40 CFR §370.40	*The owner or operator of a facility … shall submit an inventory form to the commission, the committee, and the fire department with jurisdiction over the facility. The inventory form on hazardous chemicals present at the facility during the preceding calendar year … shall be submitted on or before March 1 of each year.* On February 20, 2014, the DOE submitted the latest (CY 2013) *Tier II Emergency and Hazardous Chemical Inventory Report* (DOE, 2014b) to the SERC, the LEPC, and the fire departments that maintain memoranda of understanding (MOUs) with the DOE regarding the WIPP facility. The report for CY 2012 was submitted in February 2013 (DOE, 2013b).
8. Reporting Requirements and Schedule for Reporting, 40 CFR §372.30	*For each toxic chemical known by the owner or operator to be manufactured, processed, or otherwise used in excess of an applicable threshold quantity at its covered facility for a calendar year, the owner or operator must submit to the EPA and to the state a completed EPA Form R. The Form R must be submitted by July 1 of the following calendar year.* The DOE submitted Toxic Chemical Release Inventory Form R Reports for the WIPP facility to the EPA and the New Mexico Department of Homeland Security (NMDHS). The reports for CY 2012 were submitted in June 2013 (DOE, 2013c). The reports for CY 2013 were submitted in June 2014 (DOE, 2014c).

5.0 ATOMIC ENERGY ACT AND THE ENVIRONMENTAL PROTECTION AGENCY

5.1 Summary of the Law

The Atomic Energy Act (AEA) of 1954, as amended (42 U.S.C. §§2011, et seq.), initiated a national program for research, development, and use of atomic energy for both national defense and domestic civilian purposes.

The authority of the EPA to establish generally applicable standards for the protection of the public and the environment from radiation is derived from the AEA, as amended; Reorganization Plan No. 3 of 1970; the Nuclear Waste Policy Act (NWPA) of 1982, as amended (Pub. L. 97-425); and the LWA (Pub. L. 102-579, as amended). The protection standards found in 40 CFR Part 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Wastes," apply to both spent nuclear fuel and high-level radioactive waste as defined by the NWPA, and to TRU waste, which contains more than 100 nanocuries per gram of waste of alpha-emitting TRU isotopes with half-lives greater than 20 years. The standards of 40 CFR Part 191 consist of three subparts: Subpart A, "Environmental Standards for Management and Storage"; Subpart B, "Environmental Standards for Disposal"; and Subpart C, "Environmental Standards for Groundwater Protection."

Subpart A, "Environmental Standards for Management and Storage," sets the operational requirements limiting annual doses to members of the public from management and storage operations at disposal facilities operated by the DOE and not regulated by either the U.S. Nuclear Regulatory Commission (NRC) or by agreement states. The annual dose equivalent to any member of the public in the general environment may not exceed 25 millirem (mrem) to the whole body and 75 mrem to any critical organ.

The EPA audits the DOE's compliance with Subpart A of 40 CFR Part 191. Since these standards were promulgated by the EPA, they are discussed in this section rather than in section 13.0. Because Subpart A contains environmental performance standards, implementation details are left to the responsible agency. The EPA in January 1997 issued EPA 402-R-97-001, *Guidance for the Implementation of EPA's Standards for Management and Storage of Transuranic Waste (40 CFR Part 191, Subpart A) at the Waste Isolation Pilot Plant* (EPA, 1997), which includes methods for dose calculation, modeling, and reporting. In 2012, the DOE updated the *Implementation Plan for 40 CFR Part 191, Subpart A* (DOE/WIPP 00-3121) (DOE, 2012b), which continues to implement the EPA's guidance and outlines the 40 CFR Part 191, Subpart A, compliance program.

The LWA, Pub. L. 102-579, as amended, requires the EPA to establish criteria to certify the DOE's compliance with the radioactive waste disposal standards of 40 CFR Part 191, Subparts B and C with regard to the WIPP facility. In addition, the act requires that the EPA must conduct recertification of continued compliance five years after the initial receipt of TRU waste for disposal and at five-year intervals thereafter until the end of the decommissioning phase. The EPA issued certification and

recertification criteria in 40 CFR Part 194, “Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations,” on February 9, 1996 (EPA, 1996c).

5.2 Status of Compliance with the Regulatory Requirements

DOE/WIPP-96-2184, *40 CFR Part 191 Compliance Certification Application for the Waste Isolation Pilot Plant* (CCA) (DOE, 1996a) was submitted to the EPA in 1996. The EPA certified the DOE’s compliance in 1998. DOE/WIPP-04-2131, *Title 40 CFR Part 191 Subparts B and C Compliance Recertification Application* (CRA) (DOE, 2004a) was submitted to the EPA on March 24, 2004. On March 29, 2006, the EPA recertified DOE compliance. On March 24, 2009, the DOE submitted the second five-year CRA to the EPA (DOE, 2009a). On November 18, 2010, the EPA recertified DOE compliance. The third five-year CRA was submitted to the EPA on March 26, 2014 (DOE, 2014d).

Table 4 provides general information on regulatory requirements of the AEA and the EPA's standards implementing those requirements.

Table 4: Status of Compliance with the Regulatory Requirements of the Atomic Energy Act and the U.S. Environmental Protection Agency

Regulatory Requirement	WIPP Project Compliance
1. Environmental Radiation Protection Standards, 40 CFR Part 191	The standards of 40 CFR Part 191 applied to the WIPP facility as of March 26, 1999, when the first shipment of CH-TRU waste was received and emplaced for permanent disposal.
2. Standards, 40 CFR §191.03(b) (Subpart A)	*The combined annual dose equivalent to any member of the public in the general environment shall not exceed 25 mrem to the whole body and 75 mrem to any critical organ.* The results of the WIPP Effluent Monitoring Program have shown no releases of radionuclides that may adversely affect the public, thereby demonstrating compliance with the 40 CFR §191.03 standards. The regulatory standard specifies that the combined annual dose equivalent to any member of the public in the general environment resulting from discharges of radioactive material and direct radiation from such management and storage shall not exceed 25 mrem to the whole body and 75 mrem to any critical organ. In this program, the DOE emphasizes doses from releases through the air pathway. Air emissions are the only plausible pathway for radionuclide transport during receipt and emplacement of waste at the WIPP facility, either through the underground exhaust shaft exit or the ventilation system of the WHB. The DOE has demonstrated compliance with the radiation dose limits of Subpart A by conducting effluent monitoring since receipt of the CH-TRU and RH-TRU waste shipments at the WIPP facility. The CAP88 [Clean Air Act Assessment Package-1988]-PC computer modeling program is used to calculate radiation doses to demonstrate DOE compliance with the Subpart A standard. The model output specifies the effective dose equivalent (EDE) to which the public may be subjected by normal operation of the facility during the reporting periods, and is attached as appendix A to this report. CAP88-PC software provides the capability for assessments of both collective populations and maximally exposed individuals (MEIs). For both assessments, the DOE has examined radiation doses to individuals at any offsite point where there is a residence, school, business, or office. At the WIPP facility, consideration of businesses includes activities such as grazing, mining, or oil

Table 4: Status of Compliance with the Regulatory Requirements of the Atomic Energy Act and the U.S. Environmental Protection Agency

Regulatory Requirement	WIPP Project Compliance
	drilling in the vicinity of the site. Consequently, individual assessments at two locations (350 meters and 7,500 meters) are performed for demonstrating compliance with 40 CFR Part 191, Subpart A and 40 CFR Part 61, Subpart H, respectively. Note: Collective population assessment is chosen for 40 CFR Part 61, Subpart H adjunct regulatory compliance reporting, for DOE compilation uses. The data are read from a population file for determination of doses to the combined population within an 80-km (50-mile) radius. The individual assessment option provides the MEI dose estimate giving the highest EDE to any member of the public to receive in the reporting year, not to exceed 10 mrem/year. (See table 5 of this report.) In CY 2013, it was found during recalibration that sampling instrumentation at Station C had an as-found bias. The estimated airborne particulate doses were recalculated and conservatively adjusted to account for the bias, resulting in a dose increase of less than 10 percent from the original values. For CY 2012, the adjusted EDE from operations at the WIPP facility exclusive use area located 350 meters from the point of release (exhaust shaft and WHB ventilation system) was approximately 7.55E-04 mrem per year to the whole body, and 1.75E-03 mrem per year to the critical organ. In addition, for CY 2012, the adjusted EDE from facility operations to the MEI beyond the WIPP land withdrawal area located 7,500 meters from the point of release was about 1.06E-05 mrem per year to the whole body, and approximately 2.50E-05 mrem per year to the critical organ. For CY 2013, the EDE at the WIPP DOE exclusive use area located 350 meters from the point of release was approximately 5.25E-04 mrem per year to the whole body, and 1.31E-03 mrem per year to the critical organ. In addition, for CY 2013, the EDE from facility operations to the MEI beyond the WIPP land withdrawal area located 7,500 meters from the point of release was about 7.39E-06 mrem per year to the whole body, and approximately 1.81E-05 mrem per year to the critical organ. The results from CY 2012 and 2013 are well below the 25 mrem per year limit to the whole body, and the 75 mrem per year limit to any critical organ as required by 40 CFR §191.03, Subpart A.
3. Containment Requirements, 40 CFR §191.13 (Subpart B)	*The disposal systems for spent nuclear fuel or high-level or TRU radioactive waste shall be designed to provide a reasonable expectation that the cumulative releases to the accessible environment for 10,000 years shall have a likelihood of less than one chance in ten of exceeding the quantities calculated according to Table I (Appendix A) and less than one chance in 1,000 of exceeding ten times the quantities calculated in accordance with Table I.* These requirements were addressed in the CCA (DOE, 1996a) and CRAs (DOE, 2004a; DOE, 2009a; and DOE, 2014d).
4. Individual Protection Requirements, 40 CFR §191.15 (Subpart B)	*Disposal systems for waste and any associated radioactive material shall be designed to provide a reasonable expectation that, for 10,000 years after disposal, undisturbed performance of the disposal system shall not cause the annual committed effective dose (calculated in accordance with Appendix B of this Part) to exceed 15 mrem.* These requirements were addressed in the CCA (DOE, 1996a) and CRAs (DOE, 2004a; DOE, 2009a; and DOE, 2014d).

Table 4: Status of Compliance with the Regulatory Requirements of the Atomic Energy Act and the U.S. Environmental Protection Agency

Regulatory Requirement	WIPP Project Compliance
5. Groundwater Protection Standards, 40 CFR §191.24 (Subpart C)	*Disposal systems for waste and any associated radioactive material shall be designed to provide a reasonable expectation that, for 10,000 years after disposal, undisturbed performance of the disposal system shall not cause levels of radioactivity in any underground source of drinking water, in the accessible environment, to exceed the limits specified in 40 CFR Part 141 as they exist on January 19, 1994.* These requirements were addressed in the CCA (DOE, 1996a) and CRAs (DOE, 2004a; DOE, 2009a; and DOE, 2014d).
6. WIPP Compliance Certification Criteria, 40 CFR Part 194	As specified in section 8(d)(1) of the LWA, the DOE submitted the CCA (DOE, 1996a) to the EPA on October 29, 1996. The CCA included facility information, regional descriptive information, summaries of more than 20 years of scientific studies, details of the long-term repository performance assessments, and descriptions of programs in place to monitor the performance of the WIPP repository. The EPA evaluated the CCA and on May 18, 1998, issued a rule-making (63 Fed. Reg. 27354 through 27406), certifying that the DOE met the radioactive waste disposal standards and was in compliance with 40 CFR Part 191, Subparts B and C (EPA, 1998). Since certification of the WIPP facility, the DOE has maintained compliance with the EPA disposal regulations. The activities that must be performed to maintain compliance include: • Routine activities • Nonroutine activities • Recertification activities Activities that occur on a regular basis are considered routine. Routine activities required by the EPA certification/recertification include monitoring and reporting changes to the CCA/CRA. Monitoring is conducted to comply with the requirements of 40 CFR §191.14(b) in accordance with the criteria of 40 CFR §194.42. Monitoring provides the data that indicates the disposal system is not deviating adversely from expected performance. The monitoring parameters are: • Waste activity • Culebra groundwater composition • Change in Culebra groundwater flow • Drilling rate in the Delaware Basin • Probability of encountering a Castile brine reservoir in the Delaware Basin • Creep closure and stresses • Extent of brittle deformation • Initiation of brittle deformation • Displacement of deformation features • Subsidence in the vicinity of the repository The organizations responsible for monitoring and the frequency for conducting the monitoring and reporting results are outlined in DOE/WIPP-99-3119, *Compliance Monitoring Implementation Plan for 40 CFR §191.14(b), Assurance Requirement* (DOE, 2012c). The reporting of nonsignificant changes and updates that differ from information contained in the compliance certification is done annually, by November 18, in accordance with the criteria of 40 CFR §194.4(b)(4). This

Table 4: Status of Compliance with the Regulatory Requirements of the Atomic Energy Act and the U.S. Environmental Protection Agency

Regulatory Requirement	WIPP Project Compliance
	report, the Annual Change Report, was submitted to the EPA in November 2012 and 2013 (Annual Change Report – 2011/2012 and 2012/2013) (DOE, 2012d) (DOE, 2013d), for this reporting period. Activities that occur randomly or only once, such as an EPA request for information, the implementation of active and passive institutional controls, decommissioning the site, or activities associated with planned or unplanned changes, are considered nonroutine. Title 40 CFR §194.4(b)(3) requires the DOE to report any planned or unplanned changes in activities or conditions pertaining to the disposal system that differ significantly from the most recent compliance application. Changes are evaluated by the EPA. A planned change notice was submitted to the EPA on February 14, 2012 (DOE, 2012e). This notice was to inform the EPA of CBFO's intent to amend the practice of placement of MgO sacks on every waste column while complying with the 1.2 excess factor limit. The result of this operational change would reduce the amount of MgO waste while ensuring compliance with the excess factor of 1.2. No planned change requests were submitted to EPA during this reporting period.
7. WIPP Compliance Certification Criteria, 40 CFR Part 194	There have been no unplanned changes during this reporting period. Furthermore, the ongoing WIPP facility environmental monitoring programs have not detected any substantial and/or deleterious deviations from the expected conditions. Recertification activities are required by section 8(f) of the LWA, which establishes that, every five years after the initial receipt of TRU waste for disposal at the WIPP facility, continuing until the end of the decommissioning phase, the Secretary of Energy must submit documentation to the Administrator of the EPA that the DOE continues to comply with disposal regulations with regard to the WIPP disposal system. The DOE began emplacing TRU waste in the WIPP repository on March 26, 1999. With the initial receipt of waste, the requirement at section 8(f) of the LWA was initiated. Each recertification application submitted to the EPA for certification must be prepared in accordance with the criteria in 40 CFR §194.15. Based on the DOE submittal, the EPA will determine whether DOE continues to be in compliance with the disposal regulations. The DOE submitted the first CRA to the EPA on March 26, 2004 (DOE, 2004a), and the EPA recertified the WIPP facility on March 29, 2006. The DOE submitted the second CRA to the EPA on March 24, 2009 (DOE, 2009a), and on November 18, 2010, the EPA recertified DOE compliance. The DOE submitted the third CRA to EPA on March 26, 2014 (DOE, 2014d).

6.0 CLEAN AIR ACT

6.1 Summary of the Law

The CAA, as amended, establishes a national regulatory strategy and program to protect and enhance air quality in the United States. The CAA includes a number of standards, requirements, and permit programs to protect the quality of air in attainment areas (areas in which air quality meets the appropriate standards) and to improve it in nonattainment areas (areas that do not meet the national primary or secondary ambient air-quality standard for an air pollutant).

Congress enacted the Clean Air Act Amendments of 1990 (CAAA) (Pub. L. 101-549) on November 15, 1990. Several legislative actions have made minor amendments since then.

6.1.1 Title I, Air Pollution Prevention and Controls

Title I of the CAA contains requirements and standards for a number of programs that govern air pollutant emissions from stationary sources. These include the National Ambient Air Quality Standards (NAAQS), the New Source Performance Standards (NSPS), the National Emission Standards for Hazardous Air Pollutants (NESHAP), the Prevention of Significant Deterioration (PSD) program, and requirements for nonattainment areas. Most of these programs are requirements for proposed new construction or for modifications of existing sources established in 40 CFR Part 61. The CAA also includes requirements for a program regulating specific categories of stationary sources that emit (or have the potential to emit) one or more hazardous air pollutants (HAPs) listed in section 112(b) of the act. Title 40 CFR Part 63 contains the implementing regulations for this program. The WIPP facility does not have stationary sources regulated under these requirements.

6.1.2 National Ambient Air Quality Standards, 40 CFR §§50.4 through 50.12, and 40 CFR Part 51

This program was established by Title I of the CAA (and revised by Title I of the CAAA) for the six “criteria” pollutants: sulfur dioxide, particulate matter, carbon monoxide, ozone, nitrogen dioxide, and lead. These standards establish the maximum levels of each pollutant allowed in the air within a particular area. The federal NAAQS are specified in 40 CFR §§50.4 through 50.16, and the program is implemented under 40 CFR Part 51, “Requirements for Preparation, Adoption, and Submittal of Implementation Plans.” The EPA has authorized the NMED to administer the NAAQS program. The federal NAAQS were superseded by the New Mexico Ambient Air Quality Standards for the six criteria pollutants (20.2.3 NMAC).

Based on the current air emissions inventory, WIPP facility operations do not exceed the 10-tons-per-year (tpy) emission limit for any individual HAP, the 25-tpy limit for any combination of HAP emissions, or the 10-tpy emission limit for criteria pollutants except for total suspended particulate matter and particulate matter less than 10 microns in diameter. Particulate matter is produced from fugitive sources related to the management of salt tailings extracted from the underground. Consultation with the NMED Air Quality Bureau (AQB) resulted in a March 2006 determination that a permit is not required for fugitive emissions of particulate matter that result from salt management at the WIPP facility. Proposed facility modifications are reviewed to determine if they will create new air emission sources and require permit applications.

Based on the initial 1993 air emissions inventory, the WIPP facility is not required to have CAA permits. In 1993, the DOE did obtain a New Mexico Air Quality Control Regulation 702 Operating Permit (recodified in 2001 as 20.2.72 NMAC “Construction Permits”) for two backup diesel generators at the WIPP facility. The requirements and the compliance status associated with the operating permit for these generators are

presented in section 28.0. There have been no activities or modifications to the operating conditions of the diesel generators that would require reporting under the conditions of the permit and NMED has not requested an air emissions inventory since 2002.

6.1.3 Prevention of Significant Deterioration Program, 40 CFR §51.166

The PSD program, like many of the other programs under the CAA, is designed for proposed new construction or the modification of existing major stationary sources. It pertains to any proposed new or modified major stationary source located in an attainment area, particularly if the source could impact the air quality in a national park, wilderness area, monument, seashore, or other areas of special national or regional natural, recreational, scenic, or historic value. The WIPP facility is not categorized as a major source, as defined in 40 CFR §51.166(b)(1)(i)(a), and the PSD program does not apply. A routine review and approval process is used at the WIPP facility to evaluate proposed actions and identify potential regulatory issues such as the applicability of the PSD program.

6.1.4 New Source Performance Standards, 40 CFR Part 60

The NSPS program regulates emissions from operating facilities and specifies emission standards and test methods for analyzing the emissions. This program, which was initiated by section 111 of the CAA and is implemented by 40 CFR Part 60 (20.2.77 NMAC), “Standards of Performance for New Stationary Sources,” specifies standards of performance for air pollutant emissions from different types of facilities and equipment. Pollutants regulated under the NSPS include sulfur dioxide, nitrogen oxides, particulate matter, visible emissions (opacity), carbon monoxide, volatile organic compounds (VOCs), and lead. A routine review and approval process is used at the WIPP facility to evaluate proposed actions and identify potential regulatory issues, such as the applicability of NSPS.

6.1.5 National Emission Standards for Hazardous Air Pollutants, 40 CFR Part 61

Specific source category HAP emissions are regulated under section 112 of the CAA (Title III of the CAAA) as implemented by 40 CFR Part 61 (20.2.78 NMAC), “National Emission Standards for Hazardous Air Pollutants.” Before the CAA was amended in 1990, Subpart A of NESHAP listed only eight HAPs: asbestos, benzene, beryllium, coke oven emissions, inorganic arsenic, mercury, radionuclides, and vinyl chloride. The CAAA (§301) added 181 HAPs, significantly increasing the HAPs regulated under Subpart A.

The WIPP facility does not emit HAPs at levels subject to regulation under NESHAP. The WIPP facility is excluded from regulations under 40 CFR 63.680, “National Emissions Standards for Hazardous Air Pollutants from Off-Site Waste and Recovery Operations.” Radioactive mixed waste managed in accordance with applicable regulations under the AEA and NWPA authorities are excluded from the definition of off-site materials at 40 CFR §63.680(b)(2)(ii).

The DOE is exempt from regulation under 40 CFR Part 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities" because it is a geological repository subject to the Standards of 40 CFR 191 Subpart B. Pursuant to an MOU between the DOE and the EPA, the DOE agreed to comply with the requirements of 40 CFR Part 61, Subpart H.

6.1.6 Chemical Accident Prevention Provisions, 40 CFR Part 68

Under §112(r) of the CAA, "Prevention of Accidental Releases," the owners and operators of stationary sources are to prevent the accidental release of any substance listed in the implementing regulations. The list of regulated substances for accidental release prevention under §112(r) of the CAA and the threshold quantities for these substances were finalized in 40 CFR Part 68, "Chemical Accident Prevention Provisions." In order to comply with Subpart F of 40 CFR Part 68, "Regulated Substances for Accidental Release Prevention," two sources are used to determine whether emissions from the WIPP facility exceed the regulatory threshold level of any of the chemicals listed in the final rule. The two sources are the *Air Emissions Inventory Report for WIPP* and the *WIPP Tier II Emergency and Hazardous Chemical Inventory Report*. Of the 162 substances listed, none at the WIPP facility meet or exceed the final threshold levels. Consequently, the WIPP facility is not currently subject to these regulations.

6.1.7 Title II, Emission Standards for Mobile Sources

Although most of the requirements under the CAA pertain to stationary sources, the requirements under Title II of the CAA and the CAAA pertain to mobile sources and establish standards for motor vehicles and fuel. Many of these requirements are aimed at automobile manufacturers and petroleum companies (e.g., Part A of Title II, "Motor Vehicle Emission and Fuel Standards"). Federal agency fleets are covered in §248 of the CAA. In accordance with the DOE's Alternative Fuel Transportation Program (10 CFR Part 490) and the Energy Policy Act of 1992 (Pub. L. 102-486), federal agencies that operate fleets in nonattainment areas for ozone and/or carbon monoxide are required to use clean-fuel vehicles and must use clean alternative fuels when operating in the nonattainment area. Since the plan must be adopted only by federal agencies that operate a fleet with at least 20 light-duty vehicles in a metropolitan statistical area or a consolidated metropolitan statistical area with a 1980 population of at least 250,000 people, these regulations do not apply to Carlsbad, which is the closest population center to the WIPP facility. In addition, most of the requirements for federal agency fleets under Title II are not applicable to this facility because it is not located in a nonattainment area.

6.1.8 Title III, General Provisions

Title III of the CAA provides general provisions for the administration of the CAA and pertains to all titles (50 CFR Part 13). The provisions of Title III include administration, federal procurement, suits, audits, and air quality monitoring and modeling. Title III of the CAA also requires that the EPA perform a comprehensive analysis of the impact of the CAAA. Title III does not add additional programs.

6.1.9 Title IV, Acid Deposition Control

Title IV of both the CAA and the CAAA is aimed primarily at utilities and power plants that emit large quantities of sulfur dioxide and/or nitrogen oxides. It seeks to reduce emissions of sulfur dioxide and nitrogen oxides to decrease the acid rain problem in the United States. It is not applicable to the WIPP facility.

6.1.10 Title V, Permits

Most of the other permitting programs under the CAA are designed primarily for proposed new construction or the modification of existing facilities. Title V of both the CAA and the CAAA, as promulgated in 40 CFR Part 70, “State Operating Permit Programs,” identifies the operating permit requirements for major stationary sources. Those facilities required by the state or by the EPA to have an operating permit will be expected to submit an operating permit application, a compliance plan, and periodic compliance reports.

The EPA promulgated final approval of the State of New Mexico operating permit program and it became effective on January 27, 1997. The state's program was established as “Operating Permits” and “Operating Permit Emission Fees” in 20.2.70 NMAC and 20.2.71 NMAC, respectively.

The federal program (40 CFR Part 70) regulates and requires permits for both area and major sources. Major-source emission thresholds are used to determine which facilities require operating permits for both area and major sources under 40 CFR Part 70 and 20.2.70 NMAC. A facility is considered a “major source,” and is required to obtain an operating permit if the facility has the potential to emit or emits at least 100 tpy of any pollutant, 10 tpy of any single HAP, or 25 tpy of any combination of HAPs. Based on inventory emission calculations, the WIPP facility is not a major source and is not currently required to obtain a federal CAA operating permit. A routine review and approval process is used at the WIPP facility to evaluate proposed actions and identify potential regulatory issues such as the applicability of Title V permits.

6.1.11 Title VI, Stratospheric Ozone Protection

Title VI of both the CAA and the CAAA places restrictions on, and phases out the use of, ozone-depleting chemicals, particularly chlorofluorocarbons (CFCs). It is implemented by 40 CFR Part 82, “Protection of Stratospheric Ozone.” These regulations are designed to phase out the use of Class I and Class II substances. Class I substances (40 CFR §82.4) are CFCs, halons, carbon tetrachloride, methyl chloroform, hydrobromofluorocarbons, and methyl bromide. Class II substances (40 CFR §82.15) are hydrochlorofluorocarbons, which generally have a lower ozone-depleting potential than do CFCs. The production of most Class I substances was prohibited as of January 1, 1996 (methyl bromide was prohibited as of January 1, 2005). Effective January 1, 2015, the use of Class II substances will be prohibited unless the substance is used and entirely consumed in producing other chemicals, or is used as a refrigerant in appliances manufactured prior to January 1, 2020. By January 1, 2030, the manufacture of all Class II substances will be prohibited.

Implementing regulations pertaining to labeling requirements and the use and disposal of Class I substances during the service, repair, or disposal of appliances and industrial process refrigeration are codified in 40 CFR Part 82, Subpart E, "The Labeling of Products Using Ozone-Depleting Substances." WIPP refrigerant recycling contractors provided recycling equipment registrations and training.

Most of the requirements pertaining to ozone-depleting substances such as CFCs are applicable primarily to manufacturers of the chemicals, products containing the chemicals, or products in which ozone-depleting substances are used during the manufacturing process. These regulations are applicable to the WIPP facility and these products will no longer be available for use after the time specified in the regulations. Replacement products must be found. Any container in which Class I or Class II substances (including waste) that will be transported must have a warning label as required by 40 CFR §82.106, "Warning: Contains [or Manufactured with, if applicable] [insert name of substance], a substance which harms public health and the environment by destroying ozone in the upper atmosphere."

The WIPP WAC prohibits pressurized containers from being transported in the approved CH- and RH-TRU Type B packages in U.S. Department of Transportation (DOT) Type 7A containers. Wastes destined for the WIPP facility are excluded from the labeling requirements for Class I and Class II substances under 40 CFR 86.106(b) because carbon tetrachloride, a Class I substance, is a waste bound for discard.

6.2 Status of Compliance with the Regulatory Requirements

Table 5 provides general information on CAA requirements and the EPA and NMED regulations implementing those requirements.

Table 5: Status of Compliance with the Regulatory Requirements of the Clean Air Act

Regulatory Requirement	WIPP Project Compliance
1. Control of Pollution from Federal Facilities, CAA §118	*Each department of the executive, legislative, and judicial branches of the federal government having jurisdiction over any property or facility or engaged in any activity resulting in or that may result in the discharge of air pollutants and each employee thereof is subject to and must comply with all federal, state, interstate, and local requirements respecting the control and abatement of air pollution in the same manner and to the same extent as any nongovernmental entity.* The DOE complies with applicable federal and state requirements pertaining to the release of air pollutants from the WIPP facility. Compliance with federal and state air quality requirements are described in this section and in section 28.0, respectively.

Table 5: Status of Compliance with the Regulatory Requirements of the Clean Air Act

Regulatory Requirement	WIPP Project Compliance
2. National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities, 40 CFR Part 61, Subpart H (40 CFR §61.90)	*The provisions of this subpart apply to operations at any facility owned or operated by the DOE that emits any radionuclides other than radon-222 and radon-220 into the air, except that this subpart does not apply to disposal at facilities subject to 40 CFR Part 191, Subpart B or 40 CFR Part 192.* The WIPP facility effluent monitoring program was established and placed in operation to comply with the provisions of the May 16, 1995, Memorandum of Understanding (MOU) Between the U.S. Environmental Protection Agency and the U.S. Department of Energy Concerning the CAA Emission Standards for Radionuclides 40 CFR Part 61, Including Subparts H, I, Q, and T (DOE, 1995). The DOE has continued to demonstrate compliance with the emissions standard of 40 CFR Part 61, Subpart H by virtue of the MOU.
3. NESHAP Start-Up Notifications, 40 CFR §61.9(a)	*The EPA will be notified of planned start-up between 30 and 60 days prior to start-up. The EPA will be notified of actual start-up of WIPP within 15 days after that date.* On January 20, 1999, the DOE submitted prestart-up notification letters to the EPA Administrator and to the EPA Region VI office to inform them of the planned start-up of the WIPP facility, scheduled for late March 1999 (DOE, 1999a). The actual start-up date was March 26, 1999, with the notification letters of actual start-up submitted to the EPA on this date (DOE, 1999b). These letters met the time frame requirements for notification.
4. Standard, 40 CFR §61.92	*Emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an EDE of 10 mrem/year.* The DOE submitted the annual report of air emissions from the WIPP facility for CY 2012 and 2013. These reports have been submitted in compliance with the provisions of 40 CFR 61.94 and the May 16, 1995, MOU between the EPA and the DOE concerning the CAA Emission Standards for Radionuclides, 40 CFR Part 61 including Subparts H, I, Q, and T. The WIPP facility effluent air emissions monitoring results were reported, and the EDE values to members of the public were calculated using the EPA-approved sampling procedures and computer model CAP88-PC, Version 3. The calculated EDE from operations at the WIPP facility for CY 2012 is reported to be 1.06E-05 mrem per year to the MEI. For CY 2012, the annual report on radionuclide air emissions from the WIPP facility was submitted to the EPA on June 18, 2013 (DOE, 2013e). The calculated EDE from operations at the WIPP facility for CY 2013 is reported to be approximately 7.39E-06 mrem per year to the MEI. The CY 2013 annual report on radionuclide air emissions from the WIPP facility was submitted to the EPA in June 2014 (DOE, 2014e). An adjustment was made to the reported doses for CY 2011 and 2012 to account for an unnoticed calibration shift in one sample collection instrument recording device. Conservative recalculation of the estimated doses showed a less than 10% increase over the previously reported values. A correction note was added to the CY 2013 annual report documenting the recalculations. On February 14, 2014, a radiological release underground initiated a protective shift in the mine ventilation system to the filtration mode. Subsequent analysis documented radioactive particulate emissions to the ambient air, and prompted a cessation of all underground activities pending assessment of the cause and magnitude of the event. As of March 31, the 40 CFR 191 Subpart A fence line dose estimate was less than 0.5 mrem, and the dose to the maximally exposed off-site individual is estimated to be less than 5.0E-03 mrem for CY 2014.

Table 5: Status of Compliance with the Regulatory Requirements of the Clean Air Act

Regulatory Requirement	WIPP Project Compliance
	Both annual reports and the currently projected dose estimates for CY 2014 showed that the calculated values are well below the 40 CFR 61 Subpart H limit of 10 mrem per year to the MEI member of the public, and the 0.1 mrem per year for periodic confirmatory sampling.
5. Emissions Monitoring and Test Procedures, 40 CFR §61.93(a) and (b)	*Compliance with the standards, radionuclide emissions, shall be determined and EDE values to members of the public calculated using EPA-approved sampling procedures, computer models, or other procedures for which the EPA has granted prior approval. Radionuclide emission rates from point sources shall be measured at all release points which have a potential to discharge radionuclides into the air in quantities which could cause an EDE in excess of 1.0 percent of the standard. For other release points, periodic confirmatory measurements shall be made to verify the low emissions.* The WIPP facility has three effluent monitoring stations - Stations A, B, and C. At each station, fixed air samplers (FASs) are used to collect representative samples of airborne particulates. Approved and controlled operating procedures are used at the WIPP facility to ensure that uniform methods are used to collect, package, and transport FAS filters. Station A FAS filter samples are collected at least once each working shift from the unfiltered underground exhaust system. Station B FAS filter samples are collected at least weekly and at the end of each underground effluent filtration event. At Station C, FAS filter samples are collected at least weekly from the filtered WHB exhaust system. During 2011, Station C received an instrumentation upgrade and four FASs were used to collect weekly filter samples in the WHB. On May 6, 2011, sampling resumed at Station C. Subsequent calibration checks in CY 2013 revealed that, since the initial installation, the equipment was operating at a bias that would potentially result in a dose calculation up to 10% higher than previously calculated from WHB air emissions. The doses were recalculated based upon the as-found calibration data, and the errata reported in the CY 2013 annual report. The instrumentation was properly recalibrated in November 2013. Samples are composited on a monthly or quarterly basis, depending on sample location and the number of samples collected. These particulate filters are initially analyzed for gross alpha and gross beta activities. Filters from all three stations are analyzed for plutonium-238 (^{238}Pu), plutonium-239/240 ($^{239/240}$Pu); americium-241 (^{241}Am); strontium-90 (^{90}Sr); cesium-137 (^{137}Cs); uranium-233/234 ($^{233/234}$U); and uranium-238 (^{238}U). The composite sample results are summed to obtain a total quantity for each radionuclide released from each station. These detected radionuclide values are used as input into the CAP88-PC software package to calculate the EDE to members of the public for the purpose of demonstrating compliance with 40 CFR §61.92. In February 2014, the airborne radiological particulate emissions event effectively shut down Station A as an ambient air emission point. All underground ventilation starting February 14, 2014, through this reporting period was directed through the underground ventilation filters, and is monitored at Station B through daily sample filter collection. Station C was not affected by the airborne radiological particulate emissions event.
6. NESHAP Quality Assurance Program Plan, 40 CFR §61.93(b) and Appendix B, Method 114, Section 4.10	*A NESHAP Quality Assurance Program is required for facilities subject to Subpart H of NESHAP.* A quality assurance (QA) program plan for sampling radionuclide emissions to the ambient air at the WIPP facility is in place.

Table 5: Status of Compliance with the Regulatory Requirements of the Clean Air Act

Regulatory Requirement	WIPP Project Compliance
7. NESHAP Annual Report, 40 CFR §61.94	*A NESHAP annual report must be submitted by June 30 for facilities subject to Subpart H of NESHAP.* The DOE filed NESHAP reports (DOE, 2013e and DOE, 2014e) by June 30 for both years in this reporting period. Reports filed are for previous calendar years.
8. Record-Keeping Requirements, 40 CFR §61.95	*All facilities must maintain records documenting the source of input parameters, including the results of all measurements upon which they are based, the calculations and/or analytical methods used to derive values for input parameters, and the procedure used to determine the EDE. This documentation should be sufficient to allow an independent auditor to verify the accuracy of the determination made concerning the facility's compliance with the standard. These records must be kept at the site of the facility for at least five years and, upon request, be made available for inspection by the EPA Administrator or their authorized representative.* Monitoring for airborne radioactive emissions has been performed at the WIPP facility since 1998. All applicable records are maintained on-site for at least five years and are available for examination if requested by the EPA Administrator or an authorized representative. The results of the measurements, supporting calculations, analytical methods, and procedures used to determine the EDE are included in the records.
9. NESHAP Application for Radionuclides, 40 CFR §61.96	*The submittal of a NESHAP application is required prior to construction or modification of any DOE facility that will emit radionuclides to the air.* Compliance with NESHAP (40 CFR §61.96[b]) is maintained at the WIPP facility. No NESHAP application was submitted to the EPA during this reporting period because no new construction or modification that would emit radionuclides to the air was performed and total estimated annual EDE values for the WIPP facility were less than 1 percent of the standard.
10. Regulation of Fuel and Fuel Additives, 40 CFR Part 80	Regulation of fuels and fuel additives pertaining to the WIPP facility is included here. See also section 28.0 for more detail regarding the State of New Mexico implementation of the CAA.
11. Regulation of Fuel and Fuel Additives - Requests for Information, 40 CFR §80.7	*If the Administrator, the Regional Administrator, or a delegate has reason to believe that a violation of Section 211(c) or Section 211(n) of the CAA or its implementing regulations with respect to the use of prohibited fuel (e.g., leaded) has occurred, they may require that any wholesale purchaser/consumer report information regarding receipt, transfer, delivery, or sale of gasoline represented to be unleaded and to allow the reproduction of such information at all reasonable times. The purchaser/ consumer is also required to provide any other information to the EPA representative as requested to enable him/her to ensure that the purchaser/consumer acted in compliance with the applicable provisions of the CAA and the implementing regulations.* The WIPP project procurement program assures the purchase of fuels that are compliant with the regulatory requirements.
12. Regulation of Fuel and Fuel Additives - Controls and Prohibitions, 40 CFR §80.22	*After December 31, 1995, no person shall dispense or supply any gasoline produced with the use of lead additives or that contains more than 0.05 gram of lead per gallon, nor shall he or she supply or dispense gasoline represented to be unleaded unless it meets*

Table 5: Status of Compliance with the Regulatory Requirements of the Clean Air Act

Regulatory Requirement	WIPP Project Compliance
	the criteria specified in 40 CFR §80.2(g) or allow gasoline other than unleaded to be dispensed into any motor vehicle that is equipped with a gasoline tank filler inlet designed for the introduction of unleaded gasoline. The WIPP project procurement program assures the purchase of fuels that are compliant with the regulatory requirements.
13. Regulation of Fuel and Fuel Additives - Liability for Violations, 40 CFR §80.23	*In any case in which a wholesale purchaser-consumer or their employee or agent introduces gasoline other than unleaded into a motor vehicle equipped with a gasoline tank filler inlet designed for the introduction of unleaded gasoline, only the wholesale purchaser-consumer shall be deemed in violation.* The WIPP project procurement program assures the purchase of fuels that are compliant with the regulatory requirements.
14. Protection of Stratospheric Ozone, 40 CFR Part 82	A number of requirements have been imposed that relate to CFCs and other ozone-depleting substances. Most of these requirements pertain directly to manufacturers; however, because of the planned phase-out of these materials, the regulations also impact users of the materials.
15. Restrictions on Repairing and Servicing Motor Vehicle Air Conditioners, 40 CFR §82.34	*No person repairing or servicing motor vehicles for consideration may perform any service on a motor vehicle air conditioner involving the refrigerant for the air conditioner without using approved refrigerant recycling equipment and unless they have been properly trained and certified by a technician certification program approved by the Administrator.* No government vehicle air conditioning systems are serviced, repaired, or maintained by WIPP project employees. The DOE maintains a qualified vendor list and has procurement procedures in place to ensure that equipment is serviced by properly trained and certified vendors.
16. Prohibitions, 40 CFR §82.124(a)(4)	*On or after May 15, 1993, no person may modify, remove, or interfere with any warning statement required by this subpart, except as described in 40 CFR §82.112.* Manufacturers must label appliances and products containing CFCs. The DOE industrial safety and hazardous materials management program plans require that warning labels must not be tampered with or removed. If a label is damaged and becomes unreadable, it is replaced.
17. Service, Maintenance, and Repair of Appliances Using Refrigerants, 40 CFR §82.150	*This subpart applies to any person servicing, maintaining, or repairing appliances except for motor vehicle air conditioners. This subpart also applies to persons disposing of appliances, including motor vehicle air conditions. In addition, this subpart applies to refrigerant reclaimers, appliance owners, and manufacturers of appliances and recycling and recovery equipment.* WIPP employees do not service, maintain, or repair appliances. However, the facility owns and disposes of appliances. The DOE maintenance work instructions for recharging and reclaiming refrigerants and property management procedures dictate that WIPP facility appliances will be sold intact or the refrigerants removed by a certified recycling contractor.
18. Prohibitions Regarding Maintenance, Service, Repair, or Disposal of Appliances, 40 CFR §82.154	*Prohibitions are specified for persons who maintain, service, repair, or dispose of appliances who may vent or otherwise release into the environment any refrigerant or substitute substance used as refrigerant in such equipment. De minimis releases associated with good faith attempts to recycle or recover*

Table 5: Status of Compliance with the Regulatory Requirements of the Clean Air Act

Regulatory Requirement	WIPP Project Compliance
	refrigerants are not subject to this prohibition. No person may dispose of appliances except for small appliances, motor vehicle air conditioners, and motor vehicle air conditioner-like appliances unless the required practices described in 40 CFR §82.156 are observed and equipment that is certified for that type of appliance is used. Prohibitions are also specified regarding recycling or recovery equipment. *Prohibitions also exist for the sale of Class I or Class II substances consisting wholly or in part of used refrigerants.* *It is a violation of this subpart to accept a signed statement pursuant to 40 CFR §82.156(f)(2) if the person knew or had reason to know that such a signed statement is false.* The DOE maintains a qualified vendor list and has procurement procedures in place to ensure that equipment is serviced by properly trained and certified vendors. The qualified vendor list also ensures that materials are disposed of at properly permitted facilities that comply with the applicable regulations. No Class I or II substances are sold or distributed from the WIPP facility.
19. Required Practices, 40 CFR §82.156	*Any person opening appliances other than motor vehicle air conditioners must evacuate the refrigerant to a system receiver or to a recovery or recycling machine as specified. At least one piece of certified, self-contained recovery equipment must be available at their place of business.* *Leaks in appliances containing refrigerant must be repaired as specified.* The DOE maintains a qualified vendor list and has procurement procedures in place to ensure that equipment is serviced by properly trained and certified vendors. The qualified vendor list also ensures that materials are disposed of at properly permitted facilities that comply with the applicable regulations.

6.3 Status of Compliance with the Permit Conditions

Currently, the permit for the backup diesel electrical power supply generators is the only CAA-related permit obtained by the DOE for the facility. The requirements and the compliance status associated with the operating permit for these generators are presented in section 28.0. The WIPP facility is in compliance with this permit.

7.0 FEDERAL WATER POLLUTION CONTROL ACT OF 1972 ("CLEAN WATER ACT")

7.1 Summary of the Law

The Federal Water Pollution Control Act of 1972 (33 U.S.C.§§1251, et seq.) is usually referred to as the Clean Water Act and sets forth requirements for the discharge of pollutants into surface waters of the United States. The major programs under this act are the Oil Pollution Prevention standards of 40 CFR Part 112, and the National Pollutant Discharge Elimination System of 40 CFR Part 122.

7.2 Status of Compliance with the Regulatory Requirements

These programs are not applicable to activities conducted at the WIPP facility because the facility cannot feasibly discharge pollutants into surface waters of the United States.

8.0 SAFE DRINKING WATER ACT

8.1 Summary of the Law

The SDWA of 1974, as amended, provides the regulatory strategy for protecting public water supply systems and underground sources of drinking water. As defined in the implementing regulations in 40 CFR Part 141, “National Primary Drinking Water Regulations,” these systems provide water for human consumption, have at least 15 connections, or regularly serve at least 25 people.

The SDWA also protects underground sources of drinking water from underground injection of contaminated fluids. Underground injection, defined as “subsurface emplacements of fluids by well injections” in 42 U.S.C. §300f, is governed by the underground injection control program described in Subpart C of 40 CFR Part 144.

The EPA delegated authority for ensuring compliance with the SDWA National Primary Drinking Water Standards by approving the NMED drinking water regulations. These regulations now occupy 20.7.10 NMAC (see section 30.0).

8.2 Status of Compliance with the Regulatory Requirements

The LWA specifically requires compliance with the SDWA. The NMED has authority to administer the SDWA in New Mexico. Table 6 provides general information and compliance with the regulatory requirements of the SDWA.

Table 6: Status of Compliance with the Regulatory Requirements of the Safe Drinking Water Act

Regulatory Requirement	WIPP Project Compliance
1. State Program Requirements, 40 CFR §142.3(b)	Applicable requirements in this section are covered in the state program for the SDWA (see section 30.0).
2. Underground Injection Control, 40 CFR Part 144	*The EPA has established a number of requirements for facilities that dispose of wastes by means of underground injection.* None of the wastes currently generated at the WIPP facility are injected underground, nor will TRU waste be disposed of by underground injection at the WIPP facility. The EPA's requirements for underground injection control do not apply to the WIPP facility.

9.0 TOXIC SUBSTANCES CONTROL ACT

9.1 Summary of the Law

The TSCA regulates the production, use, distribution, and disposal of new, potentially toxic chemical substances. The act applies primarily to commercial manufacturers, importers, and processors of toxic chemicals. The WIPP facility is not a manufacturer or a processor of chemical products; therefore, most of the provisions of TSCA do not apply. However, three sections of this act pertain to existing commercial toxic substances rather than to the development of new chemicals. These sections deal with asbestos, indoor radon abatement, and polychlorinated biphenyls (PCBs).

9.1.1 Asbestos Hazard Emergency Response Act of 1986

Because of the potential for serious health hazards associated with asbestos, Congress amended TSCA in 1986 by adding Title II, the Asbestos Hazard Emergency Response Act, to control asbestos-containing materials in schools. A survey of the buildings at the WIPP facility determined that there are no asbestos-containing materials in any of the structures.

In early 2014, bulk samples collected from brake pads on the winch at the Air Intake Shaft showed a presence of asbestos. Personal and area air sampling showed airborne asbestos to be either non-detect or well beneath occupational exposure limits. The asbestos is not in friable form. Management controls are being developed to manage, reduce, and eliminate exposures to WIPP facility personnel from the presence of asbestos.

9.1.2 Indoor Radon Abatement

The Title III TSCA amendment, Indoor Radon Abatement, was added to address the national long-term goal “with respect to radon levels in buildings, the air within the buildings in the United States should be as free of radon as the ambient air outside of buildings.” One of the goal-driven requirements that Title III sets forth in §2669, “Study of Radon in Federal Buildings,” directs each federal department or agency that owns a federal building to conduct a study to determine the extent of radon contamination in such buildings. The DOE responded to this requirement through *Results of the U.S. Department of Energy Indoor Radon Study* (DOE, 1990b).

9.1.3 Polychlorinated Biphenyls

Section 6(e) of TSCA, “Polychlorinated Biphenyls,” directed the EPA to phase out PCB manufacture and use according to a mandated timetable. The regulations at 40 CFR Part 761, “Polychlorinated Biphenyls Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions,” implement the PCB provisions of TSCA. This part applies to all parties who manufacture, process, distribute in commerce, use, or dispose of PCBs or PCB items. DOE policy prohibits the use of PCB items or equipment in DOE-installed equipment at facilities such as the WIPP facility. Surveys were done at DOE sites to identify any PCBs or PCB-containing equipment and to eliminate the fluids

and equipment in accordance with EPA storage and disposal regulations. No PCBs were found to be in use at the WIPP facility.

The PCB storage and disposal regulations are listed in the applicable subparts of 40 CFR Part 761. An initial report requesting authorization to store and dispose of TRU waste contaminated with PCBs, in accordance with the chemical waste landfill provisions of 40 CFR §761.75, was submitted to EPA Region VI on March 22, 2002 (DOE/WIPP-02-3196, *Waste Isolation Pilot Plant Initial Report for PCB Disposal* Authorization) (DOE, 2002). This initial report included requests for waivers to the technical requirements for hydrological conditions, surface and groundwater monitoring, and leachate collection. On May 15, 2003, the EPA Region VI approved the disposal of TRU waste containing PCBs, in accordance with the Conditions of Approval (COA) (EPA, 2003). The chemical waste landfill permit is good for 5 years from the date of issuance. On February 5, 2005, the WIPP facility received the first shipment of PCB-contaminated TRU waste.

On April 9, 2012, the DOE submitted a request (DOE, 2012f) to EPA Region VI for re-authorization of PCB disposal at the WIPP facility, in compliance with the COA. On May 21, 2013, the EPA reauthorized the DOE chemical waste landfill permit (EPA, 2013). This reauthorization enables the DOE to continue to dispose of PCBs in accordance with the revised COA. The DOE is required to submit a request for re-authorization of its chemical waste landfill permit at least one year prior to the expiration of the current permit, which expires May 21, 2018. During its annual inspections, the EPA determined that operation of the WIPP facility is in accordance with the COA and does not present an unreasonable risk to human health or the environment in accordance with guidelines set forth in 40 CFR Part 761.

On August 14, 2012, the DOE notified the EPA of the change in the facility operator to Nuclear Waste Partnership LLC (NWP) in compliance with condition VI.J of the COA (DOE, 2012g).

9.2 Status of Compliance with the Regulatory Requirements

On March 11, 2014, the DOE notified EPA Region 6 via telephone and email, of two events that had occurred at the facility. During investigations of the two events, additional storage time of 45 days was requested for the PCB storage areas at the facility. This additional time was requested in accordance with the COA and mirrored the RCRA Permit storage time extension approved by the State of New Mexico Administrative Order issued February 27, 2014.

During this reporting period, the WIPP facility was in compliance with requirements for PCB marking, storage, and records and monitoring. Table 7 provides more detail on the compliance status of key requirements.

Table 7: Status of Compliance with the Regulatory Requirements of the Toxic Substances Control Act

Regulatory Requirement	WIPP Project Compliance
1. Study of Radon in Federal Buildings, TSCA, Part 309	*Each federal agency that owns a building must conduct a study of radon contamination in the building(s).* The DOE conducted an indoor radon study in response to this requirement and submitted the findings in *Results of the U.S. Department of Energy Indoor Radon Study* (DOE, 1990b). Radon concentrations measured were less than 1.0 picocuries per liter (pCi/l). These concentrations are below the 4 pCi/l level at which the EPA recommends further testing of indoor radon.
2. Prohibition of PCBs, 40 CFR §761.20	*No person may use any PCB or any PCB item regardless of concentration in any way other than in a totally enclosed manner within the United States.* No PCBs were identified during this reporting period.
3. Disposal Requirements for PCBs, 40 CFR Part 761, Subpart D	*In most circumstances, PCBs must be incinerated as required by 40 CFR §761.70 or placed in chemical-waste landfills that meet the requirements of 40 CFR §761.75 and that have been approved as a landfill for PCBs by the EPA.* DOE did not dispose of equipment that contained PCB fluids during the reporting period at the WIPP facility.
4. Certificate of Disposal 40 CFR §761.218(b)	*The owner or operator of the disposal facility shall send the Certificate of Disposal to the generator identified on the manifest which accompanied the shipment of PCB waste within 30 days of the date that disposal of each item of PCB waste identified on the manifest was completed unless the generator and the disposer contractually agree to another time frame.* Certificate of Disposal requirements were met during this BECR reporting period.
5. Annual Report, 40 CFR §761.280(b)(3)	*The owner or operator of a PCB disposal facility or a commercial storage facility shall submit an annual report, which briefly summarizes the records and annual document log required to be maintained and prepared to the EPA Regional Administrator by July 15.* Annual reports for 2012 and 2013 were submitted to the EPA prior to the required date.
6. Reauthorization of Chemical Waste Landfill authorization 40 CFR § 761.75.	*A chemical waste landfill used for the disposal of PCBs and PCB Items shall be approved by the Agency Regional Administrator pursuant to paragraph (c) of this section. The landfill shall meet all of the requirements specified in paragraph (b) of this section, unless a waiver from these requirements is obtained pursuant to paragraph (c)(4) of this section. In addition, the landfill shall meet any other requirements that may be prescribed pursuant to paragraph (c)(3) of this section.* On April 9, 2012, the DOE submitted a request for reauthorization from EPA Region VI for PCB disposal at the WIPP facility in compliance with the COA (DOE, 2012f). On May 21, 2013, EPA Region VI approved and reauthorized DOE for disposal of PCBs at the WIPP facility (EPA, 2013). This approval is effective for 5 years.

Table 7: Status of Compliance with the Regulatory Requirements of the Toxic Substances Control Act

Regulatory Requirement	WIPP Project Compliance
7. Conditions of Approval for Chemical Waste Landfills 40 CFR § 761.75.	*Prior to the disposal of any PCBs and PCB Items in a chemical waste landfill, the owner or operator of the landfill shall receive written approval of the Agency Regional Administrator for the Region in which the landfill is located.* On May 21, 2013, EPA Region VI approved and reauthorized DOE for disposal of PCBs at the WIPP facility (EPA, 2013). This approval is effective for 5 years.

10.0 FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT

10.1 Summary of the Law

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 U.S.C. §§136, et seq.) authorizes the EPA to regulate the registration, certification, use, storage, disposal, transportation, and recall of pesticides. Section 18 of FIFRA authorizes the EPA to exempt state and federal agencies from any provision of the act if emergency conditions requiring an exemption are determined to exist. “Exemption of Federal and State Agencies for Use of Pesticides under Emergency Conditions” provides guidelines for urgent, nonroutine situations that require the use of pesticides and for which exemptions may be authorized. Sections 19(a) and 25(a) of FIFRA authorize the EPA to establish regulations and procedures regarding the disposal or storage of packages and containers of pesticides and the disposal or storage of excess amounts of such pesticides. FIFRA provided for “Regulations for the Acceptance of Certain Pesticides and Recommended Procedures for the Disposal and Storage of Pesticides and Pesticides Containers”; established procedures for the acceptance, disposal, or storage of packages and containers of pesticides; and provided for the disposal or storage of excess amounts of such pesticides. The standards of FIFRA are considered mandatory for DOE facilities. The DOE requires applicators hired under contract by WIPP project participants to comply with the requirements of the New Mexico Pesticide Control Act and the implementing regulations set forth in 21.17.50 NMAC. More information on the state requirements is provided in section 37.0. Uses and applications of restricted-use pesticides at the WIPP facility are conducted only by commercial pesticide applicators that are under contract with the DOE and are required to comply with federal and state standards.

10.2 Status of Compliance with the Regulatory Requirements

The two major requirements of FIFRA and the compliance status of each are summarized in Table 8.

Table 8: Status of Compliance with the Regulatory Requirement of the Federal Insecticide, Fungicide, and Rodenticide Act

Regulatory Requirement	WIPP Project Compliance
1. Registration of Pesticide Products, 40 CFR §152.15	*No person may distribute or sell any pesticide product that is not registered under FIFRA. The pesticide must be registered if the person who distributes or sells the substance knows that it will be used as a pesticide.* The WIPP project does not distribute or sell pesticide products.
2. Storage and Disposal of Pesticides and Containers, 40 CFR §156.10	*The directions for use shall include specific directions for the storage and disposal of pesticides and their containers.* The WIPP project does not manufacture, formulate, or label pesticides.

11.0 NOISE CONTROL ACT OF 1972

11.1 Summary of the Law

In the Noise Control Act of 1972 (42 U.S.C. §§4901, et seq.), the Congress declared that it is the policy of the United State to promote an environment for all Americans that is free from noise that jeopardizes public health or welfare. According to §4901(a)(3), the primary responsibility for noise control is vested in state and local governments. Federal regulation is deemed essential only for commercial noise sources requiring national uniformity of treatment (e.g., aircraft noise). Federal agencies are directed to carry out the programs within their control in a manner that furthers the policy. Section 4 of the act states, “each agency having jurisdiction over any property or facility, or engaged in any activity resulting or which may result in the emission of noise, shall comply with federal, state, interstate, and local requirements regarding the control and abatement of environmental noise to the fullest extent consistent with their authority.”

11.2 Status of Compliance with the Regulatory Requirements

An evaluation of the environmental noise level of the WIPP project was conducted with the results published in the WIPP *Final Environmental Impact Statement* (FEIS) (DOE/EIS-0026) (DOE, 1980). When changes to the project are suggested, an environmental impact review is conducted in accordance with the National Environmental Policy Act (NEPA) (outlined in Chapter 12), which includes a review of noise generation. There were no changes to the WIPP facility during this reporting period that modified the noise level.

12.0 NATIONAL ENVIRONMENTAL POLICY ACT

12.1 Summary of the Law

The National Environmental Policy Act (NEPA) (42 U.S.C. §§4321, et seq.) is a comprehensive legislative policy statement on protection of the environment. NEPA requires that the federal government consider potential environmental impacts as part of the decision-making process prior to the initiation of new projects and activities. CBFO

submits an annual mitigation report to DOE Headquarters every year. The mitigation reports address the potential environmental impacts and the actions that mitigate the impacts for the previous year.

The act also requires that the public should be allowed to review and comment on proposed projects with the potential to significantly affect the quality of the human environment. Congress created the Council on Environmental Quality as part of NEPA. The Council on Environmental Quality, contained within the Executive Branch of the government, is the agency charged by Congress to advise the President with regard to national environmental policy. The Council on Environmental Quality regulations at 40 CFR Parts 1500 through 1508 outline specific requirements for the NEPA process, the preparation of environmental impact statements (EISs) or environmental assessments (EAs), public review and solicitation of comments on EISs, decisions with respect to an EIS or EA, and implementation of the decisions. The NEPA regulations instruct federal agencies to interpret and administer their own specific directives (such as regulations, plans, or orders) to implement the regulations within their agencies. General directives to federal agencies include considering the impacts of actions in decisions, providing necessary data for decisions, informing the public, and soliciting public input in the decision process.

12.1.1 Summary of DOE NEPA Regulations

DOE NEPA regulations (10 CFR Part 1021) implement NEPA and supplement those requirements contained in 40 CFR Parts 1500 through 1508. DOE Order 451.1B, National Environmental Policy Act Compliance Program, assigns responsibilities for NEPA compliance to specified DOE organizations and individuals. DOE regulations also add a requirement for mitigation action plans and supplement analyses (SAs) and delineate specific categorical exclusions (CX) for DOE facility operations.

The DOE regulations describe the process for preparation of DOE NEPA documents. In general, an EIS is prepared for proposed actions where the impacts of the action are likely to be significant, and a ROD is issued to announce the DOE's decision and the rationale behind that decision. An EA is prepared for proposed actions where the environmental impacts of the action are not likely to be significant. An EA is followed by a finding of no significant impact (FONSI) if, after analysis, the impacts are found to be insignificant. If the analyses in an EA identify potentially significant impacts, an EIS would be prepared. Both RODs and EISs may contain commitments to mitigate adverse environmental impacts, which are included in mitigation action plans. Progress toward mitigation is reported annually to ensure that mitigation actions are being implemented and are effective. SAs examine the conclusions reached in previously prepared NEPA documents in light of changed circumstances to determine whether the impacts of the proposed actions have changed significantly and warrant additional NEPA analysis (normally an EA or a supplement to an EIS). Categorical exclusions are classes of actions that the DOE has determined do not individually or collectively have the potential for significant environmental impacts.

On September 27, 2011, the DOE approved the first revisions to its NEPA regulations in a decade. The regulations became effective on November 14, 2011. The revisions were

designed to focus NEPA resources on projects with the potential for significant environmental impact, to better align the regulations with DOE's current activities and recent experiences, and to update the provisions with respect to current technologies and regulatory requirements. The revisions focused primarily on DOE's CX provisions by establishing 20 new CXs, most of which include criteria (e.g., acreage, location, and height limitations) that limit the covered actions. These CXs address actions such as stormwater runoff control, alternative fuel vehicle fueling stations and electric vehicle charging stations, and small-scale renewable energy projects.

12.2 Status of Compliance with the Regulatory Requirements

Table 9 provides general information on the regulatory requirements of NEPA and how those requirements are implemented.

Table 9: Status of Compliance with the Regulatory Requirements of the National Environmental Policy Act

Regulatory Requirement	WIPP Project Compliance
1. Status of Compliance with the Regulatory Requirements (NEPA)	Pursuant to NEPA requirements, the DOE published the FEIS (DOE/EIS-0026) (DOE, 1980). The FEIS analyzed and compared the environmental impacts of various alternatives for demonstrating the safe disposal of TRU waste resulting from national defense activities. Based on the environmental analyses in the FEIS, the DOE published a ROD in 1981 to proceed with the phased development of the WIPP facility (DOE, 1981). A number of mitigation commitments were specified in the ROD. The DOE published a supplemental EIS (SEIS) (DOE, 1990a), which addressed alterations in the composition of the waste inventory, the transportation of waste to the WIPP facility, conducting a test phase at the WIPP facility, and management of mixed waste (TRU waste with hazardous constituents). The DOE published a ROD resulting from the SEIS in 1990 (DOE, 1990c). In October 1993, the DOE decided not to conduct the test phase at the WIPP facility and moved toward the initiation of waste disposal operations. In September 1997, the DOE published the SEIS-II (DOE, 1997a). The SEIS-II evaluated the circumstances that had changed since 1990 and newer site data that might result in different potential environmental impacts from WIPP facility disposal and closure operations. In January 1998, the DOE issued the ROD resulting from the SEIS-II (DOE, 1998). The SEIS-II ROD was prepared in coordination with the DOE waste management programmatic EIS ROD for TRU waste. The SEIS-II ROD describes the DOE decision to dispose of TRU wastes generated by defense-related activities at the WIPP facility. This decision was based on the DOE analysis of alternatives described in the SEIS-II. The DOE issued the *Mitigation Action Plan for the Records of Decision for the Waste Isolation Pilot Plant* (DOE/WIPP-91-030) on July 10, 1991 (DOE, 1991). This document addresses the mitigative commitments stated in the RODs to the 1980 FEIS and the 1990 SEIS, and discusses mitigative actions, organizations responsible for implementing these actions, and the status of each commitment. Three new mitigation commitments were identified in the ROD for the SEIS-II. The Annual Mitigation Report is issued to track the status of each commitment not yet completed. The Annual Mitigation Reports for 2012 and 2013 were submitted to DOE Headquarters (DOE, 2012h and DOE, 2013f).

Table 9: Status of Compliance with the Regulatory Requirements of the National Environmental Policy Act

Regulatory Requirement	WIPP Project Compliance
2. Status of Other NEPA Documentation Related to WIPP	In addition to FEIS, SEIS, and SEIS-II, the DOE has published additional NEPA documentation related to WIPP facility operations and associated waste programs. These documents have included EAs and FONSIs, SAs, and revised RODs. To date, no FONSI has resulted in additional mitigation commitments, and no supplement analysis (SA) has resulted in the need to prepare additional NEPA analysis beyond a revision to an existing ROD. The DOE issued an SA in September 2010 for packaging and handling of RH-TRU waste in shielded containers (DOE, 2010a). This document examines the impacts of the packaging and emplacement at WIPP of a portion of the RH-TRU waste inventory using a new container design called the lead shielded container. Based on the SA, the DOE determined that a supplemental or new EIS is not required. The DOE is preparing a 5-year SA for the WIPP Project. This is due to be completed in 2014. In February 2011, DOE issued a draft EIS, DOE/EIS-0375-D (DOE, 2011a), for the Disposal of Greater-Than-Class C Low-Level Radioactive waste that analyzed an alternative for the disposal of material in the WIPP facility vicinity; DOE has not issued the final EIS. In October 2013, DOE issued a final Supplemental EIS, DOE/EIS-0423-S1 (DOE, 2013g), for the Storage and Management of Mercury that analyzed an alternative to store mercury in the WIPP facility vicinity; DOE has not issued a ROD for this EIS. In March 2014, DOE issued a SA, DOE/EIS-0026-SA-09 (DOE, 2014f), for a proposed action to temporarily store defense TRU waste prior to disposal at WIPP. This document examines the impacts of the temporary storage of defense TRU wastes at the Waste Control Specialists facility in Andrews, Texas prior to eventual disposal at WIPP. Based on the SA, the DOE determined that a supplemental or new EIS is not required.
3. Operational Compliance with NEPA at WIPP	Day-to-day operational compliance with NEPA at the WIPP facility is achieved by the review of proposed work, facility changes, and programmatic changes in accordance with a site compliance procedure. The CBFO NEPA Compliance Officer is responsible for making a determination as to whether additional NEPA documentation is required prior to the decision to implement these proposals. If the action is outside the WIPP NEPA compliance envelope (i.e., the NEPA analysis that has already been prepared for the WIPP project), the CBFO NEPA Compliance Officer may make a determination that the proposed action is CX. If the action is not covered by WIPP programmatic NEPA documentation and is not CX, the CBFO NEPA Compliance Officer submits a recommendation to the appropriate official as delineated by DOE Order 451.1B regarding the need to prepare an SA, EA, or EIS to address the proposed action and oversees said activities. The DOE made the following CX determinations during this reporting period: • August 22, 2012 – Agricultural Research Service, Wind Erosion and Water Conservation Research Unit Wind Erosion Study (DOE, 2012i) • September 11, 2012 – Routine Replacement of HEPA Filters (DOE, 2012j) • February 5, 2013 – DOE Grant for the City of Carlsbad Improvement of the Double Eagle Well Field (DOE, 2013h) • March 25, 2013 – Lease of Office Space to Support Waste Isolation Plant Activities (DOE, 2013i) • August 12, 2013 – Routine Replacement of HEPA Filters (DOE, 2013j)

13.0 ATOMIC ENERGY ACT AND PRICE ANDERSON ACT AMENDMENTS

13.1 Summary of the Law

The AEA established a national program for research, development, and use of atomic energy for national defense and civilian purposes. Section 161 of the AEA authorized the U.S. Atomic Energy Commission to establish rules, regulations, and orders to protect health and minimize hazards to life or property through standards and restrictions pertaining to the design, location, and operation of facilities.

The Energy Reorganization Act of 1974 split the U.S. Atomic Energy Commission into two new agencies: the NRC to regulate the commercial nuclear power industry, and the Energy Research and Development Administration to manage the energy research and development, nuclear weapons, and naval reactors programs. In 1977, Energy Research and Development Administration was combined with the Federal Energy Administration to form the DOE. The AEA and subsequent reorganization acts gave the DOE its authority to develop policies, issue orders, and promulgate regulations that address environmental, safety, and health protection aspects of radioactive waste and nuclear materials. Limits on radioactivity levels in TRU waste to be disposed of at WIPP are set in section 7 of the LWA. The radioactive constituents of the TRU waste to be shipped to and disposed of at the WIPP facility are regulated under the AEA by the DOE. This is done through a system of orders, notices, directives, and policies and the DOE regulations in the 10 CFR Parts 830 and 835 series.

Congress amended the AEA of 1954 with the Price-Anderson Act (42 U.S.C. §2210) in 1957. The purpose of the Price-Anderson Act is threefold: (1) to promote growth and development of nuclear energy through increased private industry participation, (2) to protect the public, and (3) to ensure compensation should a nuclear event occur that damages and/or injures members of the public by providing funds for recovery operations. Congress passed the Price-Anderson Amendments Act of 1988 (PAAA) (Pub. L. 100-408), to allow the DOE to impose civil and criminal penalties on its contractors, subcontractors, and employees for violating any nuclear safety rule or order issued by the Secretary of Energy.

13.2 Status of Compliance through DOE Orders

Table 10 provides information on WIPP project compliance status for each of the DOE orders that implement the AEA relative to the protection of public health and safety and the environment, and relevant to the management of TRU waste at the WIPP facility.

Table 10: Status of Compliance through DOE Orders

Regulatory Requirement	WIPP Project Compliance
1. DOE Order 151.1C, Comprehensive Emergency Management System	This order establishes requirements for emergency planning, categorization, classification, preparedness, response, notification, public protection, and readiness assurance activities. The applicable requirements of this order are implemented through the WIPP emergency management program, the emergency response program, the training program, the emergency readiness program, the records management program, and the RCRA Contingency Plan (WIPP Permit Attachment D).
2. DOE Order 225.1B, Accident Investigations	The objective of this order is to prescribe requirements for conducting investigations of certain accidents occurring at DOE operations and sites; prevent the recurrence of such accidents; and contribute to improved environmental protection and safety and health of DOE employees, contractors, and the public. This order is implemented through WP 15-MD3102, *Event Investigation* (NWPa) and WP 15-GM1001, *Root Cause Analysis* (NWPb). In February 2014 WIPP experienced two events that resulted in investigations by DOE. On February 5, a salt haul truck caught fire and burned such that the mine was evacuated. The accident investigation report was released in March 2014 (DOE, 2014g). On February 14, 2014, a radiological event occurred in the active disposal room in Panel 7. The accident investigation report for this event was not released during this reporting period. NWP personnel are actively working corrective actions.
3. DOE Order 231.1B Admin Change 1, Environment, Safety and Health Reporting	The objective of this order is to ensure collection and reporting of information on environment, safety and health that is required by law or regulation to be collected, or that is essential for evaluating DOE operations and identifying opportunities for improvement needed for planning purposes within the DOE. The order specifies the reports that must be filed, the persons or organizations responsible for filing the reports, the recipients of the reports, the format in which the reports must be prepared, and the schedule for filing the reports. The order is implemented at the WIPP facility through the environmental monitoring program, the hazardous and universal waste management program, the WIPP Permit reporting and notifications compliance program, the radiation safety program, the dosimetry program, the fire protection program, MOC standard operating procedures, occupational injuries and illnesses recordkeeping and reporting, and preparation and publication of the annual site environmental report.
4. DOE Order 414.1D, Admin Change 1, Quality Assurance	This order provides DOE policy, sets forth principles, and assigns responsibilities for establishing, implementing, and maintaining programs, plans, and actions to ensure quality achievement in DOE programs. The requirements are met through implementation of the DOE (DOE/CBFO-94-1012, *Quality Assurance Program Document* [DOE,2010b]) and MOC QA programs (WP 13-1, Nuclear Waste Partnership LLC *Quality Assurance Program Description* [NWPc]).
5. DOE Order 420.1B, Change 1, Facility Safety	This order specifies requirements for nuclear safety, criticality safety, fire protection, and natural phenomena hazards mitigation. This order was cancelled by DOE Order 420.1C.

Table 10: Status of Compliance through DOE Orders

Regulatory Requirement	WIPP Project Compliance
6. DOE Order 420.1C, Facility Safety	This order specifies requirements for nuclear safety, criticality safety, fire protection, and natural phenomena hazards mitigation. Site emergency plans, fire hazards analyses, and the *Waste Isolation Pilot Plant Documented Safety Analysis* (DSA) (DOE/WIPP-07-3372) (DOE, 2013k) incorporate a baseline needs assessment of the fire protection emergency response organization. The requirements are implemented through the *WIPP Fire Hazard Analysis for the Waste Isolation Pilot Plant* (WIPP-023) (DOE, 2013l); and the DSA (DOE/WIPP-07-3372). DOE O 420.1B, Admin Change 1, was superseded by DOE O 420.1C.
7. DOE Order 435.1, Change 1, Radioactive Waste Management	The objective of this order is to ensure that all DOE radioactive waste is managed in a manner that is protective of workers, public health and safety, and the environment. In the event that a conflict exists between any requirements of this order and the LWA regarding their application to the WIPP facility, the requirements of the LWA will prevail. The applicable portions of this order are implemented through the MOC low-level and mixed low-level waste management procedures, waste handling procedures, and by engineering design of the WHB and equipment, and the underground panel and room configurations.
8. DOE Order 436.1, Departmental Sustainability	This order requires DOE sites establish a site sustainability plan (SSP) that identifies commitments for contributing to meeting the DOE's sustainability goals, integrate the SSP with operational plans, and develop and implement EMSs that are certified or conform to the ISO 14001:2004 with SSP goals integrated into the EMS. The WIPP SSP (DOE, 2013m) defines how the WIPP project will contribute toward the DOE sustainability goals. It addresses performance and planned actions related to energy, fuel and water use, sustainable buildings, data center and electronics management, pollution prevention, fleet management and sustainable acquisition. SSP actions are integrated into operations through the WIPP Ten-year Site Plan (DOE, 2013n) and the EMS environmental objectives and targets. The WIPP project EMS maintained certification to the ISO 14001 EMS standard during this reporting period. The EMS processes ensure compliance with legal requirements is maintained, the environment is protected, and performance is continually improved.
9. DOE Order 451.1B, Admin Change 3, National Environmental Policy Act Compliance Program	This order is implemented by the MOC through adherence to a site NEPA compliance plan and procedure, and a CBFO management procedure. Further discussion of this requirement is presented throughout this report.
10. DOE Order 458.1, Change 3, Radiation Protection of the Public and the Environment	This order establishes standards and requirements for operations of the DOE and its contractors with respect to protecting members of the public and the environment against undue risk from radiation. Activities and analyses describing compliance with the applicable requirements of this order are cited in the DSA (DOE, 2013k). Directions regarding release of potentially radioactive materials are specified in WP 12-RE3003, *Radiological Release of Potentially Contaminated Materials, Waste, and Items* (NWPd). Monitoring activities to document compliance with the order are described in the WIPP ALARA (as low as reasonably achievable) program, the environmental monitoring program, the records management program, the radiation safety program, and health physics and radiological engineering procedures.

Table 10: Status of Compliance through DOE Orders

Regulatory Requirement	WIPP Project Compliance
11. DOE Order 460.1C, Packaging and Transportation Safety	This order establishes requirements for the packaging and transportation of hazardous materials, hazardous substances, and hazardous wastes. The order also establishes administrative procedures for the certification and use of radioactive and other hazardous materials packaging by the DOE. Requirements for portions of this order are addressed in MOC transportation procedures and the following safety analysis reports (SARs), and Certificate of Compliance (C of C) revisions specific to this reporting period: • Transuranic Package Transporter Model II (TRUPACT-II) SAR (DOE, 2013o), and C of C No. 9218 (June 13, 2013) (NRC, 2013a) • Transuranic Package Transporter Model III (TRUPACT-III) SAR (DOE, 2013p), and C of C No. 9305 (October 8, 2013) (NRC, 2013b) • Half Package Transporter (HalfPACT) SAR (DOE, 2013q), and C of C No. 9279 (June 19, 2103) (NRC, 2013c) • RH-TRU 72-B Cask SAR (DOE, 2011b), and C of C No. 9212 (June 17, 2011) (NRC, 2011) • 10-160B Type B Radwaste Shipping Cask SAR (Energy Solutions, 2013), and C of C 9204 (December 27, 2013) (NRC, 2013d) The requirements are implemented through the DOE transportation program.
12. DOE Order 460.2A, Departmental Materials Transportation and Packaging Management	This order establishes DOE policies and requirements for materials transportation and packaging operations, including traffic management, for other than intrabuilding and intrasite transfers. The order is implemented through the MOC transportation program.

13.3 Nuclear Safety Management Regulations – 10 CFR Part 830 Series

The DOE regulations that contribute to implementing requirements of the AEA were published in the Federal Register on April 5, 1994, at 10 CFR Part 830, “Nuclear Safety Management.” Table 11 provides compliance status information on nuclear safety management regulations.

Table 11: Status of Compliance with the Nuclear Safety Management Regulations of the Atomic Energy Act

Regulatory Requirement	WIPP Project Compliance
1. Implementation and Compliance with General Requirements for Assurance of Protection of Workers, the Public and Environment 10 CFR §830.4	*No person may take or cause to be taken any action inconsistent with the requirements of this part. The contractor responsible for a nuclear facility must ensure implementation and compliance with the requirements of this part. The requirements of this part must be implemented in a manner that provides reasonable assurance of adequate protection of workers, the public, and the environment from adverse consequences, taking into account the work to be performed and the associated hazards.* The MOC has implemented and is complying with the requirements of 10 CFR Part 830, Subpart A, "Quality Assurance Requirements," through implementation of the MOC Quality Assurance Program Description (QAPD) (NWPc). Compliance with 10 CFR Part 830, Subpart B, "Safety Basis Requirements" is achieved through the DSA DOE/WIPP-07-3372 (DOE, 2013k) and DOE/WIPP 07-3373, *Waste Isolation Pilot Plant Technical Safety Requirements* (TSRs) (DOE, 2013r).
2. Records to Substantiate Compliance, 10 CFR §830.6	*Complete and accurate records will be maintained as necessary to substantiate compliance with the requirements of this part.* As necessary, the MOC personnel maintain complete and accurate records to substantiate compliance with the requirements of this part. Record-keeping requirements are described in more detail in the MOC QAPD (NWPc).
3. Use of a Graded Approach, 10 CFR §830.7	*Where appropriate, a contractor must use a graded approach to implement the requirements of this part, document the basis of the graded approach used, and submit that documentation to the DOE.* Risk factors and the graded approach to QA are addressed in the MOC QAPD (NWPc). Assignment of a specific quality code to an item or activity is commensurate with the associated risk classification; the resulting levels of control provide effective program management and incorporate due regard for the health and safety of the public and plant personnel, complexity, consequences of failure, environmental impacts, and the safe and reliable operation of the WIPP facility and the TRU transport packaging program. The MOC has also issued procedure WP 09-CN3005, *Graded Approach to Application of QA Controls* (NWPe), to implement the graded approach to the application of the QA criteria described in 10 CFR §830.122. (This procedure has been approved by the DOE.)
4. Conduct of Work in Accordance with 10 CFR §830.121(a) and 10 CFR §830.122	*The contractor responsible for the DOE nuclear facility must conduct its work in accordance with the criteria described in 10 CFR §830.122.* Quality-related work is conducted in accordance with the criteria specified in 10 CFR §830.122 and as described in the MOC QAPD (NWPc).

Table 11: Status of Compliance with the Nuclear Safety Management Regulations of the Atomic Energy Act

Regulatory Requirement	WIPP Project Compliance
5. Application of the Appropriate QA Criteria in the Quality Assurance Program (QAP) and Annual Submittal of Substantive Changes in the QAP to the DOE, 10 CFR §830.121(b) and 10 CFR §830.121(c)	*The contractor shall develop a QAP and submit it to the DOE for approval. Changes made to the QAP shall be submitted annually to the DOE for review. The contractor shall conduct work in accordance with the QAP.* *The QAP must describe how the QA criteria of 10 CFR §830.122 are satisfied; integrate the QA criteria with the Safety Management System, or describe how the QA criteria apply to the Safety Management System; use voluntary consensus standards in its development and implementation; and describe how the contractor ensures that subcontractors and suppliers satisfy the QA criteria.* The MOC has developed a QAP as described in the MOC QAPD (NWPc) using the criteria specified in 10 CFR §830.122. The MOC QAPD describes how the criteria of 10 CFR §830.122 are met and how they apply to the Safety Management System. Voluntary consensus standards, such as the NQA-1-1989 (*Nuclear Quality Assurance*) national standard, Quality Assurance Program Requirements for Nuclear Facilities (with Addenda) (American Society of Mechanical Engineers, 1989), and supplementary requirements used to develop and implement the MOC QAPD are referenced in table I-1 of the MOC QAPD, QA Program Source Documents. Subcontractor/supplier controls are discussed in the MOC QAPD. The DOE approved the current MOC QAPD in October 2013. The MOC conducts work in accordance with the QAP, as described in the MOC QAPD and incorporated into implementing procedures that control work.
6. QA Criteria to be Included in the QAP, 10 CFR §830.122	*The QAP must address management program, personnel training and qualification, quality improvement, documents, and records criteria. The QAP also must address performance (i.e., work processes, design, procurement, inspection, and acceptance testing) and assessment (i.e., management assessment and independent assessment criteria).* The MOC developed and implemented the MOC QAPD (NWPc) to address the QA criteria of 10 CFR §830.122. The management program, organizational structure, functional responsibilities and authorities, interfaces, and planning considerations are described in the MOC QAPD. Personnel training and qualifications are described in the MOC QAPD. The MOC QAPD provides for quality improvement and includes a description of the requirements and responsibilities for ensuring that appropriate methods are used to enhance quality, detect and prevent quality problems, and take corrective actions when “conditions adverse to quality” have been detected. Requirements pertaining to documents and records are described in the MOC QAPD. The MOC QAPD addresses preparation, review, and approval of documents, and generation, classification, indexing, receipt, storage, preservation, disposition, retrieval, and correction of information in quality records. The Performance Quality Assurance Requirements section of the MOC QAPD addresses general performance QA requirements. Work processes include work activities; implementing procedures; item identification and control; special processes; handling, storage, and shipping; and status indicators. The Design Control section addresses design control requirements such as design input, process, analyses, interfaces, verification, and change. The Procurement section describes requirements pertaining to procurement planning, documents, evaluation of supplier performance, and commercial grade items. The Inspection and Testing section defines requirements and

Table 11: Status of Compliance with the Nuclear Safety Management Regulations of the Atomic Energy Act

Regulatory Requirement	WIPP Project Compliance
	responsibilities for the inspection of items or activities affecting quality to verify conformance to specified criteria. The Monitoring, Measuring, Testing, and Data Collection Equipment section describes requirements and responsibilities for the control of measuring and test equipment. The Assessment Requirements section comprises two subsections: Management Assessment and Independent Assessment. The Management Assessment section describes processes to identify, correct, and track problems that impede achievement of organizational goals and objectives. The Independent Assessment section describes planning and conducting assessments to evaluate compliance with applicable QA requirements and implementing procedures, and evaluating the overall effectiveness of the quality program. The Sample Control and Quality Assurance Requirements section deals with sample control and identification; handling, storing, and shipping samples; disposition of nonconforming samples; environmental data operation samples; and documentation, control, and validation. The MOC QAPD also addresses software QA requirements.
7. Safety Basis, 10 CFR §830.202(a)	*The contractor responsible for a hazard category 1, 2, or 3 DOE nuclear facility must establish and maintain the safety basis for the facility.* The MOC has implemented the requirements of 10 CFR §830.202(a) through the DSA (DOE, 2013k) and TSRs (DOE, 2013r).
8. Unreviewed Safety Question Process, 10 CFR §830.203(a)	*The contractor responsible for a hazard category 1, 2, or 3 DOE nuclear facility must establish, implement, and take actions consistent with an unreviewed safety question (USQ) process that meets the requirements of this section.* DOE G 424.1-1B, Admin Change 1, Implementation Guide for Use in Addressing Unreviewed Safety Question (USQ) Requirements, provides information to assist in the implementation and interpretation of 10 CFR §830.203. The MOC has implemented the requirements of 10 CFR §830.203 through implementation of MOC USQ procedure WP 02-AR3001, Unreviewed Safety Question Determination (NWPf).
9. Documented Safety Analysis, 10 CFR §830.204(a)	*The contractor responsible for a hazard category 1, 2, or 3 DOE nuclear facility must obtain approval from the DOE for the methodology used to prepare the DSA for the facility unless the contractor uses a methodology set forth in Table 2 of Appendix A to this part.* DOE-STD-3009, Preparation Guide for U.S. DOE Non-Reactor Nuclear Facility Safety Analysis Reports (DOE, 2006), is the approved methodology set forth in 10 CFR §830.204[a] to meet 10 CFR Part 830, Subpart B. The MOC has implemented the requirements of 10 CFR §830.204 by using DOE-STD-3009 to develop the DSA (DOE, 2013k). Supplemental guidance specific to TRU waste processing facilities is given in DOE-STD-5506-2007, Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities (DOE, 2007), was also used to develop the DSA.

Table 11: Status of Compliance with the Nuclear Safety Management Regulations of the Atomic Energy Act

Regulatory Requirement	WIPP Project Compliance
10. Technical Safety Requirements, 10 CFR §830.205(a)	*The contractor responsible for a hazard category 1, 2, or 3 DOE nuclear facility must (1) develop TSRs that are derived from the DSA….* DOE G 423.1-1A, Implementation Guide for Use in Developing Technical Safety Requirements, establishes the content of TSRs. The MOC complies with the requirements of 10 CFR §830.205 by using DOE G 423.1-1A to prepare the TSRs. The MOC also uses DOE-STD-1186-2004, Specific Administrative Controls (DOE, 2004b), to prepare the TSRs (DOE, 2013r).

13.4 Nuclear Safety Noncompliance and the Price-Anderson Amendments Act of 1988

Table 12 provides information on Nuclear Safety Noncompliance and the PAAA.

Table 12: Status of Compliance with the Nuclear Safety Noncompliance and the Price-Anderson Amendments Act

Regulatory Requirement	WIPP Project Compliance
1. Nuclear Safety Noncompliance and the PAAA of 1988	*…DOE may either reduce or not impose the base civil penalty of up to $150,000 per violation per day, if the MOC promptly identifies the violation and reports it to the DOE. Conversely, the DOE will not mitigate the base civil penalty if the MOC does not promptly identify and report nuclear safety violations.* The MOC has voluntarily implemented a WIPP PAAA program to identify and self-report potential PAAA and worker safety and health noncompliance events. Procedures are in place at the WIPP project to assist personnel in determining and reporting noncompliance issues. The program uses the DOE's Price-Anderson Noncompliance Tracking System, a centralized data base, to report and track reportable PAAA nuclear safety noncompliance events. For the reporting period, the MOC has not been cited with any notices of violations from the DOE Office of Enforcement (HSS-40).
2. Worker Safety and Health Noncompliance 10 CFR Part 851	*851.5 Enforcement.* *(a) A contractor that is indemnified under Section 170d of the AEA (or any subcontractor or supplier thereto) and that violates (or whose employee violates) any requirement of this part shall be subject to a civil penalty of up to $75,000 for each such violation.* The MOC's WIPP PAAA program is used to identify and self-report potential worker safety and health noncompliance events per 10 CFR Part 851. The program uses the DOE's Price-Anderson Noncompliance Tracking System, a centralized database, to report and track PAAA worker safety and health noncompliance events. For the reporting period, the MOC has not been cited with any notices of violations from the DOE Office of Enforcement (HSS-40) for any worker safety and health noncompliance events.

14.0 ATOMIC ENERGY ACT AND THE U.S. NUCLEAR REGULATORY COMMISSION

14.1 Summary of the Law

As previously discussed, the AEA gives the NRC its authority to develop policies, issue orders, and promulgate regulations that address environmental, safety, and health protection aspects of radioactive waste and nuclear materials in the civilian sector. Regulations promulgated by the NRC under the AEA appear in 10 CFR Part 1 to Part 199 and establish standards for the management of nuclear material and the protection of the public against radiation. Additional NRC regulations apply to the licensing of nuclear power plants and packaging, transportation, and geological disposal of radioactive materials.

14.2 Status of Compliance with the Regulatory Requirements

The WIPP Project was authorized by section 213 of the Department of Energy National Security and Military Applications of the Nuclear Energy Authorization Act of 1980 (Pub. L. 96-164; 93 Stat. 1259, 1265) to demonstrate the safe disposal of radioactive waste materials generated by atomic energy defense activities. The act exempted the waste managed at the WIPP facility from NRC regulation. The 1992 LWA required the DOE to use NRC-certified transportation packages for the transportation of TRU waste to WIPP. The NRC regulations that apply to the WIPP transportation system are stated in 10 CFR Part 71, “Packaging and Transportation of Radioactive Material,” and are limited to those parts applicable to design certification and fabrication QA. Compliance with the regulations and applicable parts is demonstrated by the NRC approval of the packaging applications with C of C.

The NRC approved the packagings for transporting CH-TRU waste to WIPP, which are the TRUPACT-II (C of C No. 9218, issued June 19, 2013) (NRC, 2013a), the TRUPACT-III (C of C No. 9305, issued October 8, 2013) (NRC, 2013b), and the half-package transporter (HalfPACT) (C of C No. 9279, issued June 19, 2013) (NRC, 2013c). The NRC also approved packagings for transporting RH-TRU waste to WIPP, which are the RH-TRU 72-B Cask (C of C No. 9212, issued December 5, 2013) (NRC, 2011), and the 10-160B Cask (C of C No. 9204, issued December 27, 2013) (NRC, 2013d). For purposes of this section, the term “packaging” implies the TRUPACT-II, the HalfPACT, the TRUPACT-III, the RH-TRU 72-B Cask, and the 10-160B Cask. Table 13 provides compliance information for the regulatory requirements.

Table 13: Status of Compliance with the Regulatory Requirements of the Atomic Energy Act and the U.S. Nuclear Regulatory Commission

Regulatory Requirement	WIPP Project Compliance
1. General License, 10 CFR §71.17	*A general license is issued to any licensee of the Commission to transport, or deliver to a carrier to transport, licensed material in a package for which a license, C of C, or other approval has been issued by the NRC.* The DOE is not required to be a licensee. In addition the DOE does not ship "NRC-licensed material" in Type B Packages to the WIPP Facility.
2. Exemption from Classification as Fissile Material, 10 CFR §71.15	*Fissile material meeting the requirements of at least one of the paragraphs (a) through (f) of this section are exempt from classification as fissile material and from the fissile material package standards of §§71.55 and 71.59, but are subject to all other requirements of this part, except as noted.* The application for the 10-160B and RH-TRU 72-B Casks specifies that the contents are optionally controlled to limit the amount of fissile material that may be shipped to exempted quantities. The NRC reissuance of the C of C confirms that the packaging continues to meet the applicable requirements of 10 CFR §71.15.
3. Contents of Application and Package Description/ Evaluation, 10 CFR §§71.31 through 71.39	*The required contents of an application are described. The application must include a package description/evaluation and description of the packaging and proposed contents as described in 10 CFR §71.33 and must demonstrate that the package meets the appropriate NRC standards. In addition, the QA program for the design, fabrication, assembly, testing, maintenance, repair, modification, and use of the package must be described, along with established codes and standards. Any additional information requested by the NRC must be provided.* The applications for the packaging describe the design, specifications, and safety evaluation in accordance with the NRC requirements. The NRC reissuance of the C of C confirms that the packaging continues to meet the applicable requirements.
4. Demonstration of Compliance, 10 CFR §71.41	*The tests specified in 10 CFR §§71.71 and 71.73 must be performed on the package to demonstrate compliance under normal conditions and hypothetical accident conditions, respectively.* The applications describe the analysis and testing to demonstrate compliance with both normal and hypothetical accident conditions of transport. The NRC reissuance of the C of C confirms that the packaging continues to meet the applicable requirements.
5. Standards for All Packages, 10 CFR §§71.43 and 71.45	*Standards for all packages must be met. These include general standards such as size, seals and fastening devices, materials and construction of the package, valves, temperature, and prohibition of continuous venting during transport as well as lifting and tiedown standards.* The applications describe the packaging features, including tiedowns. The NRC reissuance of the C of C confirms that the packaging continues to meet the applicable requirements.

Table 13: Status of Compliance with the Regulatory Requirements of the Atomic Energy Act and the U.S. Nuclear Regulatory Commission

Regulatory Requirement	WIPP Project Compliance
6. External Radiation Standards for All Packages, 10 CFR §71.47	*A package must be designed and prepared for shipment so that the radiation level at any external contact surface of the package does not exceed 200 mrem per hour and the transport index does not exceed 10.* The applications discuss the fact that the packagings and contents limit the dose rate at the contact surface of the packaging to less than 200 mrem per hour. The applications clarify that shipments are made under exclusive-use requirements such that the applicable dose rate requirements are under 200 mrem per hour at any point on the outer surface of the vehicle and 10 mrem per hour at 2 meters from the outer lateral surface of the vehicle (i.e., compliance is with 10 CFR 71.47(b) instead of 10 CFR 71.47(a)).
7. Additional Requirements for Type B Packages, 10 CFR §71.51	*Type B packages must be designed, constructed, and prepared for shipment so as to prevent loss or dispersal of radioactive material, and so that no significant increase in external radiation levels and no substantial reduction in the effectiveness of the packaging occurs during normal transport. In addition, release of krypton-85 may not exceed 10,000 curies in one week, release of other radioactive material may not exceed a total amount A2 in one week, and no external radiation dose rate may exceed 1 rem per hour at 1 meter from the external surface of the package during hypothetical accident conditions. Compliance with these requirements must not be predicated upon the use of filters or of a mechanical cooling system.* The applications discuss containment design and acceptance criteria. The NRC reissuance of the C of Cs confirms that the packaging continues to meet the applicable requirements of 10 CFR §71.51.
8. Requirements for All Fissile Material Packages, 10 CFR §§71.55 through 71.59	*All packages used to ship fissile material must be designed and constructed in accordance with 10 CFR §§71.41 through 71.47 and 71.51. In addition, each package must be designed and constructed and its contents so limited that the contents will remain subcritical during normal and accident transportation conditions and that the packaging will remain effective during normal transportation conditions. Specific standards for fissile material packages are described in 10 CFR §71.59.* The applications for the TRUPACT-II, the HalfPACT, the TRUPACT-III, the RH-TRU 72-B Cask, and the 10-160B Cask discuss criticality; the contents are controlled to limit the amount of fissile material that may be shipped. Fissile classes have been replaced with a Criticality Transport Index. The NRC reissuance of the C of C confirms that the packaging continues to meet the applicable requirements.
9. Special Requirements for Type B Packages Containing More Than 10^5A_2, 10 CFR §71.61	*A Type B package containing more than 10^5A_2 must be designed so that its undamaged containment system can withstand an external water pressure of 2 MPa (290 psi) for a period of not less than 1 hour without collapse, buckling, or in-leakage of water.* The application for the RH-TRU 72-B Cask describes the tests performed to demonstrate compliance with this requirement. The NRC reissuance of the C of C confirms that the packaging continues to meet the applicable requirements. The TRUPACT-II, TRUPACT-III, HalfPACT, and the 10-160B are limited to less than 10^5A_2.

Table 13: Status of Compliance with the Regulatory Requirements of the Atomic Energy Act and the U.S. Nuclear Regulatory Commission

Regulatory Requirement	WIPP Project Compliance
10. Special Requirements for Plutonium Shipments, 10 CFR §71.63	*Shipments containing plutonium must be made with the contents in solid form if the contents contain greater than 0.74 TBq [terabecquerel] (20 Ci [curies]) of plutonium.* The applications for the TRUPACT-II, the HalfPACT, the TRUPACT-III, the RH-TRU 72-B Cask, and the 10-160B Cask describe the allowable plutonium contents of the packaging. The NRC reissuance of the C of C confirms that the packaging continues to meet the applicable requirements.
11. Tests Under Normal Conditions of Transport, 10 CFR §71.71	*The behavior of each package design under tests and conditions simulating normal transportation conditions must be evaluated. The tests include thermal insulation for both heated and cold conditions, increased and reduced external pressure, vibration, water spray, free drop, corner drop, compressive loading, and penetration.* The applications describe the analyses and/or tests performed to demonstrate compliance with the normal conditions of transport. The NRC reissuance of the C of C confirms that the packaging continues to meet the applicable requirements.
12. Tests Under Hypothetical Accident Conditions, 10 CFR §71.73	*Evaluation of a package for hypothetical accident conditions is based upon the sequential application of tests in the order specified to determine their cumulative effect on a package or array of packages. Tests include free drop, crush, puncture, thermal, and immersion as specified in 10 CFR §71.73.* The applications describe the analyses and/or tests performed to demonstrate compliance with the hypothetical accident conditions of transport. The NRC reissuance of the C of C confirms that the packaging continues to meet the applicable requirements.
13. Assumptions Regarding Unknown Properties, 10 CFR §71.83	*When the isotopic abundance, mass, concentration, degree of irradiation, degree of moderation, or other relevant property of fissile material in any package is not known, the fissile material will be packaged as if the unknown properties have credible values that will cause the maximum neutron multiplication.* The applications limit the amount of fissile material that may be shipped in the packagings. The NRC reissuance of the C of C confirms that the packaging continues to meet the applicable requirements.
14. Special Opening Instructions, 10 CFR §71.89	*Any special opening instructions must be sent or otherwise made available to the consignee prior to delivery of a package.* The applications provide operating and maintenance instructions for preparation, use, operation, inspection, and maintenance of the packagings. DOE personnel have the responsibility for training personnel at the generator sites in accordance with the application and implementing operations and maintenance manual. DOE personnel perform assessments and audits of the generator sites to ensure that WIPP-generated methods are being applied correctly. The NRC reissuance of the C of C confirms that the packaging continues to meet the applicable requirements.
15. Reports Regarding Decreased Effectiveness or Defects with Safety Significance, 10 CFR §71.95	*Within 60 days, the licensee will report the following to the NRC: (1) any instance in which there was significant reduction in the effectiveness of any authorized packaging during use; (2) details of any defects with safety significance in packaging after first use and the means used to prevent recurrence; and (3) instances in which the COAs in the C of C were not observed in making a shipment.* The packaging maintenance program is defined and detailed in DOE procedures that address such topics as control of material, spare parts, and nonconformance

Table 13: Status of Compliance with the Regulatory Requirements of the Atomic Energy Act and the U.S. Nuclear Regulatory Commission

Regulatory Requirement	WIPP Project Compliance
	reports. Maintenance records are maintained by the packaging maintenance engineers. No conditions causing decreased effectiveness have occurred to date. In accordance with the requirements of 10 CFR Part 71, Subpart H, the triennial surveillance assessment was conducted in 2012 and identified no areas of concern in the program. The following ten 10 CFR 71.95(c) notifications were made to the NRC: • T.E. Sellmer to H. Akhavannik, September 25, 2012; CP:12:01416. Concerned that TRUPACT-III S/Ns 001, 002 and 004 were delivered from the Certificate Holder without a required liquid penetrant inspection on a seal region having been performed. A review of all applicable shipping documentation confirmed that the TRUPACT-III units in question had successfully passed all of the required pre-shipment leakage rate testing. The units were taken out of service and the required liquid penetrant inspections were performed and the units placed back in service. • T.E. Sellmer to R. Berry, September 26, 2012; CP:12:01453. Concerned the shipment of a TRUPACT-II that had been shipped with the outer containment vessel seal test port plug o-ring installed on the outer containment vessel vent port plug. A review of the shipping documentation confirmed that the TRUPACT-II had successfully passed all of the required pre-shipment leakage rate testing. • T.E. Sellmer to R. Berry, September 27, 2012; CP:12:01464. Concerned that an incorrect payload shipping category had been assigned to one drum in a TRUPACT-II shipment. An analysis was performed that verified that the hydrogen concentration within the TRUPACT-II was well below the regulatory limit of 5%. • T.E. Sellmer to H. Akhavannik, June 17, 2013; CP:13:01226. Concerned that the incorrect methodology was used for calculating the flammability index during two shipments involving a total of three payload containers in two TRUPACT-II shipments that occurred in 2011. An analysis performed on these two payloads confirmed that the payloads were compliant with the C of C requirements for flammability but the methodology used to calculate the flammability index was not in accordance with the C of C approved methodology. • T.E. Sellmer to H. Akhavannik, July 26, 2013; CP:13:01330. Concerned two shipments of TRUPACT-II units had o-rings of the incorrect size installed on the inner containment vessel seal test port plug and the inner containment vessel inner vent port plug. A review of the shipping documentation confirmed that both TRUPACT-II's had successfully passed all of the required pre-shipment leakage rate testing. • T.E. Sellmer to H. Akhavannik, October 8, 2013; CP:13:01449. Concerned the shipment of a payload within a TRUPACT-II had been assigned the incorrect TRUCON code based on the actual packaging configurations. An evaluation with regard to payload parameters using the approved CH-TRAMPAC (Transuranic Waste Authorized Methods for Payload Control) methodology confirmed that the containers were shipped in compliance with the applicable gas generation rate limits and met all other payload limits for transport. • T.E. Sellmer to H. Akhavannik, November 11, 2013; CP:13:01530. Concerned the use of four TRUPACT-II units that had been used in five shipments in which their main inner containment vessel containment o-rings had not been replaced within 12 months. A review of the shipping documentation confirmed that all four of the TRUPACT-II's had successfully passed all of the required pre-shipment leakage rate testing. • T.E. Sellmer to H. Akhavannik, November 11, 2013; CP:13:01490.

Table 13: Status of Compliance with the Regulatory Requirements of the Atomic Energy Act and the U.S. Nuclear Regulatory Commission

Regulatory Requirement	WIPP Project Compliance
	Concerned a controlled shipment made within a HalfPACT received at the WIPP Site was not vented within the nine day vent time requirement at the receiving Site identified in the CH-TRAMPAC. A review of the applicable shipping documentation confirmed that the HalfPACT was vented within the ten day limit for controlled shipments identified in the C of C. • T.E. Sellmer to H. Akhavannik, December 12, 2013; CP:13:01583. Concerned ten shipments made in TRUPACT-II's, comprised of thirteen payloads of S100 pipe overpack containers exceeded the C of C limits of 406 curies of activity per payload. A review of the shipping documentation confirmed that all of the TRUPACT-II's had successfully passed all of the required pre-shipment leakage rate testing. • T.E. Sellmer to H. Akhavannik, February 3, 2014; CP:14:01033. Concerned one shipment comprised of three TRUPACT-II's in August of 2008 that were not vented within the twenty day time limit for close proximity shipments identified in the C of C. An independent analysis of the payload contents in the TRUPACT-II's reflected that all other TRAMPAC requirements were adhered to. A review of the shipping documentation confirmed that all of the TRUPACT-II's had successfully passed all of the required pre-shipment leakage rate testing.
16. Advance Notification of Shipment of Nuclear Waste, 10 CFR §71.97	*As specified in paragraphs (b), (c), and (d) of this section, each licensee shall provide advance notification to the governor of a State, or the governor's designee, of the shipment of licensed material, through, or across the boundary of the State, before the transport, or delivery to a carrier, for transport, of licensed material outside the confines of the licensee's plant or other place of use or storage.* The advance notification of shipments of nuclear waste as stated in 10 CFR §71.97 does not apply to the WIPP project. However, in cooperation and agreement with the states' organizations (e.g., Western Governors Association), the DOE has agreed to provide written notification of the first five shipments in a corridor 14 days in advance. Further, the DOE will provide the states with an annual notification, including six-month updates, of the shipments planned for the coming year. The states receive the eight-week rolling schedule on a weekly basis. The eight-week rolling schedule provides the detail of the annual plan. State officials designated for receipt of information (or their designees) are provided access to the DOE Transportation Tracking and Communication System (TRANSCOM). Through TRANSCOM, the states can view the eight-week rolling schedule, detailed shipment information (operational status of the shipment, the location of the shipment, messages associated with the shipment) and shipment-specific emergency response and contact information.
17. NRC Quality Assurance Requirements 10 CFR §§71.101 through 71.137	*Subpart H of 10 CFR Part 71 (§§71.101 through 71.137) established the NRC QA requirements for packagings. The QA requirements pertain to design, purchase, fabrication, handling, shipping, storage, cleaning, assembly, inspections, testing, operation, maintenance, repair, and modification of components of packaging that are important for safety. The requirements address the licensee's QA organization (§71.103); QA program (§71.105); package design control (§71.107); procurement document control (§71.109); instructions, procedures, and drawings (§71.111); document control (§71.113); control of purchased material, equipment, and services (§71.115); identification and control of materials, parts, and components (§71.117); control of special processes (§71.119); internal inspections (§71.121); test control (§71.123); control of measuring and test equipment (§71.125); handling, storage, and shipping control (§71.127); inspection, test, and operating status*

Table 13: Status of Compliance with the Regulatory Requirements of the Atomic Energy Act and the U.S. Nuclear Regulatory Commission

Regulatory Requirement	WIPP Project Compliance
	(§71.129); nonconforming materials, parts, or components (§71.131); corrective action (§71.133); QA records (§71.135); and audits (§71.137). The DOE is not required to be a licensee. The DOE does not transport NRC-licensed materials. Because the DOE is a federal entity, the NRC does not require the DOE to have an "NRC-approved program." The NRC does expect the DOE to perform any required oversight of the program. The WIPP Quality Assurance Program Plan for Type "B" Packaging (WP 08-PT.03) address each of the 18 criteria specified in Annex 2 of NRC Regulatory Guide 7.10, promulgated by the Office of Nuclear Regulatory Research (NWPg). The title of this guidance document is Establishing Quality Assurance Programs for Packaging Used in the Transport of Radioactive Material (NRC, 2005). The WIPP Quality Assurance Program Plan for Type "B" Packaging is reviewed and approved by the DOE; therefore, NRC approval is not required.

14.3 Status of Compliance with the Certificate of Compliance

The NRC has issued C of Cs to the DOE for the TRUPACT-II, HalfPACT, and RH-TRU 72B packages, and is a registered user for the TRUPACT-III and 10-160B by the NRC. Packages are designed, fabricated, assembled, tested, procured, used, maintained, and repaired in accordance with the C of Cs. Table 14 provides compliance information for the regulatory requirements.

Table 14: Status of Compliance with the Certificate of Compliance of the Atomic Energy Act and the U.S. Nuclear Regulatory Commission

Regulatory Requirement	WIPP Project Compliance
1. Allowable Decay Heat, C of C, Page 3, 5(b)(2)	*Decay heat per payload must not exceed the values given in the TRAMPACs of the TRUPACT-II SAR, the TRUPACT-III SAR, the HalfPACT SAR, the RH-TRU 72-B Cask SAR, and the Consolidated 10-160B Cask SAR. (Note: The Transuranic WAC for WIPP indicates that the 10-160B does not require the preparation of a site-specific TRAMPAC.)* The decay heat within each payload container plus the measurement error shall be less than or equal to the decay heat limit specified in the packaging SARs. The total decay heat from all containers in a TRUPACT-II shall not exceed 40 watts. The total decay heat from all containers in a HalfPACT shall not exceed 30 watts. The total decay heat from the payload container within the TRUPACT-III shall not exceed 80 watts. The total decay heat from the containers in a RH-TRU 72-B Cask shall not exceed 50 watts. The total decay heat from all containers in a 10-160B Cask shall not exceed 200 watts. The C of C identified the TRUPACT-II, the HalfPACT, the TRUPACT-III, and the RH-TRU 72-B Cask as fissile material packagings, and the 10-160B as a fissile-exempt packaging with an option to ship as a fissile material package. Therefore, the requirements specified in 10 CFR §71.59 and 10 CFR §71.15, respectively, must be met. The available methods for determining and controlling the physical form of the wastes are visual examination, radiography, and acceptable knowledge. The chemical properties of the waste are determined by the allowable chemical

Table 14: Status of Compliance with the Certificate of Compliance of the Atomic Energy Act and the U.S. Nuclear Regulatory Commission

Regulatory Requirement	WIPP Project Compliance
	constituents within a given waste type and are restricted so that all of the payload containers are safe for handling and transport. Chemical compatibility within and between the waste and the packaging ensures that no chemical process will occur that might pose a threat to the safe transport of the payload in the packagings. The configuration of the payload container and content is controlled as described in the TRAMPAC for each of the Type B packages. The CH-TRAMPAC, section 2.5 describes filter vent requirements for the authorized containers for the TRUPACT-II and HalfPACT packages (DOE, 2012k). The TRUPACT-III TRAMPAC, section 2.4 describes the filter vent requirements for the authorized container for the TRUPACT-III (DOE, 2012l). The RH-TRAMPAC, section 2.4 describes filter vents for the authorized containers for the RH-TRU 72-B (DOE, 2011c). The CH-TRAMPAC, section 5.3 describes venting and aspiration requirements for the TRUPACT-II and HalfPACT. The TRUPACT-III TRAMPAC, section 5.3 describes the venting and aspiration requirements for the TRUPACT-III. The RH-TRAMPAC, section 5.2 describes venting and aspiration requirements for the RH-TRU 72-B waste containers. Appendix 4.10.2 of the Consolidated 10-160B Cask SAR describes the venting and aspiration requirements for the 10-160B (Energy Solutions, 2013). The isotopic inventory for each payload container and the fissile content are discussed in section 3 of the CH-TRAMPAC for the TRUPACT-II and HalfPACT, section 3 of the TRUPACT-III TRAMPAC for the TRUPACT-III, section 3 of the RH-TRAMPAC for the RH-TRU 72-B, and appendix 4.10.2 of the Consolidated 10-160B Cask SAR for the 10-160B. Decay heat is discussed in section 5 of the CH-TRAMPAC for the TRUPACT-II and HalfPACT, section 5 of the TRUPACT-III TRAMPAC for the TRUPACT-III, section 5 of the RH-TRAMPAC for the RH-TRU 72-B, and appendix 4.10.2 of the Consolidated 10-160B Cask SAR for the 10-160B. The TRAMPACs and SARs discuss the payload shipping categories. The primary difference among the categories is their potential for gas generation and internal bagging configuration. For waste with an adequate margin of safety, an analytical prediction suffices. Wastes without such a margin of safety require testing, as described in the TRAMPACs and SARs.

15.0 HAZARDOUS MATERIALS TRANSPORTATION ACT

15.1 Summary of the Law

The Hazardous Materials Transportation Act (HMTA) (49 U.S.C. §§1801, et seq.), as amended, is the major transportation-related statute that affects the DOE. The objective of the HMTA is “to improve the regulatory and enforcement authority of the Secretary of Transportation to protect the nation adequately against risks to life and property which are inherent in the transportation of hazardous materials in commerce.” The HMTA provides for safe intra- and interstate transportation of hazardous materials (including nuclear materials).

The Federal Hazardous Materials Transportation Law (49 U.S.C. §§5101, et seq.) was reauthorized on October 31, 1994. This public law, which amends the HMTA, required the DOT to set standards for designating routes for the transportation of hazardous

materials that are required to be placarded, establish regulations on training standards for all hazardous materials transportation workers, issue safety permits to motor carriers for certain hazardous materials, and perform a railroad transportation safety study for certain highly radioactive materials. The DOT is also required to participate in international forums dealing with recommendations or legislation relating to mandatory standards and requirements pertaining to the transportation of hazardous materials, and to consult with interested agencies to facilitate consistency in international law with respect to hazardous materials transportation. In addition, the Hazardous Materials Transportation Uniform Safety Act (Pub. L. 101-615) requires registration and an annual registration fee for shippers and carriers of certain hazardous materials, such as radioactive materials, and establishes planning and training grants to the states for developing, improving, and implementing emergency plans.

Title 49 CFR Part 171, “General Information, Regulations, and Definitions,” sets forth the DOT requirements that are applicable to the transportation of hazardous materials and the packaging used in the transportation of those materials.

Title 49 CFR Part 172, “Hazardous Materials Table, Special Provisions, Hazardous Materials Communications Emergency Response Information, Training Requirements and Security Plans,” lists and classifies the materials the DOT has designated as hazardous for the purpose of transportation, describes the communications requirements that apply when those materials are shipped, and details training requirements for those involved in the transportation of hazardous materials and the circumstances requiring written security plans for those entities handling certain high hazard materials in transportation.

In 49 CFR Part 173, “Shippers - General Requirements for Shipments and Packagings,” the DOT defines hazardous material classes for the purpose of transportation; establishes requirements in preparing materials for shipment; sets forth inspection, testing, and retesting responsibilities concerning containers built, repaired, or conditioned for use in the transportation of hazardous materials; sets forth requirements for transporting radioactive materials; classifies materials having more than one hazard; and describes criteria for testing certain hazardous materials and packaging for shipment.

In 49 CFR Part 175, “Carriage by Aircraft,” the DOT prescribes additional requirements to those in 49 CFR Parts 171, 172, and 173 concerning the transportation of hazardous material by air. Title 49 CFR Part 171, Subpart C, is the interface between DOT, the International Air Transport Association, and the International Civil Aviation Organization. This allows air shipments to be made under International Air Transport Association / International Civil Aviation Organization regulations that are not in conflict with DOT regulations.

In 49 CFR Part 177, “Carriage by Public Highway,” the DOT sets forth requirements to promote the uniform enforcement of law to minimize danger to life and property in the transportation of hazardous materials by public highway.

Title 49 CFR Part 178, “Specifications for Packagings,” describes manufacturing and testing specifications for packaging and containers used for the transportation of hazardous materials.

15.2 Status of Compliance with the Regulatory Requirements

During this reporting period, materials that were sent off-site were appropriately packaged and complied with the regulations for off-site transportation. Table 15 provides more detail on the method of compliance with regulatory requirements under the HMTA.

Table 15: Status of Compliance with the Regulatory Requirements of the Hazardous Materials Transportation Act

Regulatory Requirement	WIPP Project Compliance
1. General Requirements, 49 CFR §171.2	*Hazardous material to be shipped must be properly classed, described, packaged, marked, labeled, and in condition for shipment.* General requirements for the shipment of hazardous material are addressed in MOC programs, and implementing procedures, which identify the organizations and positions responsible for ensuring compliance with the HMTA. The MOC general programmatic transportation document is WP 08-NT.12, *NWP Transportation Program* (NWPh). The completion of several worksheets (e.g., Shipping Request, Shipment Worksheet for Ground Transportation, and Shipment Worksheet for Air Transportation) ensures compliance through careful documentation of all required actions.
2. Hazardous Waste, 49 CFR §171.3	*Requirements for the shipment of hazardous wastes include the preparation of manifests or other shipping papers, motor vehicle placarding, waste packaging, marking and labeling, and identification numbers for the generators and the transporters.* Manifests, marking and placarding, and other labeling requirements are addressed in the transportation procedures. Completion of step-by-step worksheets and checklists ensure the proper execution of these tasks in shipping hazardous wastes from the WIPP facility to an off-site TSDF.
3. Immediate Notice of Certain Hazardous Materials Incidents and Detailed Hazardous Materials Incident Reports, 49 CFR §§171.15 through 171.16	*Section 171.15 specifies the requirements of immediate notification by each entity in physical possession of hazardous materials (including hazardous wastes) that are involved in a hazardous material incident during the course of transportation (including loading, unloading, and temporary storage). Section 171.16 specifies the requirements for the submission of a written hazardous materials incident report by the entity in physical possession of a hazardous material when an incident occurs.* Requirements for transportation emergency notifications are specified in the MOC transportation program. This program and MOC procedures address reportable incident and reporting requirements, including the identification of organizations and other entities that receive reports. The transportation program specifies that the MOC will request a copy of the report submitted by the carrier to the DOT. No hazardous materials incidents as defined in these regulations occurred during this reporting period.

Table 15: Status of Compliance with the Regulatory Requirements of the Hazardous Materials Transportation Act

Regulatory Requirement	WIPP Project Compliance
4. Table of Hazardous Materials and Special Provisions, 49 CFR §172.101	*The Hazardous Materials Table designates all materials listed as hazardous for the purpose of transporting those materials.* These requirements are covered in the MOC transportation program and apply to any "…material, including its mixtures and solutions that … is listed in Table 172.101 and/or in appendix A to 49 CFR §172.101, 'List of Hazardous Substances and Reportable Quantities.'" Transportation engineers (TEs) are trained in the use of this table as specified in MOC procedures.
5. Shipping Papers, Subpart C, 49 CFR §§172.200 through 172.205	*This subpart describes the requirements for the provision of shipping papers by persons who offer hazardous material for transportation. The shipping papers must include a description of the hazardous material and a shipper's certification. A "bill of lading" or "hazardous waste manifest" may be used depending on the commodity being shipped. Hazardous waste manifests must be retained for three years.* Requirements concerning shipping papers, including manifests for hazardous waste and bills of lading for hazardous materials, are described in MOC procedures. Each required record is identified and defined by forms attached to these procedures. Manifests are managed in accordance with MOC procedures and are retained on-site for three years.
6. Marking, Subpart D, 49 CFR §§172.300 through 172.338	*Marking requirements for the transportation of hazardous materials or substances are described in this subpart.* According to MOC procedures for shipments originating at WIPP, the TE marks the shipment in accordance with Subpart D of 49 CFR Part 172. The driver's responsibility for maintaining the markings is stated in the instructions provided to the driver when hazardous material is shipped off-site.
7. Labeling, Subpart E, 49 CFR §§172.400 through 172.450	*This subpart describes the requirements for the labeling of packages or containment devices by persons who offer hazardous material for transport.* According to MOC procedure, the TE labels the containers and packages in accordance with Subpart E of 49 CFR Part 172. The driver's responsibility for maintaining the labels is stated in the instructions provided to the driver when hazardous material is shipped off-site.
8. Placarding, Subpart F, 49 CFR §§172.500 through 172.560	*This subpart describes the requirements for the placarding of hazardous material by persons who offer hazardous material for transport.* According to MOC procedure, the TE ensures that the vehicle that will transport hazardous materials or waste from WIPP is properly placarded, if necessary. The driver's responsibility for maintaining the placards is stated in the instructions provided to the driver when hazardous material is shipped off-site.

Table 15: Status of Compliance with the Regulatory Requirements of the Hazardous Materials Transportation Act

Regulatory Requirement	WIPP Project Compliance
9. Emergency Response Information, Subpart G, 49 CFR §§172.600 through 172.606	*This subpart describes the requirements for the provision of emergency response information during transportation and at facilities where hazardous materials are loaded for transportation, stored incidental to transportation, or otherwise handled during any phase of transportation.* According to MOC procedures, the TE delivers the shipping papers and the DOT Emergency Response Guides for the particular shipment materials to the driver and releases the shipment. These documents specify driver actions to be taken in the event of an incident during transportation. The TE provides the Central Monitoring Room (CMR) with copies of transportation documentation. The CMR is the 24-hour emergency contact for all shipments of hazardous waste or materials. The MOC addresses on-site emergency response in its procedures and waste management plans.
10. Training Subpart H, Federal/State Relationship, Applicability and Responsibility for Training and Testing, and Training Requirements, 49 CFR §§172.700 through 172.702 and 172.704	*Prescribes minimal training requirements for the transportation of hazardous materials and specifies requirements that hazardous materials employers as established by DOT must meet to ensure that their hazardous materials employees are trained in a systematic program. The following requirements are included: states may impose more stringent training requirements under certain conditions; the training curriculum must include general awareness and familiarization, hazardous material recognition and identification, function-specific topics, safety and emergency response information, and security awareness, and current hazardous materials employee training records must be maintained and contain specific training documentation including certification of training.* WIPP facility employees responsible for transportation of hazardous materials must complete hazardous material transportation training. Through this training, employees become familiar with applicable hazardous material regulations, learn to recognize and identify hazardous materials, become knowledgeable of function-specific hazardous material regulations, and become knowledgeable of emergency response information and hazardous material communications requirements. The MOC provides each hazardous materials employee at the WIPP facility with initial and refresher training in accordance with established schedules. New employees, or employees who change jobs, are required to attend the training within 90 days of employment or job change. Until completion of training, they may work under the direct supervision of another certified hazardous materials employee. The MOC maintains records of current training, inclusive of the preceding three years. Training records are maintained in accordance with existing requirements. TE qualification cards must be satisfactorily completed prior to the performance of work without supervision. Requalification is required every two years.
11. Safety and Security Plans Subpart I, 49 CFR §§172.800 through 172.804	*This subpart prescribes requirements for development and implementation of plans to address security risks related to the transportation of hazardous materials. It includes a list of the type and quantity of hazardous materials that require developing a security plan, as well as a description of required components of the plan.* The WIPP facility hazardous material and site-generated waste shipments are not likely to require a security plan because the nature and quantity of such shipments do not meet the requirements. Shipments of TRU-mixed waste returned to the generator exceeding the requirements will be shipped under

Table 15: Status of Compliance with the Regulatory Requirements of the Hazardous Materials Transportation Act

Regulatory Requirement	WIPP Project Compliance
	DOE/WIPP 03-3233, WIPP TRU Waste Transportation Security Plan (DOE, 2003).
12. Shippers-General Requirements for Shipments and Packaging, 49 CFR Part 173	*This part includes the requirements for preparing hazardous materials for shipment by air, highway, rail, or water and definitions and classifications of hazardous materials for transportation purposes.* MOC procedures encompass the requirements of these sections. Outbound WIPP facility shipments are evaluated and prepared by an MOC TE to ensure requirements are met.
13. Preparation of Hazardous Materials for Transportation, Subpart B, 49 CFR §§173.21 through 173.40	*This subpart describes the general requirements for the preparation of hazardous materials for transportation. The shipper's responsibilities are described and include the hazard classification and description of hazardous material and the determination that the packaging or container is an authorized packaging and that it has been manufactured, assembled, and marked properly.* According to MOC procedures, the MOC Transportation Operations group is responsible for ensuring that materials are packaged, marked, and labeled in accordance with applicable hazardous materials transportation requirements in 49 CFR Part 173. Personnel packaging hazardous materials are familiar with the packaging requirements for these materials, commensurate with the complexity of the packaging and the degree, nature, and quantity of hazard.
14. Definitions, Classification, and Packaging for Class 1 Materials, Subpart C, 49 CFR §§173.50 through 173.63	*Definitions, classifications, and requirements for packaging of Class 1 materials (explosives) are described.* The TE classifies and packages Class 1 materials for shipment in accordance with MOC procedures.
15. Definitions, Classification, Packaging Group Assignments, and Exceptions for Hazardous Materials Other than Class 1 and Class 7, Subpart D, 49 CFR §§173.115 through 173.156	*Definitions, classifications, packing group assignments, and exceptions for hazardous materials, including flammable, nonflammable, poisonous and nonpoisonous gases, flammable liquids and solids, and toxic material are specified.* Applicable MOC procedures include worksheets for ground and air shipments. Actions required for the classification and packaging of hazardous materials are included in these worksheets.
16. Non-Bulk Packaging for Hazardous Materials Other than Class 1 and Class 7, Subpart E, 49 CFR §§173.158 through 173.230	*Non-bulk packaging requirements for hazardous materials other than Class 1 and Class 7 materials are described. Specific requirements are described in 49 CFR §§173.158 through 173.198 for nitric acid; wet batteries; corrosive nonexplosive smoke bombs; chemical kits; gallium; hydrogen fluoride; mercury; smokeless powder for small arms; aircraft hydraulic power unit fuel tanks; paint, paint-related material, adhesives and ink; refrigerating machines; liquid pyrophoric materials; barium azide; nitrocellulose based film; highway or rail fuses; lithium batteries and cells; matches; pyrophoric solids, metals, or alloys; white or yellow phosphorus; certain Group 1 poisonous materials; mixtures of bromoacetone, methyl bromide, chloropicrin, and methyl chloride or of chloropicrin and methyl chloride or of chloropicrin and compressed gas; hydrogen cyanide; infectious substances; and nickel carbonyl. [List not all-inclusive. Refer to actual regulations for complete list.]*

Table 15: Status of Compliance with the Regulatory Requirements of the Hazardous Materials Transportation Act

Regulatory Requirement	WIPP Project Compliance
	MOC procedures direct the TE to classify each shipment using the information provided in the shipping request by completing a shipment worksheet. If required, the requester and/or the TE obtain additional information to classify the shipment properly. Based on this information, the TE determines the packaging requirements.
17. Class 7 (Radioactive) Materials, Subpart I, 49 CFR §§173.401 through 173.477	*This subpart sets forth requirements for the transportation of radioactive materials by carriers and shippers and includes requirements for package design, package testing, empty radioactive materials packaging, and NRC-approved packages.* The SARs and TRAMPACs for both CH-TRU and RH-TRU waste control the packaging and shipment of radioactive waste to the WIPP facility. These documents also define how packaging requirements are determined, including verification that the quantity and form of material to be shipped meet the requirements of the C of Cs and/or tested parameters of the intended package. MOC TEs receive and ship radioactive materials in accordance with DOT regulations, using MOC procedures.
18. Carriage by Aircraft, 49 CFR Part 175	*This part describes requirements that must be observed with respect to the transportation of hazardous materials by aircraft. Included are provisions relating to unacceptable hazardous materials shipments; acceptance and inspection of shipments; discrepancy reports; notification of the pilot in command; shipping papers; keeping and replacement of labels; reporting hazardous materials incidents; quantity limitation; orientation, securing, and location of cargo containing hazardous materials; compatibility of packages; damaged shipments; and specific regulations applicable according to the classification of the material, including special limitations and requirements for Class 7 (i.e., radioactive) materials).* An MOC procedure provides guidance for shipping hazardous materials by air. Hazardous materials shipped by air from the WIPP project are in accordance with the International Air Transport Association, International Civil Aviation Organization, and 49 CFR §171, Subpart C. The transportation of hazardous waste by air transport is prohibited.
19. General Information and Regulations, Subpart A, 49 CFR §177.800; Driver Training, 49 CFR §177.816; and Routing of Class 7 (Radioactive) Materials, Subpart D, 49 CFR Part 397	*These sections set forth requirements for training, including the following: a carrier may not transport or cause to be transported hazardous material by motor vehicle unless each of its hazardous materials employees has received the appropriate specialized training. Each of the carrier's hazardous materials drivers must have the appropriate state-issued commercial driver's license with the proper endorsement. Drivers transporting a Class 7 Highway Route Controlled Quantity of (radioactive) materials must have received written training within the previous two years and must have in their immediate possession a certificate of training that includes a proper statement of authentication.* Transportation of radioactive waste and hazardous waste to and from the WIPP facility is by contract carrier. Transportation employees are required to be properly trained, with all certification information maintained in their records. Drivers must have a commercial driver's license with a hazardous materials endorsement, and must be trained and certified to transport highway route controlled quantity radioactive materials. In addition, the MOC has a motor carrier program plan for the local transport of empty packaging and

Table 15: Status of Compliance with the Regulatory Requirements of the Hazardous Materials Transportation Act

Regulatory Requirement	WIPP Project Compliance
	miscellaneous hazardous materials.
20. Specifications for Packagings, 49 CFR Part 178	*This part contains prescribed manufacturing and testing specifications and inspection requirements for packaging and for containers used for the transportation of hazardous materials.* WIPP QA procedures define the methodology by which specified criteria are verified. The CH-TRU Type B packages and RH-TRU Type B packages have been developed to transport TRU waste to the WIPP facility from the generator sites. The WIPP WAC requires that packaging meet the requirements of DOT Specification 7A Type A for WIPP facility storage and disposal. Packaging purchased for the transport of hazardous materials from the WIPP facility receives a QA review beginning with the purchase order and completed with acceptance of packaging for use. MOC TEs use an MOC procedure worksheet to specify the performance-oriented packaging necessary to satisfy packaging requirements for each shipment of hazardous materials from the WIPP facility.

16.0 MATERIALS ACT OF 1947

16.1 Summary of the Law

The Materials Act of 1947 (30 U.S.C. §§601, et seq.) authorizes the U.S. Department of the Interior (DOI) Bureau of Land Management (BLM) to dispose of mineral (including, but not limited to, sand, stone, gravel, pumice, cinders, and clay) and vegetative materials on public lands under the BLM's jurisdiction at fair market value while ensuring that adequate measures are taken to protect the environment and to minimize damage to public health and safety during the authorized removal of such materials. Under the act, no mineral material shall be disposed of if the Secretary of the DOI determines that the aggregate damage to public lands and resources would exceed the benefits to be derived from the proposed sale or free use of the material.

In the LWA, the DOE was given authority and responsibility for the management of WIPP land and the disposal of materials (e.g., mined salt), consistent with sections 2 and 3 of the Materials Act of 1947. The LWA directs the DOE to produce a WIPP land management plan (LMP) to address the disposal of salt tailings in accordance with sections 2 and 3 of the Materials Act of 1947.

16.2 Status of Compliance with the Regulatory Requirements

Table 16 provides more detail on the compliance status of each Materials Act requirement.

Table 16: Status of Compliance with the Regulatory Requirements of Materials Act of 1947

Regulatory Requirement	WIPP Project Compliance
1. The WIPP LWA Pub. L 102-579	*The Secretary shall dispose of salt tailings extracted from the Withdrawal area that are not needed for backfill at the WIPP under Section 2 of the Materials Act of 1947. Disposal shall be to the highest responsible qualified bidder after formal advertising and such other notice as deemed appropriate except the secretary may authorize negotiation of a contract for the disposal if the disposal is for materials to be used in connection with a public works improvement program on behalf of a Federal, State or local governmental agency or it is impracticable to obtain competition for disposal of the materials.* An agreement for the sale of 300,000 tons of run-of-mine salt from the WIPP facility to Magnum Minerals LLC of Hereford, Texas, was reached in December 2009. This requirement was met in that the contract was negotiated without use of competitive bidding as the Secretary determined it was impracticable to obtain competition and that the proceeds from the disposal of the materials would be used in connection with a public works improvement program. There were 15,747 tons of run-of- mine salt sold during 2012 and 28,489 tons sold during 2013. Due to the February 14, 2014, event, this program was terminated with salt shipments ceasing February 14, 2014.
2. The WIPP LWA Pub. L 102-579	*The Secretary shall dispose of salt tailings extracted from the Withdrawal area that are not needed for backfill at the WIPP under Section 3 of the Materials Act of 1947. Moneys received from the disposal of materials shall be disposed of in the same manner as moneys received from the sale of public lands.* The Carlsbad Soil and Water Conservation District administers the contract, with revenues generated by the sale staying in Southeast New Mexico and benefitting area public works projects.

17.0 FEDERAL LAND POLICY AND MANAGEMENT ACT OF 1976

The DOE manages its properties (e.g., surface realty components) in accordance with the LWA and the WIPP LMP (DOE/WIPP-93-004) (DOE, 2013s) to include concurrent memoranda and agreements with participating state and federal agencies.

17.1 Summary of the Law

One of the objectives of the Federal Land Policy and Management Act of 1976 (FLPMA) (43 U.S.C. §§1701, et seq.) is to ensure the following:

> *…public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use.*

The WIPP LMP (DOE, 2013s) integrates applicable land management provisions of the LWA; BLM planning regulations (Title 43 CFR Part 1600) issued under the authority of

the FLPMA of 1976; the NEPA of 1969, as amended; DOE NEPA regulations (10 CFR Part 1021); and existing MOUs among the DOE and local, state and/or federal agencies. The LMP is designed to provide a comprehensive framework for the management and coordination of WIPP land use. The LMP, and any subsequent amendments, will continue to apply to the use of WIPP lands through the decommissioning phase.

The guidelines in the LMP provide for the management and oversight of WIPP lands under the jurisdiction of the DOE and lands outside the WIPP boundary that are used in the operation of the WIPP facility (e.g., groundwater surveillance well pads outside the withdrawal area). Furthermore, this plan provides for multi-agency involvement in the administration of DOE land management actions. Documents referenced in the LMP are available to any person and/or organization desiring to conduct activities on WIPP lands under the purview of the DOE and those involved in development and/or amending existing land management actions. Documents can be obtained from the U.S. Department of Energy, Carlsbad Field Office, P.O. Box 3090, Carlsbad, New Mexico 88221.

17.2 Status of Compliance with the Permit

Table 17 provides details on the compliance status of each right-of-way awarded to DOE by the BLM.

Table 17: Status of Compliance with the Permit Conditions of the Federal Land Policy and Management Act of 1976

Regulatory Requirement	WIPP Project Compliance
1. Common Conditions of the Right-of-Ways	*Several conditions are common to the right-of-ways (grants) awarded to WIPP by the BLM. These common conditions are:* *(1) That the subject of the right-of-way be under the control and jurisdiction of the DOE;* *(2) That right of access and use is reserved to DOE personnel and those authorized by the DOE and to BLM personnel and their authorized permittees, licensees, and lessees;* *(3) That any products or resources on lands within the right-of-way remain under the jurisdiction of the issuing agency;* *(4) That applicable regulations under 43 CFR Part 2800 and the provisions of the right-of-way be followed; and* *(5) That reclamation seeding requirements align with BLM standards and guidelines for the Carlsbad Resource Area.* The subjects of the right-of-ways are under the control and jurisdiction of the DOE. Right of access and use of structures is reserved by the DOE and the BLM and their authorized personnel, permittees, licensees, and lessees. The LWA transferred administrative responsibility for WIPP site lands from the DOI to the DOE. These lands were also withdrawn from all forms of entry, appropriation, and disposal under the public land laws, including the mineral leasing laws (subject to existing, valid rights). Reclamation of disturbed areas is an ongoing activity at WIPP and is performed as described in the LMP. Seeding is conducted in accordance with the requirements established by the BLM Roswell District for the Carlsbad Resource Area.

Table 17: Status of Compliance with the Permit Conditions of the Federal Land Policy and Management Act of 1976

Regulatory Requirement	WIPP Project Compliance
2. Right-of-Ways	The DOE constructed the facilities for each specific right-of-way as stipulated by the right-of-way and continues to comply with standard stipulations. Right-of-ways are obtained, renewed, or canceled as necessary.

18.0 PUBLIC RANGELANDS IMPROVEMENT ACT

18.1 Summary of the Law

Congress has recognized that vast segments of public rangelands produce less than their potential for livestock, wildlife habitat, recreation, forage, and water and soil conservation benefits. The Public Rangelands Improvement Act of 1978 (43 U.S.C. §§1901, et seq.) was enacted to address the concerns that such rangelands could remain in such an unsatisfactory condition and that some areas could decline further under existing levels of management.

With the passage of this act, Congress reaffirmed a national policy and commitment to:

- Inventory and identify current public rangeland conditions and trends;
- Manage, maintain, and improve the condition of public rangelands so that they become as productive as is feasible; and
- Continue the policy of protecting wild free-roaming horses and burros while facilitating the removal and disposal of excess wild free-roaming horses and burros that pose a threat to themselves, their habitat, and other rangeland values.

The LWA transferred jurisdiction over, and statutory authority and responsibility for, the management of the withdrawn lands at the WIPP site from the DOI to the DOE. Section 4 of the LWA, Establishment of Management Responsibilities, directs the DOE to conduct the management of grazing consistent with the Public Rangelands Improvement Act, the Taylor Grazing Act (section 19.0), and FLPMA Title IV, “Range Management” (section 17.0).

The implementing regulations of 43 CFR Part 4100, “Grazing Administration - Exclusive of Alaska,” provide uniform guidance for the administration of grazing on public lands. According to 43 CFR §4100.0-2:

> *The objectives of these regulations are to promote healthy sustainable rangeland ecosystems; to accelerate restoration and improvement of public rangelands to properly functioning conditions; to promote the orderly use, improvement and development of the public lands; to establish efficient and effective administration of grazing of public rangelands; and to provide for the sustainability of the*

western livestock industry and communities that are dependent upon productive, healthy public rangelands. These objectives shall be realized in a manner that is consistent with land use plans, multiple use, sustained yield, environmental values, economic and other objectives stated in the Taylor Grazing Act of June 28, 1934, as amended (43 U.S.C. §315, 315a-315r); Section 102 of the FLPMA and the Public Rangelands Improvement Act of 1978 (43 U.S.C. §1901[b][2]).

18.2 Status of Compliance with the Regulatory Requirements

Table 18 provides the compliance status of the Public Rangelands Improvement Act requirements.

Table 18: Status of Compliance with the Regulatory Requirements of the Public Rangelands Improvement Act

Regulatory Requirement	WIPP Project Compliance
1. Land Use Plans, 43 CFR §4100.0-8	*Grazing on administered public lands shall be managed under the principle of multiple use and sustained yield and must be in accordance with the applicable land-use plan.* In accordance with the LWA and as addressed in the LMP, the DOE intends to continue current range-management practices with no immediate changes. Grazing will continue on the withdrawn lands as it has since prior to the LWA. As indicated in the LMP (DOE, 2013s), the BLM will administer range management activities in accordance with LMP appendix C, an MOU between the DOE and the BLM.

19.0 TAYLOR GRAZING ACT

19.1 Summary of the Law

The Taylor Grazing Act (43 U.S.C. §§315, et seq.) was enacted by Congress in 1934 to establish a means for federal management of public lands used for grazing. The intent of Congress was to define grazing rights and to protect these rights by regulation. This act is intended to prohibit injury to public grazing lands from unregulated grazing and directs the orderly use of and improvement to public grazing lands by establishing grazing districts and a grazing permit system.

The LWA withdrew public lands and transferred jurisdiction over WIPP site lands from the DOI to the DOE. As a result of the LWA, the DOE was given statutory authority and responsibility for the management of the withdrawn land consistent with the FLPMA (see section 17.0), the LWA, and other applicable laws such as the Taylor Grazing Act. Under the LWA, the DOE may allow grazing to continue where it was established before the enactment of the LWA, consistent with the applicable implementing regulations of the Taylor Grazing Act, 43 CFR Part 4100, “Grazing Administration - Exclusive of Alaska.” As indicated in the LMP, the BLM continues to administer the grazing permit program and to collect the grazing fees. The WIPP land withdrawal area affects two grazing allotments (i.e., land designated and managed for the grazing of livestock).

The implementing regulations of 43 CFR Part 4100 provide uniform guidance for the administration of grazing on public lands, exclusive of Alaska. The objectives of these regulations are orderly use, improvement, and development of public grazing lands, enhancement of grazing land productivity by the prevention of overgrazing and soil deterioration; stabilization of the livestock industry dependent upon the public range, and provision of inventory and categorization of public rangelands on the basis of range conditions and trends. These objectives must be consistent with land-use plans, multiple-use, sustained yield, environmental values, and other general objectives as stated by the Taylor Grazing Act.

19.2 Status of Compliance with the Regulatory Requirements

Table 19 provides more detail on the compliance status of each requirement under the Taylor Grazing Act.

Table 19: Status of Compliance with the Regulatory Requirements of the Taylor Grazing Act

Regulatory Requirement	WIPP Project Compliance
1. Land Use Plans, 43 CFR §4100.0-8	*Grazing on public lands shall be managed under the principles of multiple use and sustained yield in accordance with applicable land-use plans.* As indicated in the LMP, the BLM will administer range management activities in accordance with the MOU between the DOE and the BLM. Under the MOU, "the DOE agrees to retain responsibility for grazing management decisions affecting the two grazing allotments within the land withdrawal area" (LMP, appendix C, section VI - B) (DOE, 2013s).
2. Allotment Management Plans, 43 CFR §4120.2	*An allotment management plan shall be prepared in careful and considered consultation, cooperation, and coordination with BLM personnel, the landowners involved, the district grazing advisory board, and any other affected interests.* The WIPP land withdrawal area affects two grazing allotments administered by the BLM. The 277-acre DOE exclusive use area and 23 additional acres set aside for reclamation sites, storage yards, etc., are the only portions of the land withdrawal area not currently used for livestock activity. As indicated in the LMP, the BLM will administer range management activities in accordance with the MOU between the DOE and the BLM. Under the MOU, "The DOE agrees to retain responsibility for grazing management decisions affecting the two grazing allotments within the land withdrawal area" (LMP, appendix C, section VI - B) (DOE, 2013s).

20.0 BALD AND GOLDEN EAGLE PROTECTION ACT

20.1 Summary of the Law

The Bald and Golden Eagle Protection Act (16 U.S.C. §668-668d) makes it unlawful to take (i.e., capture, kill, or destroy), possess, molest, or disturb bald eagles and golden eagles, alive or dead, their nests, or their eggs anywhere in the United States.

The regulations in 50 CFR Part 13, "General Permit Procedures," provide uniform rules, conditions, and procedures for the application for, and the issuance, denial, suspension,

revocation, and general administration of, all permits issued pursuant to 50 CFR Subchapter B. The provisions in this part are in addition to other regulations, and apply to all permits issued under these regulations, including 50 CFR Part 22.

The import, export, purchase, sale, and or barter of bald or golden eagles, their parts, nests, or eggs are not permitted by any regulation of Subchapter B. The purpose of the regulations in 50 CFR Part 22, "Eagle Permits," is to govern the taking, possession, and transportation of bald and golden eagles for scientific, educational, and depredation-control purposes and for the religious purposes of Indian tribes.

20.2 Status of Compliance with the Regulatory Requirements

Table 20 provides more detail on the compliance status of each requirement under the Bald and Golden Eagle Protection Act.

Table 20: Status of Compliance with the Regulatory Requirements of the Bald and Golden Eagle Protection Act

Regulatory Requirement	WIPP Project Compliance
1. Status of Compliance with the Regulatory Requirements	During this reporting period, no bald or golden eagles nested within the WIPP land withdrawal area; however, individual eagles overwinter on WIPP lands. Overwintering eagles are provided considerations during determinations of all land-use actions. WIPP personnel will file an application for an eagle permit as required if the need for such a permit is perceived. For the construction of the South Access Road, the NEPA Mitigation Plan required: *…surveys for raptor nests, including burrows, and nesting structures are performed by the BLM Carlsbad Field Office (CFO) multiple times before and throughout the project. A 100-meter avoidance buffer will be employed around inactive raptor nests and a 200-meter buffer will be employed around active raptor nests. Portions of the project within these distances can be either delayed until the nest fledges or up to 90 days.* BLM CFO was consulted to determine locations of raptor nests prior to issuance of notice to proceed with construction activities and at weekly intervals during construction activities.

21.0 MIGRATORY BIRD TREATY ACT

21.1 Summary of the Law

The Migratory Bird Treaty Act (16 U.S.C. §§703 et seq.) is intended to protect birds that have common migratory flyways between the United States and Canada, Mexico, Japan, and Russia. A migratory bird means any bird that belongs to a species listed in 50 CFR §10.13. The act makes it unlawful "at any time, by any means or in any manner, to pursue, hunt, take, capture, kill, or attempt to take, capture, or kill … any migratory bird, any part, nest, or eggs of any such bird" unless specifically authorized by the Secretary of the Interior by direction or through regulations permitting and governing these actions.

The regulations in 50 CFR Part 13, “General Permit Procedures,” provide uniform rules, conditions, and procedures for the application for and the issuance, denial, suspension, revocation, and general administration of all permits issued pursuant to 50 CFR Subchapter B.

The regulations in 50 CFR Part 21, “Migratory Bird Permits,” supplement the general permit regulations with respect to permits for the taking, possession, transportation, sale, purchase, barter, importation, exportation, and banding or marking of migratory birds.

21.2 Status of Compliance with the Regulatory Requirements

Table 21 provides more detail on the compliance status of each requirement under the Migratory Bird Treaty Act.

Table 21: Status of Compliance with the Regulatory Requirements of the Migratory Bird Treaty Act

Regulatory Requirement	WIPP Project Compliance
1. Status of Compliance with the Regulatory Requirements	Routine inspections of equipment on the WIPP site are performed during the nesting season to monitor for early signs of nesting and to remove nesting materials before a nest can be established or tag out equipment in which birds have made a home. DOE maintained a United States Fish and Wildlife Service (USFWS) Migratory Bird Special Purpose Permit (USFWS, 2012), which allows for the relocation of certain bird species that are found nesting on equipment and could be in danger due to routine operations. No activities involving migratory birds took place at the WIPP facility during the reporting period.

22.0 ENDANGERED SPECIES ACT

22.1 Summary of the Law

The Endangered Species Act (ESA) was enacted in 1973 to prevent the extinction of certain species of animals and plants. This act provides strong measures to help alleviate the loss of species and their habitats and places restrictions on a wide range of activities involving endangered and threatened animals and plants to help ensure their continued survival. With limited exceptions, this act prohibits activities that could potentially impact these protected species unless authorized by a permit from the USFWS. Under section 1536 of the act and the implementing regulations in 50 CFR Part 402, Interagency Cooperation-Endangered Species Act, as Amended, the EPA is prohibited from authorizing activities likely to jeopardize the continued existence of any threatened or endangered species or its critical habitat. A biological assessment and “formal consultation,” followed by the issuance of a “biological opinion” by the USFWS, may be required for any species that is determined to be in potential jeopardy.

The regulations in 50 CFR Part 13, “General Permit Procedures,” provide uniform rules, conditions, and procedures for the application for and the issuance, denial, suspension, revocation, and general administration of all permits issued pursuant to 50 CFR Subchapter B. The provisions in this part are in addition to other regulations and apply to all permits issued under them, including 50 CFR Parts 17 and 22.

The regulations of 50 CFR Part 17, “Endangered and Threatened Wildlife and Plants,” implement the ESA. The regulations in this part outline the requirements for permits for activities involving endangered wildlife and identify those species of wildlife and plants recognized as endangered or threatened with extinction.

22.2 Status of Compliance with the Regulatory Requirements

Table 22 provides more detail on the compliance status of each requirement under the ESA.

Table 22: Status of Compliance with the Regulatory Requirements of the Endangered Species Act

Regulatory Requirement	WIPP Project Compliance
1. Status of Compliance with the Regulatory Requirements	To ensure that WIPP environmental protection programs were current in their consideration of sensitive and protected species, the *Waste Isolation Pilot Plant Threatened and Endangered Species Survey*, DOE/WIPP-97-2228 (DOE, 1996b), was conducted from August to November 1996. No threatened or endangered species were found within the WIPP land withdrawal area boundaries during the 1996 survey. Consequently, no current activities impacting endangered species are conducted at the WIPP facility. No permits, biological assessments, or formal consultations are required. On March 27, 2014, the Lesser Prairie Chicken was listed and is protected by the ESA. The Lesser Prairie Chicken does have favorable habitat within the WIPP land withdrawal area and other surrounding areas affected by WIPP operational activities (e.g., drilling boreholes). DOE adheres to established BLM timing restrictions for protection of the Lesser Prairie Chicken when performing off-site field activities.

23.0 NATIONAL HISTORIC PRESERVATION ACT

23.1 Summary of the Law

The National Historic Preservation Act (NHPA) (16 U.S.C. §§470, et seq.) was enacted to protect the nation's cultural resources in conjunction with the states, local governments, Indian tribes, and private organizations and individuals. The act also established the National Register of Historic Places (National Register). At the state level, the State Historic Preservation Officer (SHPO) coordinates the state's participation in implementing the NHPA. The NHPA was last amended in 2000.

Section 106 of the NHPA requires that a federal agency head who has jurisdiction over a federal, federally assisted, or federally licensed undertaking take into account the effects of the agency's undertaking on historic properties included in or eligible for the

National Register. This is accomplished through consultation among the federal agency, the SHPO, and other interested parties during the early stages of planning.

Section 110 of the NHPA requires each federal agency to provide a program to protect and preserve historic properties and is implemented through regulations at 36 CFR Part 800, “Protection of Historic Properties.” The regulations require development of a treatment plan by a federal agency that identifies historic properties likely to be discovered during the implementation of an undertaking and how they will be managed.

Since 1976, cultural resource investigations have recorded 60 archaeological sites and 91 isolated occurrences within the 16-square-mile WIPP site boundary. The exact number of sites within the WIPP site boundary was confirmed with the completion of a comprehensive archaeological database created in July 1994.

In 1997, the DOE officially entered into a Joint Powers Agreement with agencies from the State of New Mexico (DOE, 1997b). One of the participating agencies is the SHPO. Commitments by both agencies are established in the agreement with regard to notification time lines. In addition, the agreement reiterates the DOE obligation to manage cultural resources in accordance with sections 106 and 110 of the NHPA, the Archaeological Resource Protection Act, Native American Graves Protection and Repatriation Act, and applicable DOE orders.

23.2 Status of Compliance with the Regulatory Requirements

Table 23 summarizes the regulatory requirements and their compliance status under the NHPA.

Table 23: Status of Compliance with the Regulatory Requirements of the National Historic Preservation Act

Regulatory Requirement	WIPP Project Compliance
1. Assessment of Adverse Effects, 36 CFR §800.5	*In consultation with the SHPO, the federal agency official with jurisdiction over an undertaking is responsible for assessing the effect of an undertaking on affected historic properties, obtaining the SHPO's concurrence when the effect is not considered adverse, and notifying and submitting summary documentation to the Council.* The DOE submitted documentation to the New Mexico SHPO describing excavation activities and the avoidance of any potential historical sites. A determination of No Adverse Effect from WIPP project activities on historic properties was made by the SHPO in May 1980. This determination was applicable for the primary construction activities associated with the WIPP facility. Since the 1980 determination, the DOE has evaluated minor construction activities in previously undisturbed areas for potential impacts to cultural resources. New surface-disturbing activities are evaluated by a licensed archaeologist and concurrence is obtained from the SHPO prior to allowing the action to proceed. No new surface-disturbing activities were evaluated during the reporting period.

Table 23: Status of Compliance with the Regulatory Requirements of the National Historic Preservation Act

Regulatory Requirement	WIPP Project Compliance
2. Document Standards, 36 CFR §800.11	*After a determination by the federal agency official presiding over an undertaking that the potential for the discovery of historical property exists, the agency official may develop a plan for the treatment of such properties if discovered and include this plan in any documentation prepared to comply with 36 CFR §800.5.* The LMP outlines objectives and planned actions for the management of cultural resources within the withdrawal area.
3. Permit Requirements and Exceptions, 43 CFR §7.5	*Any person proposing to excavate and/or remove archaeological resources from public lands and to carry out activities associated with such excavation and/or removal shall apply for a permit for the proposed work and shall not begin the proposed work until a permit has been issued.* Avoidance of known archaeological sites is the primary mitigation measure used at the WIPP facility. There were no archaeological clearances required and conducted during this reporting period. There were no requests for mitigation submitted to the SHPO during this reporting period.

24.0 NEW MEXICO ENVIRONMENTAL IMPROVEMENT ACT

24.1 Summary of the Law

The enactment of the New Mexico Environmental Improvement Act (74-1-1 through 74-1-16 NMSA 1978) created the Environmental Improvement Board to promulgate regulations and standards to protect health and safety and the environment. The New Mexico Environmental Improvement Act also created the Environmental Improvement Division, now known as the NMED. The act directs the NMED to assume responsibility for environmental management and protection to demonstrate that environmental policy provides optimal health, safety, social, and economic well-being for the people of New Mexico. In carrying out its responsibilities, the NMED is directed to maintain, develop, and enforce regulations and standards in areas including water supply, liquid waste, air quality, radiation control, health and safety, hazardous wastes, and USTs. Many of these regulations and standards have been determined to be applicable to the WIPP facility. These include the HWA, the Solid Waste Act (74-9 NMSA 1978), the petroleum storage tank regulations (20.5 NMAC), the Ground Water Protection Act (74-6-1 through 74-6-17 NMSA 1978) (GWPA), the Air Quality Control Act (74-2 NMSA 1978), the Water Quality Act (74-8 NMSA 1978), and the Wastewater and Water Supply Facilities regulations (20.7 NMAC).

24.2 Status of Compliance with the Regulatory Requirements

DOE continued to comply with applicable New Mexico environmental regulations and standards as demonstrated in the following sections.

25.0 NEW MEXICO HAZARDOUS WASTE ACT

25.1 Summary of the Law

The purpose of the HWA is to ensure New Mexico's environment is maintained; to confer optimal health, safety, comfort, and economic and social well-being on its inhabitants; and to protect the proper utilization of its lands. The HWA established the program for hazardous waste management in the State of New Mexico.

On January 11, 1985, New Mexico received authorization from the EPA to administer the base federal hazardous waste program, effective January 25, 1985. On January 2, 1996, the EPA provided the State of New Mexico with authorization to implement the 1984 HSWA. With this authorization, the EPA determined that the revisions to the New Mexico hazardous waste program met the requirements of section 3006(b) of the RCRA by demonstrating that the state program was equivalent to and consistent with the federal program, and that the state program provided adequate enforcement authority to implement the revised HSWA authority under RCRA.

Section 74-4-4.E of the HWA allows the Environmental Improvement Board to adopt federal hazardous waste management regulations by reference after public notice and public hearing. The State of New Mexico has adopted the entire body of the EPA's hazardous waste regulations, with some substitutions, omissions, and exceptions. With regard to the management of mixed waste, on July 11, 1990, the EPA published its acceptance of New Mexico's revised hazardous waste program, effective July 25, 1990. This authorization allows New Mexico to regulate the hazardous constituents of mixed waste under the revised HWA. In May of 2000, New Mexico adopted federal regulations 40 CFR Parts 260 through 279, which were effective June 14, 2000. This authorization allowed the state to regulate the hazardous constituents of the mixed waste to be sent to WIPP unless changes in the federal regulations have been made and not adopted by the NMED. In March 2009, NMED adopted the federal regulations effective July 1, 2008, except for 40 CFR Part 267. On this occasion, the NMED instituted several deviations from the federal program, requiring certain records to be maintained until closure of the facility and incorporating provisions for allowing aerosol cans to be managed as universal waste under 40 CFR Part 273.

The state's Hazardous Waste Management Regulations are applicable to WIPP in three different areas. First, WIPP personnel generate hazardous waste, universal waste, and used oil and are thus required to comply with the Standards Applicable to Generators of Hazardous Waste codified in 40 CFR Part 262 (20.4.1.300 NMAC), “Standards for Universal Waste Management under 40 CFR Part 273,” and “Standards for the Management of Used Oil under 40 CFR Part 279.” As long as site-generated wastes are managed in accordance with the applicable parts of 40 CFR, no permit is required for the accumulation of these wastes.

Second, WIPP is a storage and disposal facility for TRU mixed waste, which required DOE to obtain a permit in accordance with 40 CFR Part 270 (20.4.1.900 NMAC and 20.4.1.901 NMAC) and comply with the TSDF regulatory requirements of 40 CFR Part 264 (20.4.1.500 NMAC). The WIPP Permit was issued by the NMED on

October 27, 1999 (NMED, 1999). The NMED issued the 10-year renewal WIPP Permit November 30, 2010, with an effective date of December 30, 2010 (NMED, 2010a).

Third, USTs are regulated under the New Mexico petroleum storage tank regulations, codified as 20.5 NMAC. The New Mexico petroleum storage tank regulations differ somewhat from the federal regulations specified in 40 CFR Part 280.

25.2 Status of Compliance with the Regulatory Requirements

25.2.1 Compliance with Standards Applicable to Generators of Hazardous Waste, 20.4.1.300 NMAC

Table 24 summarizes the applicable regulatory requirements and compliance status for hazardous waste generators under 20.4.1.300 NMAC, which corresponds to the federal implementing regulations of 40 CFR Part 262. Because New Mexico adopts the federal implementing regulations by reference, the citations list references from the federal regulations (e.g., 40 CFR Part 262) first, followed by the New Mexico regulatory citation.

Table 24: Status of Compliance with Standards Applicable to Generators of Hazardous Waste, 20.4.1.300 NMAC

Regulatory Requirement	WIPP Project Compliance
1. Hazardous Waste Determination, 40 CFR §262.11 (20.4.1.300 NMAC)	*The generator of solid waste is required to determine whether the waste is hazardous as defined in 40 CFR Part 261.* Hazardous waste is currently generated from maintenance, construction, and other support operations at the WIPP facility. This waste is characterized through knowledge of the materials and processes that generated the waste, MSDS, or waste sampling and analysis.
2. EPA Identification Number, 40 CFR §262.12 (20.4.1.300 NMAC)	*An EPA identification number is required for each generator of hazardous waste. In addition, a generator must not offer waste to transporters or TSDFs that have not received an EPA identification number.* The DOE has obtained a generator identification number for the WIPP facility: NM4890139088. The DOE uses only transporters or TSDFs that have an EPA identification number.
3. Manifest Requirements, 40 CFR §262.20 (20.4.1.300 NMAC)	*Compliance with the manifest requirements is mandatory for shipping hazardous waste off-site.* The DOE uses the EPA-specified Uniform Hazardous Waste Manifest (EPA Form 8700-22; Rev. 3-05) for all off-site hazardous waste shipments. The EPA required the use of this uniform manifest as of September 5, 2006.
4. Acquisition of Manifests, 40 CFR §262.21 (20.4.1.300 NMAC)	*A generator may use manifests printed by any source so long as the source of the printed form has received approval from EPA to print the manifest.* Manifests used at the WIPP facility are obtained from an EPA-approved printer.
5. Number of Copies, 40 CFR §262.22 (20.4.1.300 NMAC)	*The manifest shall consist of sufficient copies to provide two for the generator and one each for the transporter and owner or operator of the designated facility.* Manifests used at the WIPP facility contain sufficient copies to fulfill this requirement.

Table 24: Status of Compliance with Standards Applicable to Generators of Hazardous Waste, 20.4.1.300 NMAC

Regulatory Requirement	WIPP Project Compliance
6. Use of the Manifest, 40 CFR §262.23 (20.4.1.300 NMAC)	*The generator must sign the manifest certification by hand, obtain the handwritten signature of the initial transporter and date of acceptance on the manifest, and retain one copy. The generator must give the transporter the remaining copies of the manifest. Other requirements of this regulation pertain to shipments by water, rail, or to a designated facility in an authorized state which has not yet obtained authorization to regulate that particular waste as hazardous.* The DOE hazardous waste management and transportation procedures ensure that these requirements are met. Hazardous waste generated at the WIPP facility is sent to TSDFs in states authorized to regulate that particular hazardous waste.
7. Packaging Requirements, 40 CFR §262.30 (20.4.1.300 NMAC)	*EPA and DOT packaging requirements must be met before shipping hazardous waste off-site.* The DOE transportation and shipping procedures address these requirements. The DOE is responsible for proper packaging of hazardous waste shipped from the site.
8. Labeling and Marking Requirements, 40 CFR §262.31 and §262.32 (20.4.1.300 NMAC)	*DOT labeling and marking requirements must be met before shipping hazardous waste off-site.* The DOE hazardous waste management and transportation procedures address these requirements. The DOE ensures that each package of hazardous waste is properly labeled and marked before being shipped off-site.
9. Placarding Requirements, 40 CFR §262.33 (20.4.1.300 NMAC)	*DOT placarding requirements must be met before shipping hazardous waste off-site.* The DOE hazardous waste management and transportation procedures address these requirements. The DOE ensures that each shipment of hazardous waste is placarded in accordance with regulations.
10. Accumulation Time, 40 CFR §262.34(a) (20.4.1.300 NMAC)	*Large-quantity generators may accumulate hazardous wastes on-site in containers for up to 90 days without a permit.* An accumulation start date is placed on each container of hazardous waste generated at the WIPP facility at the time that waste is first added to the container or the waste exits a satellite accumulation area (SAA) as described in 40 CFR §262.34(c). The DOE follows hazardous waste management, storage area inspection, and waste disposal plans and procedures to ensure that accumulation time is not exceeded.
11. Accumulation of Hazardous Wastes, 40 CFR §262.34(a)(1)(i) (20.4.1.300 NMAC)	*Except as provided in paragraphs (d), (e), and (f) of this section, a generator may accumulate hazardous waste on-site for 90 days or less without a permit or without having interim status, provided that the waste is placed in containers, and the generator complies with Subparts I, AA, BB, and CC of 40 CFR Part 265.* Hazardous waste management, storage area inspection, and waste disposal procedures are in place to verify that no waste is accumulated for more than 90 days. Compliance with Subpart I of 40 CFR Part 265, “Use and Management of Containers,” is required for waste placed in containers. The requirements of this subpart pertain to the condition of containers, compatibility of waste with the containers, closing containers during storage, inspections, the location of containers holding ignitable or reactive waste, the segregation of incompatible wastes, and air emission standards.

Table 24: Status of Compliance with Standards Applicable to Generators of Hazardous Waste, 20.4.1.300 NMAC

Regulatory Requirement	WIPP Project Compliance
	DOE hazardous waste management procedures ensure compliance with Subpart I of 40 CFR Part 265. These include weekly inspections for container condition, container/waste compatibility, and the segregation of incompatible wastes. The hazardous waste storage area is located more than 50 feet from the WIPP facility property line for compliance with the requirements for ignitable or reactive waste (40 CFR §265.176). Container Level 1 controls (use of properly closed DOT-approved containers less than or equal to 0.1 cubic meters) are used to ensure compliance with Subpart CC standards. Subparts AA and BB do not apply to hazardous waste management activities at the WIPP facility. Implementation of these standards is required in less-than-90-day container accumulation areas but not in SAAs, per 40 CFR §262.34(c)(1). Areas exclusively storing mixed waste are not subject to the Air Emissions Standards for Tanks, Surface Impoundments, and Containers, per 40 CFR §265.1080. To date, containers used for storing organic waste have been less than $0.1m^3$, and implement Container Level 1 Controls by using DOT-approved containers.
12. Marking with Date of Initial Accumulation, 40 CFR §262.34(a)(2) (20.4.1.300 NMAC)	*Each container of hazardous waste must be clearly marked with the date of the initial accumulation of the waste.* For waste that is not managed in an SAA, the accumulation date is placed on a container when waste is first added to the container. When waste is managed in an SAA, the accumulation date is placed on the container when the container becomes full or when it is removed from the SAA.
13. Marking as Hazardous Waste, 40 CFR §262.34(a)(3) (20.4.1.300 NMAC)	*While being accumulated on-site, each container and tank is labeled or marked clearly with the words "Hazardous Waste."* Each hazardous waste container in the 90-day storage area and SAA is clearly marked with the words "hazardous waste," as described in DOE procedures. Marking on containers is inspected weekly.
14. Compliance with Preparedness and Prevention, Contingency Plan and Emergency Procedures, Training, and Waste Analysis Plan Requirements, 40 CFR §262.34(a)(4) (20.4.1.300 NMAC)	*Compliance with Subparts C (preparedness and prevention) and D (contingency plans and emergency procedures) of 40 CFR Part 265, §265.16 (personnel training), and §268.7(a)(5) (waste analysis plan [WAP] for prohibited waste under the LDRs) are required.* The DOE complies with this requirement through WIPP Permit Part 2, sections 2.6, Security; 2.7, General Inspection Requirements; 2.8, Personnel Training; 2.10, Preparedness and Prevention; 2.11, Hazards Prevention; and 2.12, Contingency Plan; and WIPP Permit Attachment D, RCRA Contingency Plan. Compliance is also assured through various emergency response procedures, formal personnel training, and operation, maintenance, and testing of emergency equipment. Details of compliance activities are provided below. Preparedness and Prevention, 40 CFR Part 265, Subpart C: The WIPP facility is designed, maintained and operated to minimize the possibility of fire, explosions, or any unplanned release of hazardous waste to the environment. Inspections of waste handling areas and equipment are conducted periodically in accordance with applicable regulations and Permittee procedures. Corrective actions are accomplished through spill management procedures and action requests. The following communication and alarm systems are in place at the WIPP facility: one-way communication by the public address (PA) system and its intercom phones and paging channels; local and facility-wide alarm systems, pagers and Plectron; and two-way communication using an intraplant telephone system, mine phones, and portable two-way radios. Inspection procedures are in place for the communication and alarm systems and the fire protection

Table 24: Status of Compliance with Standards Applicable to Generators of Hazardous Waste, 20.4.1.300 NMAC

Regulatory Requirement	WIPP Project Compliance
	equipment. These procedures include provisions for testing and maintenance to ensure that equipment will be operable in an emergency. Spill control and decontamination equipment is inspected weekly, and the results are recorded on inspection sheets as defined in WIPP Permit Attachment E, Inspection Schedule, Process and Forms. Adequate aisle space is maintained in the WIPP facility hazardous waste storage area to allow for emergency response activities. The DOE supports local ambulance and emergency medical services through MOUs with off-site emergency response agencies for fire fighting, medical assistance, and law enforcement. For example, the mutual aid agreement between the City of Hobbs and the DOE provides for mutual ambulance, medical, fire, rescue, and hazardous material response services. All outside agencies with which DOE has an MOU have received current copies of the WIPP RCRA Contingency Plan. Contingency Plan and Emergency Procedures, 40 CFR Part 265, Subpart D: The RCRA Contingency Plan defines responsibilities, provides guidance for the coordination of activities, and describes procedures and actions to minimize the threat to human health and the environment from fires, explosions, or any release of hazardous waste or hazardous waste constituents. The plan describes actions that must be taken in response to fires, explosions, or any unplanned release of hazardous waste or hazardous waste constituents to air, soil, or water. The plan lists agreements with local authorities, the names, addresses, and phone numbers of persons qualified to act as RCRA Emergency Coordinators, and the emergency equipment at the facility; and includes an evacuation plan. As stated in the plan, the RCRA Emergency Coordinator has the authority to commit the resources necessary to respond to an emergency. Copies of the plan, and all amendments, are provided to the Secretary of the NMED and outside agencies with which DOE has agreements for assistance in an emergency. The DOE maintains the distribution list for the plan and is responsible for providing up-to-date copies. A comprehensive review of the plan is conducted at least annually, and the plan is modified as necessary to ensure information is up to date. WIPP Permit modifications are submitted, if necessary, whenever applicable regulations are revised; if the plan fails in an emergency; if the facility changes in a way that materially increases the potential for fires, explosions, or releases of hazardous waste or hazardous waste constituents, or changes the response necessary in an emergency; or if the list of RCRA Emergency Coordinators or the list of emergency equipment changes. A RCRA Emergency Coordinator, on-site 24 hours a day, 7 days a week, coordinates all emergency response measures. The primary RCRA Emergency Coordinator is the on-duty Facility Shift Manager. Emergency Coordinators are thoroughly familiar with the RCRA Contingency Plan. The RCRA Contingency Plan has provisions that meet emergency procedure requirements such as communication of an emergency to employees, notification of the appropriate agency if assistance is needed, identification of hazardous materials, assessment of hazards, and notification of any incident that requires implementation of the RCRA Contingency Plan. Personnel Training, 40 CFR §265.16: Formal training at the WIPP facility is conducted in accordance with the DOE training program. Waste Analysis Plan for Managing and Treating Prohibited Wastes or Contaminated Soil in Tanks or Containers, 40 CFR §268.7(a)(5): TRU mixed waste received at the WIPP facility is exempt from the LDRs. Hazardous waste generated at the WIPP project is sent off-site for disposal in compliance with 40 CFR Part 268. If hazardous waste shipped off-site is subject to a treatment standard or technology, an LDR notice is on file with the receiving TSDF

Table 24: Status of Compliance with Standards Applicable to Generators of Hazardous Waste, 20.4.1.300 NMAC

Regulatory Requirement	WIPP Project Compliance
	specifying the treatment requirements prior to land disposal.
15. Extension of Storage Period, 40 CFR §262.34(b) (20.4.1.300 NMAC)	*The 90-day storage period may be extended for up to 30 days due to unforeseen, temporary, and uncontrollable circumstances.* Applicable DOE procedures provide instruction for the shipment of hazardous waste off-site prior to the 90-day deadline. Procedures exist if a request for an extension is needed. There were no extensions during this reporting period.
16. Restrictions and Requirements, 40 CFR §262.34(c)(1) (20.4.1.300 NMAC)	*There are a number of restrictions and requirements for SAAs. These include the limit of 55 gallons of hazardous or 1 quart of acutely hazardous waste (listed in 40 CFR §261.33[e]) and the requirement that the SAA be located at or near the point of generation of the waste and under the control of the operator.* None of the SAAs have a capacity that exceeds 55 gallons. The DOE SAA management procedure addresses how inspections are conducted to verify that the 55-gallon limit per SAA is not exceeded. In addition, the procedure defines requirements for placing waste in an SAA, and defines the responsibilities of the waste generator. No acutely hazardous waste was generated at WIPP during this reporting period; therefore, SAAs for acutely hazardous waste are not necessary and have not been established. The SAAs are located at or near the points of generation of the hazardous waste, and are under the control of the operator generating the waste.
17. Compliance with 40 CFR §§265.171, 265.172, and 265.173(a), 40 CFR §262.34(c)(1)(i) (20.4.1.300 NMAC)	*Requirements for hazardous waste generators from 40 CFR Part 265 pertain to the condition of the containers (§265.171), compatibility of the waste with the container (§265.172), and the necessity to keep the containers closed when not actually adding waste to or removing it from the containers (§265.173[a]). In addition, a container holding hazardous waste must not be opened, handled, or stored in a manner that could rupture the container or cause it to leak (40 CFR §262.34[c][1][i]).* The DOE SAA procedures and weekly inspections ensure that containers used to hold hazardous waste in SAAs are in good condition. If a container is found to be unusable, the waste is removed and transferred to another container. These procedures address waste/container compatibility and the requirement that containers be closed except when waste is being added or removed. The procedures also address the requirement that containers not be opened, handled, or stored in a manner that could cause the container to rupture or leak by requiring that containers be inspected before and after transportation from the SAA to the staging area.
18. Marking of Container as "Hazardous Waste," 40 CFR §262.34(c)(1)(ii) (20.4.1.300 NMAC)	*Marking of each hazardous waste container as "hazardous waste" is required.* Applicable DOE procedures are in place, and weekly inspections are conducted, to verify that each container of hazardous waste is clearly marked as hazardous waste.

Table 24: Status of Compliance with Standards Applicable to Generators of Hazardous Waste, 20.4.1.300 NMAC

Regulatory Requirement	WIPP Project Compliance
19. Management of Waste, 40 CFR §262.34(c)(2) (20.4.1.300 NMAC)	*If waste accumulates in one of the SAAs in excess of the 55-gallon or 1-quart limit, the container(s) containing the excess waste must be marked with the date on which excess waste began accumulating, and excess accumulation wastes must be moved to the 90-day storage area within three days.* There were no excess accumulations in the SAAs during this reporting period. Procedures and weekly inspections ensure that all waste in an SAA is moved to the 90-day accumulation area before excess amounts are accumulated.
20. Record-Keeping Requirements, 40 CFR §262.40 (20.4.1.300 NMAC)	*Manifests, test results, waste analyses, biennial reports, and exception reports must be kept on-site for at least three years.* Required records are maintained by the DOE on-site for a minimum of three years. Waste analyses and reports supporting LDRs are kept on file for a minimum of three years.
21. Generator-Biennial Report, 40 CFR §262.41 (20.4.1.300 NMAC)	*Each generator of hazardous waste that ships the waste off-site to an approved TSDF must file a report to the EPA by March 1 of every even-numbered year. This report is required to contain a description of the efforts undertaken during the year to reduce the volume and toxicity of the waste and a comparison of the volume and toxicity of the waste to previous years.* The DOE prepares this report to meet these requirements. The most recent report was submitted in February 2014 (DOE, 2014a).
22. Exception Reporting, 40 CFR §262.42 (20.4.1.300 NMAC)	*Exception reporting is required if a copy of the manifest is not returned to the generator within 45 days of the date of acceptance of the hazardous waste by the transporter.* The DOE hazardous waste management procedures address exception reporting. No exception reports were required during this reporting period.
23. Additional Reporting, 40 CFR §262.43 (20.4.1.300 NMAC)	*The Secretary, as he or she deems necessary, may require generators to furnish additional reports concerning the quantities and disposition of wastes identified or listed in 40 CFR Part 261.* No additional reports have been requested to date.
24. Special Requirements for Generators of Between 100 and 1,000 Kilograms Per Month, 40 CFR §262.44 (20.4.1.300 NMAC)	*A generator of greater than 100 kilograms (kg) but less than 1,000 kg of hazardous waste in a calendar month is subject to only … record keeping; … exception reporting; and … additional reporting requirements.* The WIPP site is currently categorized as a large-quantity generator (over 1,000 kg in any calendar month). This regulation is not applicable.

Table 24: Status of Compliance with Standards Applicable to Generators of Hazardous Waste, 20.4.1.300 NMAC

Regulatory Requirement	WIPP Project Compliance
25. Container Level 1 Standards, 40 CFR §264.1086(c)(4)(iii) (20.4.1.500 NMAC)	*When a defect is detected for the container, cover, or closure devices, the owner or operator shall make first efforts at repair of the defect no later than 24 hours after detection and repair shall be completed as soon as possible but no later than five calendar days after detection. If repair of a defect cannot be completed within five calendar days, then the hazardous waste shall be removed from the container and the container shall not be used to manage hazardous waste until the defect is repaired.* If the contents of a leaking container cannot be immediately transferred to a nondefective container, MOC personnel will temporarily plug or patch the leak as soon as it is detected. As soon as possible after a container defect is detected, but no later than the end of the work shift, MOC personnel transfer hazardous waste into a nondefective container. Empty defective containers are crushed and sent to a scrap metal recycler. Repaired containers are not used at the WIPP facility.

25.2.2 Compliance with Standards Applicable to Transporters of Hazardous Waste, 40 CFR Part 263 (20.4.1.400 NMAC)

The DOE conducts assessments or audits to review compliance with requirements of applicable federal regulations and DOE orders that pertain to hazardous waste transportation activities. A summary of the requirements for transporters of hazardous or mixed wastes and the compliance status of each requirement is provided in table 25.

Table 25: Status of Compliance with Standards Applicable to Transporters of Hazardous Waste, 40 CFR Part 263 (20.4.1.400 NMAC)

Regulatory Requirement	WIPP Project Compliance
1. Compliance with Department of Transportation Regulations, 40 CFR §263.10(a) (20.4.1.400 NMAC)	*Transporters of hazardous/mixed waste must comply with all applicable DOT regulations.* Cast Specialty Transportation, Inc., and Visionary Solutions LLC, were contracted to transport TRU waste to the WIPP facility from the generator sites during this reporting period. DOE transportation management programs incorporate applicable DOT regulations from 40 CFR Part 263. Any transporter hired to ship TRU and TRU mixed waste from the generator sites to the WIPP facility, or to transport site-generated waste from the WIPP facility to off-site TSDFs, must comply with DOT regulations.
2. EPA Identification Number, 40 CFR §263.11 (20.4.1.400 NMAC)	*The transporter of hazardous waste must have an EPA identification number from the EPA Administrator.* Any transporter hired to ship TRU and TRU mixed waste to the WIPP facility has an EPA identification number. The transporters used to transport site-generated hazardous waste from the WIPP facility to off-site TSDFs must have EPA identification numbers. During this BECR reporting period, the following transporters were used for off-site transportation of site-generated waste: Rinchem Company, Inc., and Advanced Chemical Transport.

Table 25: Status of Compliance with Standards Applicable to Transporters of Hazardous Waste, 40 CFR Part 263 (20.4.1.400 NMAC)

Regulatory Requirement	WIPP Project Compliance
3. Compliance with the Manifest System and with Record-Keeping Requirements, 40 CFR §§263.20 through 263.22 (20.4.1.400 NMAC)	*The transporter must comply with all relevant manifest and recordkeeping requirements.* The DOE transportation management plans require that transporters comply with requirements of the manifest system. Any transporter hired to ship TRU mixed waste to the WIPP facility must comply with these requirements. When shipments of TRU mixed waste are received at the WIPP facility, the manifest is signed and a copy is immediately given to the transporter. Applicable records are maintained by the DOE. Transporters of site-generated hazardous waste are given copies of manifests that include both transporter and generator signatures before leaving the WIPP facility. Transporters ensure that the manifests accompany the hazardous waste shipments and are signed and delivered to the designated TSDF facility.
4. Immediate Action after Hazardous Waste Discharges During Transportation, 40 CFR §263.30 (20.4.1.400 NMAC)	*The transporter will take appropriate immediate action in the event of a discharge of hazardous waste during transportation.* The DOE transportation management plans address actions that will be undertaken to protect human health and the environment. Any transporter that ships TRU mixed waste to WIPP must have these capabilities. No hazardous waste discharges during transportation occurred during this reporting period. Transporters used for site-generated hazardous waste shipments to off-site facilities have spill control plans that address hazardous waste discharges during shipment. No hazardous waste discharges occurred during this reporting period.
5. Discharge Cleanup, 40 CFR §263.31 (20.4.1.400 NMAC)	*A transporter must clean up any hazardous waste discharge that occurs during transportation or must take any action(s) required by federal, state, or local officials to render the discharge nonhazardous to human health and the environment.* In the event of a hazardous waste constituent discharge during transportation, cleanup activities will be undertaken, as required. Any transporter of TRU waste to the WIPP facility must be capable of ensuring adequate cleanup of any hazardous or mixed waste released to the environment during a transportation incident or accident. No hazardous waste discharges occurred during this reporting period. Transporters used for site-generated hazardous waste shipments carry spill control plans and cleanup equipment. In the event of a hazardous waste discharge, cleanup activities will be undertaken. No hazardous waste discharges occurred during this reporting period.

25.2.3 Compliance with the Regulatory Requirements for TSDFs, 40 CFR Part 264 (20.4.1.500 NMAC)

An operating permit for WIPP was issued on October 27, 1999 (NMED, 1999). The permit authorized the Permittees to receive TRU and TRU mixed waste, store the waste, and dispose of the waste in underground hazardous waste disposal units (HWDUs). The NMED issued the WIPP Permit 10-year renewal on November 30, 2010 (NMED, 2010a).

On February 5, 2014, a vehicle fire occurred in the WIPP underground, resulting in suspension of normal waste operations and shipments from generator sites. On February 14, 2014, a Continuous Air Monitor detected airborne radiation in the underground, causing the ventilation exhaust to automatically shift to HEPA filtration mode. The ventilation system remained in filtration mode through the reporting period. Entries into Panel 7 in the underground confirmed that one container from a nitrate salt bearing waste stream from Los Alamos National Laboratory was breached. Cleanup of the contamination event and investigation as to its cause are ongoing as part of the recovery process. Presently, shipments of waste to the WIPP facility remain suspended and the underground is unaccessible to normal activities. No shipments have been received at WIPP since February 6, 2014.

As of this reporting period, NMED issued one Administrative Order (NMED, 2014) to address WIPP Permit requirements that could not be met due to inaccessibility to the underground for normal activities. The Administrative Order, issued on February 27, 2014, provides requirements for monitoring and reporting to the NMED the status of recovery from the two events. It required weekly reporting on above-ground compliance and permitted surface-related requirements. The weekly reports are available online at http://www.wipp.energy.gov/library/Information_Repository_A/IR_2014.htm.

Due to the fire and radiological events occurring in the underground, impacts to human health and the environment were minimized in accordance with 40 CFR §264.31. The Permittees are in the process of developing a WIPP Recovery Plan, that will provide the safe and environmentally sound approach for bringing the WIPP facility back to an operational state.

Applicable requirements of a permitted RCRA disposal facility are described in table 26.

Table 26: Status of Compliance with the Regulatory Requirements for TSDFs, 40 CFR Part 264 (20.4.1.500 NMAC)

Regulatory Requirement	WIPP Project Compliance
1. Applicability, 40 CFR §264.10 (20.4.1.500 NMAC)	*The regulations in Subpart B apply to owners and operators of all hazardous waste facilities, except as §264.1 provides otherwise.* The portions of Subpart B applicable to the WIPP facility are identified in §§264.11 through 264.18, as discussed below.
2. EPA Identification Number, 40 CFR §264.11 (20.4.1.500 NMAC)	*Each TSDF must have an EPA identification number.* The EPA identification number for the WIPP facility is NM4890139088.
3. Required Notices, 40 CFR §264.12(b) (20.4.1.500 NMAC)	*The owner or operator of a facility that receives waste from an off-site source must inform the generator that the appropriate permits are in place and the waste will be accepted.* On January 12, 2000, the DOE sent notification to all applicable generators that a permit had been received. As new generators become certified under the WIPP program, notifications are sent to the generators stating that the appropriate permits are in place and that waste meeting WIPP's WAC will be accepted in accordance with the WIPP Permit.

Table 26: Status of Compliance with the Regulatory Requirements for TSDFs, 40 CFR Part 264 (20.4.1.500 NMAC)

Regulatory Requirement	WIPP Project Compliance
4. General Waste Analysis, 40 CFR §264.13 (20.4.1.500 NMAC)	*A detailed chemical and physical analysis of a representative sample of the wastes is required before a TSDF may treat, store, or dispose of waste. The owner/operator of the TSDF must inspect and, if necessary, analyze the waste received to ensure that it matches the identity of the waste described in the accompanying manifest. The owner/operator must follow a written WAP to ensure compliance with these requirements.* General waste analysis is addressed in WIPP Permit Part 2, General Facility Conditions, and WIPP Permit Attachments C, Waste Analysis Plan; C1, Waste Characterization Sampling Methods; C3, Quality Assurance Objectives and Data Validation Techniques for Waste Characterization Methods; C4, TRU Mixed Waste Characterization Using Acceptable Knowledge; C5, Quality Assurance Project Plan Requirements; C6, Audit and Surveillance Program; and C7, TRU Waste Confirmation. Characterization methods consist of acceptable knowledge, visual examination, radiography, headspace gas sampling and analysis, and additional sampling and analysis for homogeneous solids, soil, and gravel waste forms. The Permittees examine a representative subpopulation of the waste prior to shipment to confirm that the waste contains no ignitable, corrosive or reactive waste and that the EPA hazardous waste numbers are allowed by the permit.
5. Security, 40 CFR §264.14 (20.4.1.500 NMAC)	*Security measures are required to prevent the possibility of unknowing and/or unauthorized entry by persons or livestock onto the active portion of the facility. A 24-hour surveillance system or barrier is required, and the facility must be posted.* Security requirements are contained in WIPP Permit Part 2, section 2.6, Security. The WIPP Property Protection Area is enclosed within an 8-foot-high chain-link fence, and 24-hour surveillance is conducted by guards trained to prevent unauthorized entry onto the facility. Signs are posted with the legend “Danger—Authorized Personnel Only” in both English and Spanish. The perimeter fence, gates, and signs are inspected daily for evidence of tampering or structural damage in accordance with Permittee-approved procedures.
6. General Inspection Requirements, 40 CFR §264.15 (20.4.1.500 NMAC)	*The owner/operator must inspect the facility for malfunctions, deterioration, operator errors, and discharges that cause actual or potential releases of hazardous constituents to the environment or a threat to human health. A written schedule must be developed and followed for inspecting all monitoring, safety, and emergency equipment; security devices; and operating/structural equipment needed to prevent, detect, or respond to environmental or human health hazards. The inspections must be recorded in an inspection log or summary and kept for at least three years.* The Permittees implement inspection procedures for monitoring, safety, and emergency equipment; security devices; and operating and structural equipment. Written schedules (WIPP Permit Attachment E, Inspection Schedule, Process, and Forms) establish the frequency of routine inspections. Cognizant individuals develop and maintain procedures that outline the types of inspections of equipment and systems that will be performed. Each organization responsible for inspections maintains its own inspection information. Completed inspection sheets include a signature, date and time of inspection; observations made; and the date and nature of any repairs or other remedial actions. Inspection documentation is maintained in the operating record for a minimum of three years.

Table 26: Status of Compliance with the Regulatory Requirements for TSDFs, 40 CFR Part 264 (20.4.1.500 NMAC)

Regulatory Requirement	WIPP Project Compliance
7. Personnel Training, 40 CFR §264.16 (20.4.1.500 NMAC)	*Personnel training must be provided to facility personnel within six months of their employment or new assignment; personnel must not work in unsupervised positions until the training has been completed. The training program must be designed to ensure that facility personnel can respond effectively to an emergency. The training program must teach personnel those hazardous waste management procedures that are relevant to the positions in which they are employed. The program must be directed by a person trained in hazardous waste management procedures. The job title for each position at the facility that is related to hazardous waste management, the name of the employee filling the position, a written description of the training required, and records that document that the training and/or job experience has been completed are also required. These records must be kept until closure for current personnel and for at least three years for former employees.* Training requirements are specified in WIPP Permit Attachments F, Personnel Training; F-1a, Job Title/Job Description; and F-1b, Training Content, Frequency, and Techniques. Attachment F1, RCRA Hazardous Waste Management Job Titles and Descriptions, lists all applicable job titles with detailed descriptions, and Attachment F2, Training Course and Qualification Card Outlines, describes all training courses required by the WIPP Permit. Formal training is conducted in accordance with the WIPP Training Program WP 14-TR.01 (NWPi) and its associated procedures. The training includes General Employee Training for all WIPP project employees, other classroom training, and on-the-job training. WIPP-related training is conducted by qualified instructors. The Permittees maintain a listing of all hazardous waste management job titles, names and titles of employees assigned to hazardous waste management jobs, and job descriptions that identify RCRA duties. Records on active and inactive personnel are kept at the WIPP facility for the specified time periods.
8. General Requirements for Ignitable, Reactive, or Incompatible Wastes, 40 CFR §264.17 (20.4.1.500 NMAC)	*Precautions must be taken to prevent accidental ignition or reaction of ignitable or reactive waste. Any mixture or commingling of incompatible wastes must be conducted so that it does not generate extreme heat or pressure, fire or explosion, violent reaction; does not produce uncontrolled toxic airborne materials; does not produce uncontrolled flammable fumes or gases; does not damage the structural integrity of the device or facility; or does not threaten human health or the environment.* The WIPP facility is precluded from accepting ignitable, corrosive, or reactive waste as specified in WIPP Permit Part 2, General Facility Conditions, and Attachment C, Waste Analysis Plan. Addendum B2 of the WIPP Permit Application, “Chemical Compatibility Analyses of Waste Forms and Container Materials,” reported the results of an analysis of the compatibility of the TRU waste streams with each other and with waste containers, backfill, and other facility materials. No incompatibilities were identified during the reporting period.

Table 26: Status of Compliance with the Regulatory Requirements for TSDFs, 40 CFR Part 264 (20.4.1.500 NMAC)

Regulatory Requirement	WIPP Project Compliance
9. Location Standards, 40 CFR §264.18 (20.4.1.500 NMAC)	*Facilities where disposal of hazardous waste will be conducted must not be located near a fault as listed in 40 CFR §270.14(b)(11). Facilities in a 100-year flood plain must be designed, constructed, operated, and maintained to prevent washout by a 100-year flood. No noncontainerized or bulk liquid hazardous waste may be emplaced in such structures as a salt bed formation or an underground mine except at the DOE WIPP in New Mexico.* Eddy County is not listed as a political jurisdiction in which compliance with the seismic standard of 40 CFR §264.18(a) must be demonstrated. The WIPP site does not lie within a 100-year flood plain.
10. Design and Operation of Facility, 40 CFR §264.31 (20.4.1.500 NMAC)	*Facilities must be designed, constructed, maintained, and operated to minimize the possibility of fire, explosions, or any unplanned release of hazardous constituents to air, soil, or surface water that could threaten human health or the environment.* Waste-handling facilities are designed, constructed, maintained, and operated to minimize the possibility of a fire, explosions or any unplanned release of hazardous waste or hazardous waste constituents. General facility conditions for maintenance and operation of the WIPP facility are stated in WIPP Permit Part 2, General Facility Conditions. Preventive procedures, structures, and equipment are specified in WIPP Permit Part 2, section 2.10, Preparedness and Prevention. An inspection schedule for equipment instrumental in preventing, detecting, or responding to environmental or human health hazards is given in WIPP Permit Attachment E, Inspection Schedule, Process and Forms. WIPP Permit Attachment D, RCRA Contingency Plan, defines the responsibilities and coordination of activities to minimize hazards to human health and the environment from fires, explosions, or any release of hazardous waste, or hazardous waste constituents to air, soil, or surface water. This plan also consists of descriptions of processes and emergency responses specific to hazardous substances, CH- and RH-TRU mixed waste, and other hazardous waste handled at the WIPP facility.
11. Required Equipment, 40 CFR §264.32 (20.4.1.500 NMAC)	*All facilities must be equipped with an internal communications or alarm system for immediate emergency instruction; devices to summon external emergency assistance; fire extinguishers and fire-control, spill-control, and decontamination equipment; and water or foam equipment, sprinklers, or water-spray systems.* The intraplant communication systems, designed to provide immediate emergency instructions to facility personnel, include communication by the PA system and its intercom phones and paging channels, an intraplant telephone system, mine phones, pagers and Plectrons, portable two-way radios, and local and facility-wide alarm systems. The procedures for notifying facility personnel of an emergency are described in the RCRA Contingency Plan, WIPP Permit Attachment D. Various alarm systems are used at the WIPP facility. The PA system has two alarm tones in use, a yelp and a gong. Its signals are produced in the master PA system console by a tone generator and are transmitted sitewide over the paging channel of the system, overriding its normal use. Whenever TRU mixed wastes are handled, two persons, at a minimum, are involved in the operation. The WHB contains readily accessible telephones and PA stations throughout. The mine phones are the main means of communication underground, although the PA system is also available. Underground communication and alarm systems are arranged to meet the

Table 26: Status of Compliance with the Regulatory Requirements for TSDFs, 40 CFR Part 264 (20.4.1.500 NMAC)

Regulatory Requirement	WIPP Project Compliance
	requirements of 30 CFR §57.4360, which regulates the operation of underground mines and is imposed by the Mine Safety and Health Administration. Telephones or other two-way communication equipment, with instructions for use, are provided for communications from underground to the surface. Alarm systems capable of promptly warning every person underground are provided and maintained in operating condition. Typically, these provisions include a flashing light positioned to be easily seen. If persons are assigned to work areas beyond the warning capabilities of the system, provisions will be made to properly alert them and to provide for their safe evacuation. The external communication systems, designed to provide two-way communication with outside agencies or for summoning emergency assistance from off-site, include the commercial telephone system and two-way radios. WIPP Permit Part 2, General Facility Conditions, specifies preventive procedures, structures, and equipment. The RCRA Contingency Plan, WIPP Permit Attachment D, describes the capabilities and locations of the fire-suppression equipment and systems. The WIPP facility water system supplies water for domestic use and fire protection. Water is furnished by the City of Carlsbad. Fire sprinkler systems are installed in the Pumphouse, the Guard and Security Building, the Support Building, the WHB, the Exhaust Filter Building, the TRUPACT Maintenance Facility, the Engineering Building, the Safety and Emergency Services Building, the Training Building, and several other warehouse and maintenance buildings. The WIPP facility maintains a fire brigade and has on-site fire fighting equipment. Fire hydrants and hose connections for fire fighting are located throughout the facility. There is no fire fighting water supply system underground. Instead, the underground is equipped with fire extinguishers of various types and in various locations (including vehicles), and a fire truck with a dry chemical extinguisher and a foam extinguisher. The underground fuel station is equipped with an automatic dry chemical extinguishing system. On February 5, 2014, a salt haul truck caught fire in the underground and burned such that the underground was evacuated. The subsequent accident investigation report (DOE, 2014g) identified issues with the underground evacuation alarm and strobe, the onboard fire suppression system on the haul truck, the use of fire extinguishers, operation of the equipment, and the associated training and drills. Actions are in progress to correct the identified deficiencies.
12. Testing and Maintenance of Equipment, 40 CFR §264.33 (20.4.1.500 NMAC)	*All facility communications or alarm systems and fire-control, spill-control, and decontamination equipment must be tested and maintained as needed to ensure its proper operation during an emergency.* Equipment instrumental in preventing, detecting, or responding to environmental or human health hazards, such as alarm systems, fire protection equipment, and decontamination equipment, are tested and maintained to assure proper operation in a time of emergency. Alarms, spill control, and decontamination equipment are inspected periodically in accordance with the WIPP Permit Attachment E, Inspection Schedule, Process and Forms. On February 5, 2014, a salt haul truck caught fire in the underground and burned such that the underground was evacuated. The subsequent accident investigation report (DOE, 2014g) identified issues with maintenance of the specific haul truck and other underground equipment, Identified issues included, but are not limited to, discrepancies between manufacturer

Table 26: Status of Compliance with the Regulatory Requirements for TSDFs, 40 CFR Part 264 (20.4.1.500 NMAC)

Regulatory Requirement	WIPP Project Compliance
	maintenance recommendatons and actual maintenance performed, various underground components that were either out of service or being configured in a manner that hampered communications and critical equipment operations during an emergency. Corrective actions have been identified and are in progress to address the identified deficiencies.
13. Access to Communications or Alarm Systems, 40 CFR §264.34 (20.4.1.500 NMAC)	*Immediate access to a communications or internal alarm system is required for all personnel involved when handling hazardous waste. If just one employee is ever on the premises during operations, he or she must have immediate access to a device (e.g., telephone) for summoning external emergency assistance.* The following communication and alarm systems are available at the WIPP facility: the PA system and its intercom phones and paging channels, an intraplant telephone system, mine phones, local and facility-wide alarm systems, pagers and Plectron, and portable two-way radios. WIPP Permit Part 2, section 2.10, Preparedness and Prevention, specifies preventive procedures, structures, and equipment. WIPP Permit Attachment E, Inspection Schedule, Process and Forms, provides an inspection schedule for this equipment and describes its location. Alarms and telephones are strategically placed in and adjacent to hazardous and TRU waste management facilities. There is more than one employee on the premises at all times.
14. Required Aisle Space, 40 CFR §264.35 (20.4.1.500 NMAC)	*Aisle space must be maintained to allow the unobstructed movement of personnel and of fire-protection, spill-control, and decontamination equipment to any area of facility operation unless aisle space is not needed for these purposes.* WIPP Permit Part 2, General Facility Conditions, and WIPP Permit Part 2, section 2.10, Preparedness and Prevention, WIPP Permit Part 3, Container Storage, and Permittee procedures, call for maintaining appropriate aisle space for all stored waste in the WHB. No aisle space is required to be maintained between containers emplaced in the HWDUs as permitted by WIPP Permit Attachment A2, Geologic Repository.
15. Arrangements with Local Authorities, 40 CFR §264.37 (20.4.1.500 NMAC)	*Arrangements with local authorities must be made for the provision of emergency services if needed. Requirements include familiarizing the local authorities with the layout of the facility, properties of hazardous waste to be handled, possible evacuation routes, and other information needed for emergency responses.* The Permittees have established MOUs with appropriate off-site emergency response agencies for the provision of emergency services. Outside agencies with which MOUs have been established have received copies of the RCRA Contingency Plan and all amendments as required by the WIPP Permit Part 2, General Facility Conditions, and 40 CFR §§264.53 and 264.54.
16. Purpose and Implementation of the Contingency Plan, 40 CFR §264.51 (20.4.1.500 NMAC)	*Each owner/operator must have a contingency plan for their TSDF. The contingency plan must be designed to minimize hazards to human health or the environment from fires, explosions, or unplanned releases of hazardous waste or hazardous constituents to the environment. The provisions of the plan must be carried out whenever a fire, explosion, or release of hazardous waste or hazardous constituents could threaten human health or the environment.* The RCRA Contingency Plan, WIPP Permit Attachment D, defines responsibilities; provides guidance for coordination of activities; and

Table 26: Status of Compliance with the Regulatory Requirements for TSDFs, 40 CFR Part 264 (20.4.1.500 NMAC)

Regulatory Requirement	WIPP Project Compliance
	minimizes hazards to human health and the environment from fires, explosions, or any unplanned release of hazardous waste or hazardous waste constituents.
17. Content of the Contingency Plan, 40 CFR §264.52 (20.4.1.500 NMAC)	*The contingency plan must describe the actions to be taken by facility personnel in response to fires, explosions, or any unplanned releases of hazardous waste or hazardous constituents to the environment. The plan must describe arrangements agreed to by local authorities and emergency response units and must list the current names, addresses, and phone numbers (work and home) of all Emergency Coordinators. All emergency equipment must be listed, along with the location, description, and capabilities of all equipment. An evacuation plan for facility personnel must be included.* The RCRA Contingency Plan describes actions that must be taken in response to fires, explosions, or any unplanned release of hazardous waste or hazardous waste constituents to air, soil, or water, and describes agreements with local authorities (police and fire departments, hospitals, contractors, and state and local emergency response teams). It also lists the names, addresses, and phone numbers of persons qualified to act as Emergency Coordinators, provides a list of emergency equipment at the facility, and includes an evacuation plan.
18. Copies of the Contingency Plan, 40 CFR §264.53 (20.4.1.500 NMAC)	*Copies of the contingency plan and all revisions to the plan must be maintained at the facility and submitted to all local police and fire departments, hospitals, and state and local emergency response teams that may be called upon to provide emergency services.* Copies of the RCRA Contingency Plan are maintained at the WIPP facility at document locations accessible to emergency responders, and on the WIPP network available to all WIPP facility personnel. The Permittees maintain a distribution list and are responsible for distributing the RCRA Contingency Plan to local officials and MOU agencies when the plan is modified. When the plan is revised, copies are provided to each outside agency with which the Permittees have agreements for assistance in an emergency.
19. Amendment of Contingency Plan, 40 CFR §264.54 (20.4.1.500 NMAC)	*The contingency plan must be reviewed and immediately revised, if necessary, whenever applicable regulations are revised; the plan fails in an emergency; the facility changes in a way that increases the potential for fire, explosions, or release of hazardous waste; or the list of Emergency Coordinators or emergency equipment changes.* The RCRA Contingency Plan is reviewed at least annually, and the WIPP Permit is modified if necessary whenever applicable regulations are revised; the plan fails in an emergency; the facility changes in a way that materially increases the potential for fires, explosions, or releases of hazardous waste or hazardous waste constituents or changes the response necessary in an emergency; the list of Emergency Coordinators changes; or the list of emergency equipment changes. The Contingency Plan was last modified in October 2013, updating figures to indicate Panel 7 as approved for use. Copies of the modified RCRA Contingency Plan were distributed to the appropriate on-site departments and off-site agencies and the Secretary of the NMED.
20. Emergency Coordinator, 40 CFR §264.55 (20.4.1.500 NMAC)	*At least one employee (on the facility premises or on call) must be designated as the Emergency Coordinator, with the responsibility for coordinating all emergency response measures. The Emergency Coordinator must be familiar with the*

Table 26: Status of Compliance with the Regulatory Requirements for TSDFs, 40 CFR Part 264 (20.4.1.500 NMAC)

Regulatory Requirement	WIPP Project Compliance
	contingency plan, all operations and activities at the facility, the location and characteristics of waste handled, location of all facility records, and the facility layout. The Emergency Coordinator must have the authority to commit the resources needed to carry out the contingency plan. A RCRA Emergency Coordinator is on-site at the WIPP facility 24 hours a day, 7 days a week, and is responsible for coordinating all emergency response measures. The primary RCRA Emergency Coordinator is the Facility Shift Manager, who is on duty at the time of any incident that requires implementation of the RCRA Contingency Plan. Personnel qualified to act as RCRA Emergency Coordinator are listed in the RCRA Contingency Plan. These employees have the requisite experience and authority to perform this role.
21. Emergency Procedures, 40 CFR §264.56 (20.4.1.500 NMAC)	*In the event of an imminent or actual emergency, the Emergency Coordinator or designee must notify facility personnel via internal alarms or communications systems and must notify state or local agencies if their help is needed. A release, fire, or explosion mandates that the Emergency Coordinator obtain appropriate information, assess possible hazards, make any notifications required, prevent the spread or reoccurrence of the incident, monitor if necessary, recover waste, prevent handling of incompatible waste in the area, ensure that emergency equipment is cleaned up and fit for use after the event, and record details regarding the incident in the facility's operating record. The owner or operator must note specific information about any incident that requires the contingency plan to be implemented. This information must be recorded in the facility's operating record. A written report must be submitted to the Regional EPA office and the NMED within 15 days of the incident. The NMED and the SERC must be contacted in the event of any spill incident that may endanger human health or the environment.* WIPP facility RCRA Emergency Coordinators are thoroughly familiar with the RCRA Contingency Plan. The plan has provisions that meet the emergency procedure requirements, such as communicating emergency information to employees, notifying appropriate agencies to obtain assistance, identifying hazardous materials, assessing hazards, and making the necessary notifications. The appropriate agencies include the LEPC, the Carlsbad Police Department, the Carlsbad Fire Department, and the Eddy County Sheriff's Department. The Facility Shift Manager is responsible for coordinating the cleanup of spills. Disposal of the waste resulting from cleanup is the responsibility of the Permittees. Equipment used in an emergency will be thoroughly decontaminated before being placed back in service. If decontamination is not possible, equipment will be disposed of according to Permittee procedures and replaced. Equipment listed in the plan is kept clean and fit for its intended use. As described in the plan, a daily log is maintained in the WIPP facility CMR. Incidents, regardless of whether or not they activate the plan, are recorded in the CMR log. The RCRA Contingency Plan addresses the requirement that the NMED and SERC be notified in the event of a spill that would endanger human health or the environment. The RCRA Contingency Plan has not been implemented and no notifications were necessary during the reporting period.

Table 26: Status of Compliance with the Regulatory Requirements for TSDFs, 40 CFR Part 264 (20.4.1.500 NMAC)

Regulatory Requirement	WIPP Project Compliance
22. Use of Manifest System, 40 CFR §264.71 (20.4.1.500 NMAC)	*If a facility receives hazardous waste or hazardous constituents accompanied by a manifest, the owner or operator or designee must sign and date each copy of the manifest to certify receipt of the waste, note any significant discrepancies in the manifest, return at least one copy of the manifest to the transporter, send a copy of the manifest to the generator within 30 days, and retain a copy of the manifest for at least three years.* Permittee waste management and transportation procedures implement regulations on the use and retention of hazardous waste manifests. Generator sites are required to provide a manifest for all shipments of TRU mixed waste. Significant manifest discrepancies are noted as required and a copy of the manifest is returned to the generator within 30 days. No significant manifest discrepancies were recorded during this reporting period.
23. Manifest Discrepancies, 40 CFR §264.72 (20.4.1.500 NMAC)	*Manifest discrepancies are differences between the quantity or type of hazardous waste designated in the manifest and that actually received. Upon discovering a significant discrepancy, the owner or operator must try to reconcile the discrepancy with the generator or transporter. If not resolved within 15 days, the owner or operator must notify the Secretary.* Permittee waste-handling and transportation procedures provide instruction and guidance for handling manifest discrepancies. The generator will be notified of discrepancies, and the discrepancies will be recorded in the "remarks" section of the appropriate form. If the discrepancies cannot be resolved within 15 days, they will be reported in writing to the Secretary of the NMED. No shipments had significant discrepancies during this reporting period.
24. Operating Record, 40 CFR §264.73 (20.4.1.500 NMAC)	*The owner/operator must keep a written operating record at the facility. Information relating to the type and amount of hazardous waste, its location and quantity at each location, cross-references to specific manifest documents and records and the results of waste analyses, summary reports and details of all incidents requiring implementation of the contingency plan, records and results of inspections, monitoring and analytical data and any corrective actions taken, and closure cost estimates must be included. In addition, information on the annual certification of a waste minimization program must be kept in the operating record.* WIPP Permit Part 2, General Facility Conditions, establishes, and the Permittees comply with, the above requirements for maintaining the written operating record. Closure cost estimates are not required for the WIPP facility. The NMED modified 20.4.1.500 NMAC effective March 1, 2009, to require most records to be maintained until closure. The retention period for operating records specified by the WIPP Permit was revised with the permit renewal application. Annual certifications of the waste minimization program are kept in the operating record.
25. Availability, Retention, and Disposition of Records, 40 CFR §264.74 (20.4.1.500 NMAC)	*All records required under this part, including plans, must be retained and made available for inspection by Department designees. The retention period for all records required under this part is automatically extended during the course of any unresolved enforcement action or as requested by the Secretary. Records of waste disposal locations and quantities must be submitted to the appropriate agencies upon closure of the facility.* The WIPP Permit establishes requirements for maintaining a written

Table 26: Status of Compliance with the Regulatory Requirements for TSDFs, 40 CFR Part 264 (20.4.1.500 NMAC)

Regulatory Requirement	WIPP Project Compliance
	operating record. The Permittees' implementation includes provisions for furnishing records upon request to the EPA and/or the NMED, as well as provisions for submitting a copy of waste emplacement locations and quantities to appropriate state and federal regulators. In the event of an enforcement action, records are retained for the duration of the action.
26. TSDF Biennial Report, 40 CFR §264.75 (20.4.1.500 NMAC)	*The owner or operator of a TSDF must submit a copy of a biennial report to the Secretary by March 1 of each even-numbered year using EPA Form 8700-13B.* The Permittees submit TRU mixed waste data for the TSDF biennial report to the NMED. The last biennial report was submitted in February 2014 (DOE, 2014a).
27. Unmanifested Waste Report, 40 CFR §264.76 (20.4.1.500 NMAC)	*A report must be submitted to the Secretary for any hazardous waste accepted for treatment, storage, or disposal that is not accompanied by a hazardous waste manifest.* As required by WIPP Permit Part 2, section 2.13, Manifest System; WIPP Permit Attachment C, Waste Analysis Plan; and the WIPP WAC, a hazardous waste manifest is transmitted with each shipment of TRU mixed waste to the WIPP facility. No unmanifested waste reports for hazardous waste shipments without a hazardous waste manifest were necessary during this reporting period.
28. Additional Reports, 40 CFR §264.77 (20.4.1.500 NMAC)	*Additional reports required of the owner or operator of a TSDF by the Secretary are reports relating to releases, fire, or explosions; groundwater contamination and monitoring data; facility closure; and air emissions under Subparts AA, BB, and CC of this part.* On February 5, 2014, the Permittees reported a fire in the WIPP underground. The underground was temporarily closed for normal operations and waste shipments from generator sites were suspended. On February 14, 2014, a radiological event occurred in the WIPP underground. The facility remained in stand down as of the end of this reporting period. On February 27, 2014, an Administrative Order (NMED, 2014) was issued by NMED that required the commencement of weekly reporting no later than 15 days after the issuance of the Order. Reporting criteria are specified in the Administrative Order. Subsequent to the first report issued on March 14, 2014, weekly reports have been submitted that identify new information from preceding reporting periods. No additional reports were required for Subparts AA, BB, or CC air emissions as these standards are not applicable to TRU mixed wastes managed and disposed of at the WIPP facility.
29. Applicability of Releases from Solid Waste Management Units, 40 CFR §264.90 (20.4.1.500 NMAC)	*A groundwater monitoring system is required by the owner or operator of a surface impoundment, landfill, or land treatment facility used to manage hazardous waste. All or part of the groundwater monitoring requirements may be waived if the owner/operator can demonstrate that there is no potential for migration of liquid from the facility via the uppermost aquifer to water supply wells or to surface water. The demonstration, in writing, must be certified by a qualified geologist or geotechnical engineer.* A groundwater detection monitoring program is required by WIPP Permit Part 5, Groundwater Detection Monitoring, and is incorporated into the WIPP Permit as Attachment L, WIPP Groundwater Detection Monitoring Program Plan. This program has been implemented.

Table 26: Status of Compliance with the Regulatory Requirements for TSDFs, 40 CFR Part 264 (20.4.1.500 NMAC)

Regulatory Requirement	WIPP Project Compliance
30. Required Programs, 40 CFR §264.91 (20.4.1.500 NMAC)	*The owner or operator must institute a detection monitoring program. The Secretary will specify in the facility permit the specific elements of the program.* The WIPP Groundwater Monitoring Program Plan (WP 02-1) meets this requirement (NWPj). During this reporting period, semiannual water level monitoring and annual sampling and analysis was performed and results submitted to the NMED in accordance with WIPP Permit Part 5, section 5.10.2, Submittal of Results.
31. Groundwater Protection Standard, 40 CFR §264.92 (20.4.1.500 NMAC)	*The owner or operator must comply with conditions specified in the facility permit that are designed to ensure that hazardous constituents detected in the groundwater do not exceed concentration limits under 40 CFR §264.94.* Detection monitoring program results confirmed there was no statistically significant evidence of contamination during this reporting period as outlined in WIPP Permit Part 5, section 5.10.3, Determination of Contamination, and WIPP Permit Attachment L, WIPP Groundwater Detection Monitoring Program Plan.
32. Hazardous Constituents, 40 CFR §264.93 (20.4.1.500 NMAC)	*The Secretary will specify in the facility permit the hazardous constituents to which the groundwater protection standard applies.* The NMED has specified the target analytes for the WIPP groundwater monitoring program. These are in the WIPP Permit Part 5, table 5.4.a, Indicator Parameters, and 5.4.b, Hazardous Constituents.
33. Concentration Limits, 40 CFR §264.94	*The Secretary will specify in the facility permit concentration limits in the groundwater for hazardous constituents.* The NMED has established these limits in WIPP Permit Part 5, section 5.10.3, Determination of Contamination.
34. Point of Compliance, 40 CFR §264.95 (20.4.1.500 NMAC)	*The Secretary will specify in the facility permit the point of compliance at which the groundwater protection standard applies and at which monitoring must be conducted.* The point of compliance is specified in WIPP Permit Part 5, section 5.2, Identification of Point of Compliance, as "the vertical surface located perpendicular to the groundwater flow direction at the detection monitoring wells that extends to the Culebra Member of the Rustler Formation."
35. General Groundwater Monitoring Requirements, 40 CFR §264.97 (20.4.1.500 NMAC)	*The groundwater monitoring program must include consistent sampling and analysis procedures. The groundwater monitoring program must include sampling and analytical methods that are appropriate for groundwater sampling and that accurately measure hazardous constituents in groundwater samples.* The sampling and analysis procedures are specified in WIPP Permit Part 5, section 5.5, Sampling and Analysis Procedures, and WIPP Permit Attachment L, WIPP Groundwater Detection Monitoring Program Plan. These procedures are implemented at the WIPP facility.
	The groundwater monitoring program must include a determination of the groundwater surface elevation each time groundwater is sampled. Groundwater surface elevations are obtained before sampling activities occur, as specified in WIPP Permit Part 5, section 5.7, Groundwater Surface Elevation Determination, and WIPP Permit Attachment L, WIPP Groundwater Detection Monitoring Program Plan.

Table 26: Status of Compliance with the Regulatory Requirements for TSDFs, 40 CFR Part 264 (20.4.1.500 NMAC)

Regulatory Requirement	WIPP Project Compliance
	Data on each hazardous constituent specified in the permit will be collected from background wells and wells at the compliance point. The number and kinds of samples collected to establish background shall be appropriate for the form of statistical test employed. Groundwater monitoring data, including actual levels of constituents must be maintained in the facility operating record. The Secretary will specify in the permit when the data must be submitted for review. Background groundwater quality samples were collected and the data submitted to the NMED prior to receipt of TRU mixed waste at WIPP (WIPP Permit table 5.6, WQSP [Water Quality Sampling Program] Well Background Values). Through implementation of the WIPP Groundwater Detection Monitoring Program, the Permittees submit groundwater monitoring results for required parameters and hazardous constituents to the NMED annually during the reporting period. Monitoring data are maintained in the facility operating record in accordance with WIPP Permit Part 5, section 5.10.1, Operating Record Requirements.
36. Detection Monitoring Program, 40 CFR §264.98 (20.4.1.500 NMAC)	*The Secretary will specify the parameters or constituents to be monitored in the facility permit.* The parameters and constituents to be monitored are listed in WIPP Permit Part 5, tables 5.4.a, Indicator Parameters, and 5.4.b, Hazardous Constituents, respectively.
	The Secretary will specify the frequencies for collecting samples and conducting statistical tests to determine whether there is statistically significant evidence of contamination for any parameter or hazardous constituent specified in the permit. The sampling frequency is specified in WIPP Permit Part 5, section 5.5.1, Sample Collection Procedures, and in WIPP Permit Attachment L, table L-2, WIPP Groundwater Detection Monitoring Program Sample Collection and Groundwater Surface Elevation Measurement Frequency.
	The owner or operator must determine the groundwater flow rate and direction at least annually. Groundwater flow rate and direction are determined at least annually as specified in WIPP Permit Part 5, section 5.8, Groundwater Flow Determination.
	The owner or operator must determine whether there is statistically significant evidence of contamination for any chemical parameter or hazardous constituent specified in the permit. Statistical analysis methods are specified in the WIPP Groundwater Detection Monitoring Plan. For each sampling event, comparisons were made, using the specified statistical methods, between the groundwater quality and the baseline groundwater quality established from background sampling in accordance with WIPP Permit Part 5, section 5.9, Data Evaluation.
	If the owner or operator determines there is statistically significant evidence of contamination, additional reporting and sampling are required. In addition, a permit modification to establish a compliance monitoring program and submittal of additional information are required. The Permittees will respond to any statistically significant contamination events as specified in the WIPP Permit Part 5, section 5.10.3, Determination of Contamination. The initial sampling of WQSP-5 in 2013 contained toluene

Table 26: Status of Compliance with the Regulatory Requirements for TSDFs, 40 CFR Part 264 (20.4.1.500 NMAC)

Regulatory Requirement	WIPP Project Compliance
	from the use of electrical tape when installing a new pump. WIPP Permit Condition 5, section 5.10.4.1 requires notification to the NMED of the intent to demonstrate outside contamination within seven calendar days of determining statistically significant evidence of contamination. This was completed and a plan was developed to remove the tape and purge the well of remaining toluene in the water and then it was re-sampled twice. The first re-sampling resulted in the detection of toluene at concentrations of 7.6 ug/L in the primary sample and 8.1 ug/L in the duplicate sample. During the second re-sampling toluene was detected above the Method Reporting Limit at 2.9 ug/L in both the primary and duplicate sample. No statistically significant contamination has been detected to date from the regulated unit and, therefore, no corrective action under 40 CFR §264.100 (20.4.1.500 NMAC) is required.
37. Corrective Action for Solid Waste Management Units, 40 CFR §264.101	*Corrective action will be specified in the permit in accordance with this section and subpart S of this part. The permit will contain schedules of compliance for such corrective action (where such corrective action cannot be completed prior to issuance of the permit) and assurances of financial responsibility for completing such corrective action.* No new solid waste management units (SWMUs) were identified during this reporting period. WIPP Permit Attachment K, table K-3, SWMUs & AOCs Requiring No Further Action (NFA), identifies the SWMUs and areas of concern (AOCs) that require no further action.
38. Applicability of the Closure/Post-Closure Requirements, 40 CFR §264.110 (20.4.1.500 NMAC)	*Closure requirements apply to the owners and operators of all hazardous waste facilities. Post-closure requirements apply to all hazardous waste disposal facilities.* The Permittees have prepared a closure plan and a post-closure plan for the WIPP facility. These are included in the WIPP Permit (Attachment G, Closure Plan; and Attachment H, Post-Closure Plan). The Closure Plan contains three main phases. The first is closure of each HWDU after the panel is filled. The second is closure of the parking area and WHB storage units. The third is sealing the shafts, which occurs at the end of the disposal phase. Both the second and third items are part of final closure. Final closure entails clean closure of all surface units and backfilling the four shaft seal systems in the repository. The Post-Closure Plan describes the active institutional controls, which limit access to the facility, and monitoring activities, which ensure that repository performance is protective of human health and the environment. The post-closure care period for the WIPP facility begins following the closure of the first HWDU and continues for 30 years.
39. Closure Performance Standard, 40 CFR §264.111 (20.4.1.500 NMAC)	*A closure performance standard is required to minimize the need for further maintenance; to control, minimize, or eliminate the post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the environment; and to comply with the other closure requirements of this subpart.* In accordance with the WIPP Permit Attachment G, Closure Plan, closure will be deemed complete when all hazardous waste and hazardous waste residues have been removed from the storage units, all equipment and structures associated with the operation of the units have been decontaminated, the panels and facility are closed, and unit closure certification has been submitted to and approved by the NMED.
40. Closure Plan; Amendment of Plan, 40 CFR §264.112	*The owner/operator of a hazardous or mixed-waste management facility must have a written closure plan. The plan*

Table 26: Status of Compliance with the Regulatory Requirements for TSDFs, 40 CFR Part 264 (20.4.1.500 NMAC)

Regulatory Requirement	WIPP Project Compliance
(20.4.1.500 NMAC)	*must identify the steps necessary to perform partial and/or final closure of the facility. The plan may be amended as needed. The owner or operator must notify the Regional Director in writing prior to the date on which closure will begin.* The Permittees have prepared a written closure plan to satisfy the RCRA closure requirements. The NMED has incorporated this plan into the WIPP Permit as Attachment G, Closure Plan.
41. Time Allowed for Closure, 40 CFR §264.113 (20.4.1.500 NMAC)	*Within 90 days after receipt of the final volume of hazardous mixed waste at a hazardous waste management unit or facility, the owner or operator must treat, remove, or dispose of all hazardous/mixed wastes on-site in accordance with the approved closure plan. Partial or final closure activities must be complete in accordance with the approved closure plan within 180 days of receipt of the final volume of waste. An extension of time may be allowed if the owner/operator can demonstrate that the activities required will take longer than the allotted time period and has taken and will continue to take all steps necessary to prevent threats to human health and the environment from the unclosed but nonoperational facility.* The time allowed for closure is addressed in the WIPP Permit Attachment G, Closure Plan.
42. Disposal or Decontamination of Equipment, Structures, and Soils, 40 CFR §264.114 (204.1.500 NMAC)	*During the partial and final closure periods, all contaminated equipment, structures, and soils must be properly disposed of or decontaminated. By removing all hazardous constituents during closure, the owner/operator may become a mixed or hazardous waste generator and must handle all such waste in accordance with the requirements of 40 CFR Part 262.* The regulatory requirements for the disposal or decontamination of equipment, structures, and soils are addressed in Permittee procedures, and include the removal of hazardous waste residues; the decontamination of equipment, structures, and soils; personnel decontamination; and sampling and QA.
43. Certification of Closure, 40 CFR §264.115 (20.4.1.500 NMAC)	*Within 60 days of the completion of closure of each landfill unit and within 60 days of completion of final closure, the owner/operator must submit a certification that the hazardous or mixed waste unit has been closed in accordance with the specifications in the approved closure plan. The certification must be sent to the Secretary by registered mail and must be signed by the owner/operator and by an independent registered professional engineer.* The DOE will submit the Certification of Closure to the Secretary of the NMED within 60 days of completion of panel closure and final closure activities.
44. Survey Plat, 40 CFR §264.116 (20.4.1.500 NMAC)	*The owner/operator must submit a survey plat to the Secretary and the authority with jurisdiction over local land use no later than the submittal of the certification of closure. The survey plat must indicate the location and dimensions of landfill cells or other HWDUs with respect to permanently surveyed benchmarks. The plat must be prepared and certified by a professional land surveyor.* The survey plat will be submitted to the NMED following closure and will indicate the location and dimensions of HWDUs with respect to permanently

Table 26: Status of Compliance with the Regulatory Requirements for TSDFs, 40 CFR Part 264 (20.4.1.500 NMAC)

Regulatory Requirement	WIPP Project Compliance
	surveyed benchmarks. The plat will be prepared and certified by a professional land surveyor and will contain a prominently displayed note that states the DOE's obligation to restrict disturbance of the HWDU. No HWDU has been certified as closed to date as described above. Survey plats for all HWDUs will be submitted to the NMED upon certification of final closure of each HWDU.
45. Post-Closure Care and Use of Property, 40 CFR §264.117 (20.4.1.500 NMAC)	*Post-closure care for each hazardous/mixed-waste unit must begin after completion of closure and continue for 30 years after that date. All post-closure care must be performed in accordance with the post-closure plan for the facility.* Post-closure care and use of property will be performed in accordance with WIPP Permit Attachment H, Post-Closure Plan.
46. Post-Closure Plan; Amendment of Plan, 40 CFR §264.118 (20.4.1.500 NMAC)	*The owner/operator of a hazardous or mixed waste disposal unit must have a written post-closure plan. The plan, approved by the Secretary or designee, may be amended subject to the Secretary's approval.* The Post-Closure Plan is WIPP Permit Attachment H.
47. Post-Closure Notices, 40 CFR §264.119 (20.4.1.500 NMAC)	*A record of the type, location, and quantity of hazardous/mixed wastes disposed of within each unit must be submitted to the NMED and the authority with jurisdiction over local land use no later than 60 days after submittal of the certification of closure. Within the same time frame, the owner/operator must also record a notation in the deed to the facility that the facility has been used to manage hazardous/mixed wastes and that the record of type, location, and quantity of waste disposal has been filed; the owner/operator must also certify that this notation has been recorded as required.* The DOE will submit to the NMED and to Eddy County within 60 days after certification of final closure, a registered professional engineer's certification. The DOE will also assure that this notification is properly recorded in the deed to the facility.
48. Certification of Completion of Post-Closure Care, 40 CFR §264.120 (20.4.1.500 NMAC)	*Within 60 days of the completion of post-closure of each landfill unit and within 60 days of completion of final post-closure, the owner/operator must submit a certification that the hazardous or mixed-waste unit has been closed in accordance with the specifications in the approved post-closure plan. The certification must be sent to the NMED Secretary by registered mail and must be signed by the owner/operator and by an independent registered professional engineer.* The DOE will notify the NMED within 60 days after completion of post-closure care, and submit a registered professional engineer's certification that the post-closure care period was performed in accordance with the WIPP Permit Attachment H, Post-Closure Plan.
49. Title 40 CFR Subpart I, "Use and Management of Containers" (40 CFR §§264.171, 264.172, 264.173, 264.174, 264.175, 264.176, 264.177, 264.178 and 264.179) (20.4.1.500 NMAC)	*Subpart I of 40 CFR addresses the requirements for the use and management of containers at TSDFs. This section addresses container condition, compatibility of wastes with containers, management of containers to prevent releases, keeping the containers closed, weekly inspections, containment, requirements for ignitible or reactive wastes, special requirements for incompatible wastes, closure, and the air emission standards.* WIPP Permit Part 3, Container Storage, and Attachment A1, Container Storage, describe how the Permittees comply with the requirements for the

Table 26: Status of Compliance with the Regulatory Requirements for TSDFs, 40 CFR Part 264 (20.4.1.500 NMAC)

Regulatory Requirement	WIPP Project Compliance
	use and management of containers. Wastes are received in NRC Type B packages, which are stored in the Parking Area Unit and opened in the applicable WHB Unit. Waste containers meeting DOT 7A specifications are removed from the NRC Type B packages. The WIPP WAC and waste handling procedures are in place to ensure that waste is shipped to WIPP in DOT 7A waste containers that are in good condition. A compatibility study was conducted and submitted in appendix C1 of the WIPP RCRA Part B Application (DOE, 1997c) to document that the containers used (steel construction, some containing polyethylene liners) meet the requirements of 40 CFR §264.172. Containers are not opened at the WIPP facility and procedures are in place to ensure that every effort is taken to minimize the potential for damaging a container. Inspections are conducted at least weekly as described in WIPP Permit Attachment E, Inspection Schedule, Process and Forms. Calculations demonstrating adequate secondary containment are included in WIPP Permit Attachment A1, Container Storage. The WAP and WAC prohibit ignitable, reactive and incompatible wastes from being shipped to the WIPP facility. All container storage areas will be closed as described in WIPP Permit Attachments G, Closure Plan, and G3, Radiological Surveys to Indicate Potential Hazardous Waste Releases. The air emission standards for containers are not applicable to TRU mixed wastes disposed of at the WIPP facility. There were no exceptions to compliance with these requirements during the reporting period. Due to the February 2014 events rendering the underground temporarily inoperable, the February 27, 2014, Administrative Order (NMED 2014) extended the surface container storage times.
50. Title 40 CFR Subpart X, "Miscellaneous Units," (40 §§CFR 264.601, 264.602 and 264.603)	*A miscellaneous unit must be located, designed, and operated, maintained and closed in a manner that will ensure protection of human health and the environment. Monitoring, testing, analytical data, inspections, response and reporting procedures and frequencies must protect human health and the environment. A miscellaneous unit must be maintained in manner that complies with the environmental performance standards during the post-closure care period.* WIPP Permit Part 4, Geologic Repository Disposal, and Attachment A2, Geologic Repository, describe the location, design, operation, and maintenance of the geologic repository and associated environmental monitoring. Monitoring and testing includes geomechanical, ventilation rate, and VOC monitoring. Reports are submitted to the NMED to demonstrate compliance with these requirements. Each underground HWDU will be closed in accordance with the Closure Plan (WIPP Permit Attachment G); Technical Specifications (WIPP Permit Attachment G1 appendix G); and the final repository closure plan incorporated into the WIPP Permit as Attachment G2, Waste Isolation Pilot Plant Shaft Sealing System Compliance Submittal Design Report. The Post-Closure Plan (WIPP Permit Attachment H) describes the activities required to maintain WIPP after the completion of facility closure. The WIPP site maintained compliance with these requirements during the reporting period.

25.2.4 Compliance with the Hazardous/Mixed Waste Permit Program, 40 CFR Part 270 (20.4.1.900 NMAC and 20.4.1.901 NMAC)

The requirements of 40 CFR Part 270 pertain to general hazardous waste facility permitting requirements for TSDFs and include provisions for submitting applications,

standard permit conditions, monitoring and reporting requirements, and modifying permits. The compliance status of each applicable requirement is summarized in table 27.

Table 27: Status of Compliance with the Hazardous/Mixed Waste Permit Program, 40 CFR Part 270 (20.4.1.900 NMAC and 20.4.1.901 NMAC)

Regulatory Requirement	WIPP Project Compliance
1. Purpose and Scope of the Hazardous Waste Facility Permit Program Regulations, 40 CFR §270.1 (20.4.1.900 NMAC)	*The purpose and scope of the hazardous waste facility permit program regulations are defined, and the regulations are summarized.* The NMED has updated the WIPP Permit several times to incorporate permit modifications. The permit is updated through permit modifications, as necessary. The Permittees submitted eleven WIPP Permit modification applications to the NMED for this reporting period consisting of six Class 1, one Class 1*, three Class 2 and one Class 3 (subsequently withdrawn) listed in table 29. These changes were classified pursuant to 20.4.1.900 NMAC, incorporating 40 CFR 270.42.
2. Signatories to Permit Applications and Reports, 40 CFR §270.11 (20.4.1.900 NMAC)	*Signatories to permit applications shall be by a senior executive officer with responsibility for overall operations for a federal agency and/or a responsible corporate officer for a corporation. Reports and plans required by permits (e.g., the annual waste minimization plan) and other information requested shall be signed by a duly authorized representative. Any person signing one of these documents is required to make the certification statement specified in 40 CFR §270.11(d).* The requirement is incorporated into WIPP Permit Part 1, section 1.9, Signatory Requirement. The manager of the DOE CBFO has signatory authority on behalf of the owner/operator DOE, and the Project Manager of the MOC has signatory authority as the co-operator and co-permittee.
3. Conditions Applicable to all Permits, 40 CFR §270.30 (20.4.1.900 NMAC)	*Conditions applicable to all permits are specified and include duty to comply, duty to reapply, minimization of releases, proper operation and maintenance, permit actions, property rights, duty to provide information, inspection and entry, monitoring and records, signatory requirements, and reporting requirements.* The general permit conditions are incorporated into WIPP Permit Part 1, General Permit Conditions. The Permittees comply with these permit conditions.
4. Requirements for Recording and Reporting of Monitoring Results, 40 CFR §270.31 (20.4.1.900 NMAC)	*Requirements for recording and reporting monitoring results will be specified in the Permit.* The requirements for recording and reporting monitoring results are incorporated into the WIPP Permit Part 1, section 1.7.10, Monitoring and Records; and WIPP Permit Part 1, section 1.7.11, Reporting Requirements. The Permittees comply with these requirements by submitting numerous WIPP Permit-required reports such as semiannual groundwater monitoring reports, an annual mine ventilation rate report, and a semiannual VOC monitoring report.
5. Permit Modification at the Request of the Permittee, 40 CFR §270.42 (20.4.1.900 NMAC, and 20.5.1.901 NMAC)	*After a Permit has been finalized, the permittee may request that it be modified. Three classes of modifications are identified in Appendix I to 40 CFR §270.42. Class 1, the least significant of the permit modifications, covers minor modifications such as the correction of typographical errors; changes to conform with agency guidelines or regulations; or procedural changes that increase the frequency of monitoring, reporting, sampling, or*

Table 27: Status of Compliance with the Hazardous/Mixed Waste Permit Program, 40 CFR Part 270 (20.4.1.900 NMAC and 20.4.1.901 NMAC)

Regulatory Requirement	WIPP Project Compliance
	maintenance activities. Class 1 modifications may require approval of the Director prior to implementation (i.e., Class 1 permit modifications), or require notification of the Director within seven days after the change has been made. All persons on the facility mailing list must be notified within 90 calendar days after the change is put into effect or after the request, whichever applies.* *Class 2 modifications are more extensive and significant and apply to changes needed to allow timely response to common variations in the types and quantities of wastes managed, technological advancements, and changes in the regulations (e.g., changes in emergency procedures or removal of equipment from the emergency equipment list). They require that the permittee submit a modification request to the Director, announce a 60-day comment period, notify all persons on the facility mailing list, publish the notice in a major local newspaper of general circulation, and hold a public meeting. Class 3 modifications are the most significant, have potential impacts, and substantially alter the facility or its operation (e.g., extending the closure period or a final compliance date; creating a new landfill or other type of unit or increasing the capacity of a preexisting one). The notification and other requirements are similar to those for Class 2 modifications.* The Permittees have notified the NMED of six Class 1 permit modification notifications, one Class 1* Permit Modification Request (PMR), three Class 2 PMRs and one Class 3 PMR during this reporting period, as outlined in table 28.

Table 28: Hazardous Waste Facility Permit Modifications Submitted During this Reporting Period (April 1, 2012, through March 31, 2014)

Class	Subject	Date
1	Various editorial changes	5/3/2012
1	Update to the emergency coordinator address and telephone numbers	5/24/2012
1*	Change related to the Operational Control of the WIPP	6/25/2012
2	Addition of shielded container	7/5/2012
2	Revision to the WAP waste characterization methods	12/12/2012
1	Contingency Plan update	12/12/2012
3	Redesign of panel closure; repository reconfiguration; and changes to the VOC program (withdrawn)	3/18/2013
2	Modification to the excluded waste prohibition (elevated to Class 3 by NMED)	4/8/2013
1	Revision to a course outline; revision to Panel 7 figures and table; Type B package description updates; and update to TRUPACT-II and HalfPACT figures	8/29/2013

Table 28: Hazardous Waste Facility Permit Modifications Submitted During this Reporting Period (April 1, 2012, through March 31, 2014)

Class	Subject	Date
1	Editorial changes to monitoring records (Part 1), attachment C6 and C3; update to table L-4 and the list of active permits, clarification to marking and labeling packages; clarification to table E-1a; and revisions to tables 4.1.1 and G-1	2/06/2014
1	Update to the co-permittee project manager	3/18/2014

25.2.5 Compliance with the Universal Waste Management Regulations Under 40 CFR Part 273 (20.4.1.1000 NMAC)

The Permittees manage nickel-cadmium, nickel-metal hydride, and lithium batteries, and used lamps at WIPP under these regulations. The WIPP facility typically does not generate pesticide waste and rarely generates thermostat waste. Spent lead acid batteries are returned to the manufacturer for recycling and thus, are managed under the regulations at 40 CFR §266.80 (20.4.1.700 NMAC) rather than these regulations. Compliance with the requirement is shown in table 29.

Table 29: Status of Compliance with the Universal Waste Management Regulations Under 40 CFR Part 273 (20.4.1.1000 NMAC)

Regulatory Requirement	WIPP Project Compliance
1. Standards for Universal Waste, Small Quantity Handlers, 40 CFR Part 273.9 (20.4.1.1000 NMAC)	*Small-quantity handlers are those who accumulate less than 5,000 kg of universal waste at any one time.* The WIPP facility is a small-quantity handler of universal waste, as defined in 40 CFR §273.9. The Permittees manage nickel-cadmium batteries, nickel-metal hydride batteries, lithium batteries, and used lamps at the WIPP facility under the universal waste regulations.
2. Prohibitions, 40 CFR §273.11 (20.4.1.1000 NMAC)	*Universal waste is not to be disposed of or diluted or treated to render it less hazardous except by responding to a release of universal waste or by managing the waste as provided in 40 CFR §273.13.* Universal waste is not treated at the WIPP facility. Universal waste is handled in accordance with the requirements of 40 CFR Part 273, and is shipped off-site to a permitted facility.
3. Waste Management, 40 CFR §273.13 (20.4.1.1000 NMAC)	*Universal waste must be properly contained to prevent releases and must lack evidence of leakage, spillage, etc.* Universal waste is managed in accordance with Permittee hazardous and universal waste management programs and procedures. It is contained, stored in the universal waste storage area, and inspected weekly for evidence of spillage or leakage. Compliance was maintained during the reporting period.

Table 29: Status of Compliance with the Universal Waste Management Regulations Under 40 CFR Part 273 (20.4.1.1000 NMAC)

Regulatory Requirement	WIPP Project Compliance
4. Labeling/Marking, 40 CFR §273.14 (20.4.1.1000 NMAC)	*Universal waste must be labeled or marked appropriately (e.g., universal waste batteries).* Universal waste containers were labeled with the words "Universal Waste," a brief description of the contents, and the accumulation start date, in accordance with Permittee hazardous and universal waste management plans and procedures.
5. Accumulation Time Limits, 40 CFR §273.15 (20.4.1.1000 NMAC)	*A small-quantity universal waste handler may accumulate universal waste for up to one year from the date the waste was generated. The handler must be able to demonstrate the length of time that the waste has been accumulated from the date it becomes a waste or is received.* In accordance with the Permittee hazardous waste management plans and procedures, the Permittee logs the date universal waste is generated at WIPP and the date universal waste is shipped to an off-site TSDF for recycling. In accordance with inspection procedures, the DOE checks the accumulation date during weekly inspections to ensure that the one-year storage limit is not exceeded. The Permittees have been in compliance with these requirements.
6. Employee Training, 40 CFR §273.16 (20.4.1.1000 NMAC)	*Employees who handle or are responsible for managing universal waste should be provided with the appropriate information needed with respect to proper handling and appropriate emergency procedures for the type of universal waste being managed at the facility.* The handlers of universal waste and those responsible for its management are trained hazardous waste workers. This training applies to universal waste handlers and managers.
7. Responses to Releases, 40 CFR §273.17 (20.4.1.1000 NMAC)	*All releases of universal wastes and residues from such wastes must be contained immediately; any material resulting from the release must be assessed to determine if it is hazardous waste; if so, it must be managed in compliance with all applicable RCRA regulations.* Any such releases of universal waste are characterized and managed in accordance with procedures and processes in place for hazardous and universal waste. There were no releases of universal waste during the reporting period.
8. Off-Site Shipments, 40 CFR §273.18 (20.4.1.1000 NMAC)	*A small-quantity universal waste generator may send its universal waste only to another universal waste handler, a destination facility, or a foreign destination.* Universal waste was shipped to a permitted off-site facility during the reporting period.

25.2.6 Compliance with the UST Regulatory Requirements Under 20.5 NMAC

This section of the report will examine the New Mexico UST requirements as they pertain to WIPP. WIPP's compliance status is summarized in table 30.

Table 30: Status of Compliance with the UST Regulatory Requirements Under 20.5 NMAC

Regulatory Requirement	WIPP Project Compliance
1. Scope, 20.5.1.2 NMAC (40 CFR §280.10)	*Any owner or operator of an UST that contains a hazardous substance or petroleum product must meet the standards set by the New Mexico Environmental Improvement Board in the New Mexico UST regulations.* There are two 8,000-gallon USTs at WIPP; one contains unleaded gasoline, and the other contains diesel fuel.
2. Existing Tanks, 20.5.2.8 NMAC	*The owner of any UST must register such tank or tanks with the NMED Petroleum Storage Tank Bureau within three months after April 14, 1988, the effective date of this Part II as first adopted, except that any owner who has filed the form of notice entitled "Notification for Underground Storage Tanks," prescribed by the EPA and described in 40 CFR Part 280, is not required to register a tank for which a notice has been filed, provided that the information provided is still current.* Both USTs at the WIPP facility are properly registered with the NMED Petroleum Storage Tank Bureau.
3. Transfer of Ownership, 20.5.2.9 NMAC	*If ownership of a storage tank system changes, the new owner must re-register the tank with the NMED Petroleum Storage Tank Bureau within 30 days of ownership transfer, using a form provided by the NMED Petroleum Storage Tank Bureau.* This section is not applicable since ownership of the tanks has not been transferred.
4. New Storage Tank Systems, 20.5.2.10 NMAC	*The owner must notify the NMED Petroleum Storage Tank Bureau in writing at least 30 days before any new tank or UST system is installed and must register any new tank or UST system with the NMED Petroleum Storage Tank Bureau prior to placing it in service.* No new aboveground or UST systems were installed during this reporting period.
5. Substantially Modified Storage Tank Systems, 20.5.2.11 NMAC	*When an existing storage tank system is substantially modified or replaced, the owner must notify the NMED Petroleum Storage Tank Bureau in writing of such modification or replacement at least 15 days prior to the modification or replacement. Emergency repairs or replacements are exempt from these notification requirements.* No UST systems were substantially modified during this reporting period.
6. Notification of Spill or Release, 20.5.2.12 NMAC	*Notice of any known or suspected release from a storage tank system, any spill, or any other emergency must be given to the NMED in accordance with 20.5.7 NMAC.* No releases from USTs occurred during this reporting period.
7. Emergency Repairs and Tank Replacement, 20.5.2.13 NMAC	*Immediate repairs or replacement of a storage tank system may be made in the event an emergency presents a threat to the public health, provided notice is given to the NMED.* No such emergency repair or replacement of a storage tank system was necessary during this reporting period.

Table 30: Status of Compliance with the UST Regulatory Requirements Under 20.5 NMAC

Regulatory Requirement	WIPP Project Compliance
8. Registration, 20.5.2.14 NMAC	*All storage tanks must be registered on application forms provided by the NMED unless the EPA form (Notification for Underground Storage Tanks) has been submitted to the NMED and all information contained therein is still accurate. An application submitted by a municipal, state, or other public facility must be signed by either a principal executive officer, ranking elected official, or other duly authorized employee.* The New Mexico storage tank registration form was used to register the USTs at WIPP.
9. Registration Certificate, 20.5.2.15 NMAC	*Upon submittal of a complete registration application or the EPA form and payment of the annual fee, the NMED shall issue a validated registration certificate which is current and valid and must be displayed on the premises of the storage tank system at all times. In the event that any information provided on the registration form or the EPA form changes or is no longer accurate, the change must be reported to the NMED on the appropriate form within 30 days.* The current registration certificate from the NMED is displayed in Facility Operations at the WIPP facility.
10. Payment of Fee, 20.5.3.8 NMAC	*An annual per-tank fee shall be paid to the NMED no later than July 1 for each current calendar year or portion of a year that a tank is in use. A tank shall be deemed "in use" until notice is received by the NMED that the tank has been removed or otherwise permanently closed in a manner acceptable to the division.* *The annual fee for a new tank placed in service after July 1 for any calendar year after 1989 shall be paid within 30 days after the tank is placed in service. The annual fees shall be designated to the Hazardous Waste and Underground Storage Tank Fund.* The annual WIPP facility storage tank fees were paid by July 1, 2012, and July 1, 2013.
11. Amount of Fee, 20.5.3.9 NMAC	*The annual fee for each UST is $100.00 per tank.* The annual UST fee paid by the Permittees is $200 for the two storage tanks.
12. Timeliness and Late Fees, 20.5.3.10 NMAC	*In the event that the annual fee is not paid when due, a late fee of $25.00 or 25 percent of the unpaid fee, whichever is greater, shall be imposed and shall accumulate until the annual fee and all accrued late fees and interest charges are paid.* No late payment penalties have been incurred.
13. General Performance Standards for UST Systems, 20.5.4.8 NMAC (40 CFR §280.20[a])	*In order to prevent releases due to structural failure, corrosion or spills and overfills for as long as a UST system is used to store regulated substances, owners and operators of any UST system shall properly design, construct, and initially test each new UST system; provide project drawings; and ensure that any portion of a UST system that routinely contains regulated substances and is in contact with the ground or water shall be protected from corrosion, in accordance with the current edition of an industry standard or code of practice developed by a nationally recognized association or independent testing laboratory approved in advance by the department. Owners and operators shall ensure that the entire UST system is compatible with any regulated*

Table 30: Status of Compliance with the UST Regulatory Requirements Under 20.5 NMAC

Regulatory Requirement	WIPP Project Compliance
	substance conveyed, as required by 20.5.5.16 NMAC. The tanks are designed and constructed of fiberglass-reinforced plastic in accordance with the appropriate standards. The tanks are double walled and are compatible with gasoline and diesel.
14. Performance Standards for Fiberglass-Reinforced Plastic USTs 20.5.4.9 NMAC (40 CFR §280.20[b])	*If a UST is constructed of fiberglass-reinforced plastic, owners and operators shall comply with the requirements of the current edition of an industry standard or code of practice developed by a nationally recognized association or independent testing laboratory approved in advance by the department.* The piping is constructed of fiberglass-reinforced plastic in accordance with the appropriate standards.
15. Spill and Overfill Prevention 20.5.4.33 NMAC (40 CFR §280.20[c][1][I])	*Owners and operators must use spill prevention equipment that will prevent release of regulated substances to the environment when the transfer hose is detached from the fill pipe (for example, a spill catchment basin);* The WIPP UST system uses a spill catchment basin at the fill port of each tank.
16. Overfill Prevention Equipment, Paragraph 2 of Subsection A of 20.5.4.33 NMAC (40 CFR §280.20[c][1][ii])	*Overfill-prevention equipment must be used that will automatically shut off flow into the tank when the tank is no more than 95 percent full; alert the transfer operator when the tank is no more than 90 percent full by restricting the flow into the tank or triggering a high-level alarm; Owners and operators may use alternative equipment if it is determined by the implementing agency to be no less protective of human health and the environment than the equipment specified above or if the UST system is filled by transfers of no more than 25 gallons at one time.* The Model 310 extractor vent valve is used to automatically shut off the flow into the tanks at the WIPP facility when the tank is no more than 95 percent full. This valve is a permanent part of the system.
17. Installation, Subsection A of 20.5.4.14 NMAC (40 CFR §280.20[d])	*All tanks and piping must be properly installed in accordance with a code of practice developed by a nationally recognized association or independent testing laboratory and in accordance with the manufacturer's instructions.* The installer (Cline Pump Company) certified on the NMED application that the methods used to install the tanks and piping at the WIPP facility comply with the requirements. Cline Pump Company has supplied the DOE with copies of qualified certification.

Table 30: Status of Compliance with the UST Regulatory Requirements Under 20.5 NMAC

Regulatory Requirement	WIPP Project Compliance
18. Certificate of Installation, Subsection C of 20.5.4.37 & 38 NMAC (40 CFR §280.20[e])	*All owners and operators must ensure that one or more of the specified methods of certification, testing, or inspection was used to demonstrate compliance with Subsection 25.2.6.17 above by providing a certification of compliance on the UST notification form required by 20.5.2 NMAC. The allowable methods of certification for the installer are certification by the tank and piping manufacturers; certification or licensing by the implementing agency; inspection and certification of the installation by a registered professional engineer with education and experience in UST system installation, inspection and approval by the implementing agency, or the presence of a representative from the UST Bureau of the NMED at the installation; completion of all work listed on the manufacturer's installation checklists; or compliance with another method for ensuring compliance with this section that is determined by the implementing agency to be no less protective of human health and the environment.* A certified tank installer was used to install the USTs at the WIPP facility. The installation of the new systems was inspected and approved by an NMED representative who was present during the installation.
19. Certificate of Compliance and Notification Requirements, 20.5.4.37 NMAC (40 CFR §280.22)	*Certification of compliance. All owners and operators of new storage tank systems shall certify in the registration form required by 20.5.2 NMAC compliance with the following requirements:* *Installation of tanks and piping in 20.5.4.14 NMAC for UST systems, 20.5.4.19 NMAC for AST systems or 20.5.4.38 NMAC for either cathodic protection of steel tanks and piping in 20.5.4.10 NMAC and 20.5.4.22 NMAC for UST systems, or 20.5.4.12 NMAC for UST systems; or 20.5.4.16 and 24 NMAC for AST systems; financial responsibility under 20.5.9 NMAC; and release detection in 20.5.6 NMAC.* As outlined in the registration form, the certification requirements were met. Cathodic protection requirements are not applicable since neither the tank nor the piping at the WIPP facility are made of steel. Financial responsibility requirements cited in 20.5.9.1.900.C NMAC are not applicable because the WIPP facility is a federal facility. Notification requirements apply only to the person who sold the tank to be used as an UST and do not apply to the facility.
20. Operation and Maintenance Plan, 20.5.5.9 NMAC	*Owners and operators of all storage tank systems shall adopt and implement a written operations and maintenance plan, which they shall keep at the facility for the life of the storage tank system. Owners and operators shall not implement the plan until it has been approved by the Department.* An operations and maintenance plan was approved by the NMED Petroleum Storage Tanks Bureau on October 29, 2009 (WIPP, 2009). The UST procedure WP 04-GC1605, Operation of Surface Fuel Station Storage Tanks (NWPk), guides the operators in performing daily, monthly, and annual inspections.

Table 30: Status of Compliance with the UST Regulatory Requirements Under 20.5 NMAC

Regulatory Requirement	WIPP Project Compliance
21. Spill and Overfill Control, Subsection A of 20.5.5.14 NMAC (40 CFR §280.30)	*Owners and operators must ensure that any releases due to spilling or overfilling do not occur, that the volume available in the tank is greater than the volume of product to be transferred to the tank before the transfer is made, and that the transfer operation is monitored constantly to prevent overfilling and spilling.* The tanks are equipped with spill and overfill protection equipment. Applicable DOE hazardous material spill and release response plans and procedures are in place that govern the transfer of product to the tanks and that specify requirements for reporting, cleaning up, and investigating spills or overfills.
22. Compatibility, 20.5.5.16 NMAC (40 CFR §280.32)	*Owners and operators must use an UST system made of or lined with materials that are compatible with the substance stored in the UST system.* Fiberglass-reinforced plastic tanks at the WIPP facility are compatible with unleaded gasoline and diesel fuel.
23. Repairs Allowed, Subsection B of 20.5.5.17 NMAC (40 CFR §280.33[a])	*Repairs to UST systems must be properly conducted in accordance with a code of practice developed by a nationally recognized association or an independent testing laboratory.* No repairs to the tanks at the WIPP facility were made during this reporting period.
24. Repairs to Fiberglass-Reinforced Plastic Tanks, 20.5.5.17 NMAC (40 CFR §280.33[b])	*Repairs to fiberglass-reinforced plastic tanks may be made by the manufacturer's authorized representatives or in accordance with a code of practice developed by a nationally recognized association or an independent testing laboratory.* No repairs to the tanks at the WIPP facility were made during this reporting period.
25. Repairs of Pipe Sections and Fittings, 20.5.5.17NMAC (40 CFR §280.33[c])	*Metal pipe sections and fittings that have released product as a result of corrosion or other damage must be replaced. Fiberglass pipes and fittings may be repaired in accordance with the manufacturer's specifications.* No repairs to pipes or fittings on the tanks at the WIPP facility were performed during this reporting period.
26. Tightness Testing After Repairs, Subsection D of 20.5.5.17 NMAC (40 CFR §280.33[d])	*Repaired tanks and piping must be tightness tested in accordance with Subsection C of 20.5.6.603 NMAC and Subsection B of 20.5.6.604 NMAC within 30 days after the date of the completion of the repair except as provided in this section.* No repairs to tanks or piping at the WIPP facility were required during this reporting period.
27. Records of all Repairs, Subsection F of 20.5.5.17 NMAC (40 CFR §280.33[f])	*UST system owners and operators must maintain records of each repair for the remaining operating life of the UST system to demonstrate compliance with the requirements of this section.* No repairs were performed on the USTs at the WIPP facility during this reporting period.

Table 30: Status of Compliance with the UST Regulatory Requirements Under 20.5 NMAC

Regulatory Requirement	WIPP Project Compliance
28. Reporting, of 20.5.5.18 NMAC (40 CFR §280.34[a])	*Owners and operators must submit the following information to the NMED: registration of all storage tank systems, including certification of installation for new UST systems (20.5.2 NMAC); reports of all releases (including suspected releases, spills, and overfills) and confirmed releases; corrective actions planned or taken; and a notification before permanent closure or change in service.* The DOE has procedures in place to implement the notification requirements in the event of a release.
29. Record-Keeping Requirements, Subsection A of 20.5.5.19 NMAC (40 CFR §280.34[b])	*Owners and operators must maintain the following information: a corrosion expert's analysis of site corrosion potential if corrosion protection equipment is not used, documentation of operation of corrosion protection equipment, documentation of storage tank system repairs, recent compliance with release detection requirements, and the results of the site investigation required prior to permanent closure.* The DOE has a procedure that addresses the retention of monitoring results.
30. Availability and Maintenance of Records, Subsection B of 20.5.5.19 NMAC (40 CFR §280.34[c])	*The applicable records must be kept either at the storage tank site and immediately available for inspections by the NMED or at a readily available alternative site and be provided to the NMED upon request.* The UST records are maintained at the WIPP facility and are readily available to NMED inspectors.
31. Inspections, Monitoring, and Testing, Subsection A of 20.5.5.20 NMAC	*For the purpose of enforcing the provisions of these regulations, any owner and operator of a storage tank shall, upon the request of the secretary or authorized department representatives, furnish information relating to such tanks, including tank equipment and contents, conduct monitoring or testing, and permit the department representative at all reasonable times to have access to, and to copy all records relating to such tanks. Owners and operators shall comply with all applicable and appropriate Occupational Health and Safety Act requirements, NMSA 1978, Sections 50-9-1 through 50-9-25, so that storage tanks may be safely inspected. For the purpose of enforcing these regulations, department officers, employees, or representatives are authorized:* *(1) To enter at reasonable times any establishment or place where a storage tank is located;* *(2) To inspect the storage tank system and obtain samples of its contents; and* *(3) To conduct monitoring or testing of the tanks, associated equipment, contents, or surrounding soils, air, surface water, or groundwater.* NMED personnel are allowed to inspect the storage tank systems at any reasonable time. They are also allowed to sample the contents of the storage tanks. Monitoring or testing of the tanks and associated equipment and contents or the surrounding soils, air, surface water, or groundwater may also be performed. Inspections were conducted by the NMED Petroleum Storage Tank Bureau on June 19, 2012. No violations were noted. Applicable and appropriate occupational safety and health requirements are met in accordance with the WIPP Integrated Safety Management System, which focuses on accomplishing work safely, and protecting workers, the public, and the environment.

Table 30: Status of Compliance with the UST Regulatory Requirements Under 20.5 NMAC

Regulatory Requirement	WIPP Project Compliance
32. Inspections of Storage Tank Installations, Repairs or Modifications, or Removals or System Closures, Subsection B of 20.5.5.21 NMAC	*Owners, operators, and certified tank installers shall give at least 30 days' written notice before the installation, modification or repair of a storage tank system. It may not be feasible for owners, operators, and certified tank installers to provide advance notice of emergency repairs; however, owners, operators, and certified tank installers shall provide notice of emergency repairs as soon as possible after completing emergency repairs. Owners, operators and certified tank installers shall give oral notice at least 24 hours in advance of the commencement of the procedure. If owners, operators, and certified tank installers are separate persons, only one person is required to comply with the notice requirements of this subsection; however, all parties are liable in the event of noncompliance.* No installations, repairs, or modifications to the UST systems at the WIPP facility occurred during this reporting period. In the event that any installation, repair, or modification to the UST systems at the WIPP facility is planned, the NMED will be provided the appropriate notice.
33. Deadlines for Release Detection for All Storage Tank Systems, General Requirements, Subsection A of 20.5.6.9 NMAC (40 CFR §280.40[a])	*Owners and operators of new and existing UST systems must provide a method, or combination of methods, of release detection that can detect a release from any portion of the tank and the connected underground piping that routinely contains product; is installed, calibrated, operated, and maintained in accordance with the manufacturer's instructions, including routine maintenance and service checks for operability or running condition; meets the performance requirements; and must be capable of detecting the leak rate or quantity specified for that method in the corresponding section of the rule with a probability of detection of 0.95 and a probability of false alarm of 0.05.* The UST system at the WIPP facility uses interstitial monitoring to detect releases. There are sensors between the walls at the lowest end of the piping and tank. Interstitial monitoring is adequate because it can detect a release through the inner wall in any portion of the double-walled tank and/or piping that regularly contains product. The system is equipped with an alarm that will sound in the event of a leak into the interstitial area. In addition, personnel conduct a test and compile a weekly report to assure correct operations of the leak detection system. Inspection and maintenance of the leak detection system are performed by a certified UST repairman.
34. Notification of Releases, Subsection B of 20.5.6.9 NMAC (40 CFR §280.40[b])	*When a release detection method operated in accordance with the performance standards in 20.5.6.603 NMAC and 20.5.6.604 NMAC indicate that a release may have occurred, owners and operators must notify the NMED in accordance with 20.5.2.204 NMAC and 20.5.7 NMAC.* No releases or suspected releases occurred with the current UST system at the WIPP facility during this reporting period.
35. Schedule for Required Release Detection, Subsection C of 20.5.6.9 NMAC (40 CFR §280.40[c])	*Owners and operators of all UST systems must comply with the release-detection requirements of this part by December 22 of the year listed in the schedule in 40 CFR §280.40(c).* The current UST systems at the WIPP facility were installed on February 10, 1992. The current systems meet the release-detection requirements of this part.

Table 30: Status of Compliance with the UST Regulatory Requirements Under 20.5 NMAC

Regulatory Requirement	WIPP Project Compliance
36. Requirements for Tanks of Petroleum UST Systems, Subsection A of 20.5.6.9 NMAC (40 CFR §280.41[a])	*Owners and operators of new and existing UST systems shall provide a method or combination of methods, of release detection that:* *(1) Can detect a release from any portion of the tank, connected piping and ancillary equipment that routinely contains a regulated substance;* *(2) Is installed, calibrated, operated and maintained in accordance with the manufacturer's instructions, including routine maintenance and service checks for proper operating condition; and* *(3) Meets the applicable performance requirements in 20.5.6 NMAC with any performance claims and their manner of determination described in writing by the equipment manufacturer or installer, following the current edition of an industry standard or code of practice developed by a nationally recognized association or independent testing laboratory approved in advance by the department; in addition, methods for USTs used after December 22, 1990, except for methods permanently installed prior to that date, shall be capable of detecting the leak rate or quantity specified for that method in 20.5.6 NMAC with a probability of detection of 0.95 and a probability of false alarm of 0.05.* The interstitial monitoring system meets the release-detection requirement. Should the interstitial system become inoperable, monthly inventory controls will be used. In this contingency situation, tank tightness testing will be performed every five years.
37. Requirements for Piping of Petroleum UST Systems, Subsection A of 20.5.6. 11 NMAC (40 CFR §280.41[b])	*Underground piping that routinely contains regulated substances must be monitored for releases in a manner that meets the requirements for pressurized or suction piping.* See below for specific requirements for suction piping as used in the UST systems at the WIPP facility.
38. Requirements for Pressurized Piping, Paragraph (1) of Subsection A of 20.5.6.11 NMAC (40 CFR §280.41[b][1])	*Underground piping that conveys regulated substances under pressure must be equipped with an automatic line leak detector and have an annual line-tightness test or have monthly monitoring conducted.* This requirement is not applicable since the current UST system at the WIPP facility operates under suction piping.

Table 30: Status of Compliance with the UST Regulatory Requirements Under 20.5 NMAC

Regulatory Requirement	WIPP Project Compliance
39. Requirements for Suction Piping, Paragraph 2 of Subsection B of 20.5.6.11 NMAC (40 CFR §280.41[b][2])	*Underground piping that conveys regulated substances under suction must either have a line tightness test conducted at least every three years in accordance with 20.5.6.604.B NMAC, or use a monthly monitoring method conducted in accordance with 20.5.6.604.C NMAC. No release detection is required for suction piping that is designed and constructed to meet the following standards: the below-grade piping operates at less than atmospheric pressure; the below-grade piping is sloped so that the contents of the pipe will drain back into the storage tank if the suction is released; only one check valve is included in each suction line; the check valve is located directly below and as close as practical to the suction pump; and a method is provided that allows compliance with this section to be readily determined.* The below-grade piping will drain back into a foot valve within the storage tank.
40. Requirements for Hazardous Substance UST Systems, 20.5.6.12 NMAC (40 CFR §280.42)	*A number of release-detection requirements are specified for UST systems that contain hazardous substances.* The tanks in the UST system are double lined with interstitial monitoring to detect leaks from the inner wall. The outer wall will contain leaks from the inner wall.
41. Methods of Release Detection for Tanks, 20.5.6.13-19 NMAC (40 CFR §280.43)	*A number of requirements for the acceptable release-detection methods are specified. The release-detection methods described are inventory control, manual tank gauging, tank-tightness testing, automatic tank gauging, vapor monitoring, groundwater monitoring, interstitial monitoring, and other methods.* The DOE uses interstitial monitoring to meet this requirement.
42. Inventory Control, Subsection A of 20.5.6.13 NMAC (40 CFR §280.43[a])	*Product inventory control (or another test of equivalent performance) must be conducted monthly to detect a release of at least 1.0 percent of flow-through plus 130 gallons on a monthly basis in the following manner: inventory volume measurements for regulated substance inputs, withdrawals, and the amount still remaining in the tank are recorded each operating day; the equipment used is capable of measuring the level of product over the full range of the tank's height to the nearest one-eighth of an inch; the regulated substance inputs are reconciled with delivery receipts by measurement of the tank inventory volume before and after delivery; deliveries are made through a drop tube that extends to within one foot of the tank bottom; product dispensing is metered and recorded within the local standards for meter calibration or an accuracy of six cubic inches for every five gallons of product withdrawn; and the measurement of any water level in the bottom of the tank is made to the nearest one-eighth of an inch at least once a month.* Inventory control is a “contingency” method used only if the interstitial monitoring system fails. The DOE underground fuel station operation procedure addresses the requirements for using this method if this situation arises. Compliance with the requirement for a drop tube extending to within 1 foot of the tank bottom has been verified through discussions with the installing organization. The stick reading can measure to the nearest one-eighth of an inch.

Table 30: Status of Compliance with the UST Regulatory Requirements Under 20.5 NMAC

Regulatory Requirement	WIPP Project Compliance
43. Interstitial Monitoring, 20.5.6.19 NMAC (40 CFR §280.43[g])	*Interstitial monitoring between the UST system and a secondary barrier immediately around or beneath it may be used, but only if the system is designed, constructed, and installed to detect a leak from any portion of the tank that routinely contains product and also meets one of the following requirements: for double-walled UST systems, the sampling or testing method can detect a release through the inner wall in any portion of the tank that routinely contains product; for UST systems with a secondary barrier within the excavation zone, the sampling or testing method used can detect a release between the UST system and the secondary barrier; the secondary barrier around or beneath the UST system consists of artificially constructed material that is sufficiently thick and impermeable (at least 10-6 cm/sec for the regulated substance stored) to direct a release to the monitoring point and permit its detection; the barrier is compatible with the regulated substance stored so that a release from the UST system will not cause a deterioration of the barrier, allowing a release to pass through undetected; for cathodically protected tanks, the secondary barrier must be installed so that it does not interfere with the proper operation of the cathodic protection system; the groundwater, soil moisture, or rainfall will not render the testing or sampling method used inoperative so that a release could go undetected for more than 30 days; the site is assessed to ensure that the secondary barrier is always above the groundwater and is not located in a 25-year flood plain, unless the barrier and monitoring designs are for use under such conditions; monitoring wells are clearly marked and secured to avoid unauthorized access and tampering; and, for tanks with an internally fitted liner, an automated device can detect a release between the inner wall of the tank and the liner, and the liner is compatible with the substance stored.* The interstitial monitoring system is the primary method of release detection for the UST system at the WIPP facility. The as-built engineering drawings verify that this method can detect a release through the inner wall in any portion of the tank that routinely contains product.
44. Methods of Release Detection of Piping, 20.5.6.23 NMAC (40 CFR §280.44)	*Each method of release detection for piping used to meet the requirements of 20.5.6.601 NMAC must be conducted in accordance with specific requirements for automatic line leak detectors, line tightness testing, or applicable tank methods, or interstitial monitoring.* The interstitial monitoring system meets the release-detection requirement. Should the interstitial system become inoperable, monthly inventory controls will be used until the system is repaired or replaced. In this contingency situation, tank tightness testing will be performed every five years.
45. Other Methods of Detecting Releases, 20.5.6.24 NMAC (40 CFR §280.43[h])	*Any other method may be used if it can detect a 0.2-gallon-per-hour leak rate or a release of 150 gallons within a month with a probability of detection of 0.95, and a probability of false alarm of 0.05, and it has been approved by the NMED.* The DOE does not use any methods of release detection other than the ones described above.

Table 30: Status of Compliance with the UST Regulatory Requirements Under 20.5 NMAC

Regulatory Requirement	WIPP Project Compliance
46. Release Detection Recordkeeping, 20.5.6.25 NMAC (40 CFR §280.45)	*All storage tank system owners and operators shall maintain records in accordance with 20.5.5.504 NMAC, which demonstrate compliance with all applicable requirements in 20.5.6 NMAC. All written performance claims pertaining to any release detection system used, and the manner in which these claims have been justified or tested by the equipment manufacturer or installer, must be maintained for five years, or for another reasonable period of time determined by the NMED, from the date of installation. The results of any sampling, testing, or monitoring must be maintained for at least one year, or for any reasonable period of time determined by the NMED, except that the results of tank tightness testing conducted in accordance with 20.5.6.603.C NMAC, must be retained until the next test is conducted. Written documentation of all calibration, maintenance, and repair of release-detection equipment permanently located on-site must be maintained for at least one year after the servicing work has been completed or for any reasonable time period determined by the NMED. Any schedules of required calibration and maintenance provided by the release-detection equipment manufacturer must be retained for five years from the date of installation.* The MOC purchasing group maintains the manufacturer's equipment and performance claims records. The DOE records management program discusses the maintenance of records. The MOC purchasing group's Records Inventory and Disposition Schedule adequately addresses the record retention requirements of this section. According to the manufacturer of the tanks, no calibration or maintenance is required for the current configuration. If modifications are made, these functions will need to be performed.
47. Reporting Suspected Releases, 20.5.7.9 NMAC (40 CFR §280.50)	*Owners and operators of storage tank systems must report suspected releases to the NMED within 24 hours in accordance with 20.5.7.700 NMAC, and follow the procedures in 20.5.7.703 NMAC for any of the following conditions:* *A. Evidence of released regulated substances in the vicinity of the storage tank site, including but not limited to, the presence of non-aqueous phase liquid or vapors in soils, basements, sewer and utility lines, groundwater, drinking water or nearby surface water;* *B. Unusual operating conditions such as, but not limited to, the erratic function of product dispensing equipment, the sudden loss of regulated substance from the storage tank system, an unexplained presence of water in the tank, the presence of a regulated substance in the annular or interstitial space of double-walled tanks or piping, anything other than a "pass" result from any release detection method in 20.5.6 NMAC, unless system equipment is found to be defective but not leaking and is immediately repaired or replaced;* *C. Monitoring results from a release detection method described under 20.5.6.601, 602, 603 and 604 NMAC that indicate a release may have occurred.* No releases or suspected releases occurred from the current UST system at the WIPP facility during this reporting period. The DOE fuel station operation procedure outlines the required steps should a suspected release occur.

Table 30: Status of Compliance with the UST Regulatory Requirements Under 20.5 NMAC

Regulatory Requirement	WIPP Project Compliance
48. Confirmed Releases, 20.5.7.10 NMAC (40 CFR §280.51)	*When required by the NMED, owners and operators of storage tank systems must follow the procedures in 20.5.7.700 NMAC regarding any unexpected or confirmed release.* The NMED has not requested off-site impact information and there has been no evidence of a release of regulated substances during this reporting period.
49. Investigation of Suspected Releases, 20.5.7.9 NMAC (40 CFR §280.52)	*Owners and operators shall immediately investigate all suspected releases of regulated substances requiring reporting under 20.5.7.701 NMAC within 14 days. Owners and operators shall conduct a system test, monitoring result check, site check or another procedure approved by the Department.* The DOE fuel station operation procedure indicates the appropriate testing, investigating, reporting, and corrective action to be taken if a release of regulated substances is suspected. There were no leaks in the WIPP USTs during this reporting period.
50. Reporting and Cleanup of Large Spills and Overfills, Subsection C of 20.5.7.11 NMAC (40 CFR §280.53[a])	*Owners and operators of storage tank systems must contain and immediately clean up a spill or overfill and report it to the NMED within 24 hours in accordance with 20.5.7.700 NMAC. If a spill or overfill of a petroleum product results in a release to the environment that exceeds 25 gallons, or a hazardous substance spill results in a release to the environment that equals or exceeds its RQ under CERCLA (40 CFR Part 302), corrective action must be initiated in accordance with 20.5.12 NMAC and 20.5.13 NMAC.* There were no spills or overfills exceeding 25 gallons from the WIPP USTs during this reporting period. WIPP USTs contain only petroleum products. The DOE fuel station operation procedure addresses requirements with respect to petroleum UST systems (i.e., as specified in 20.5.12 NMAC).
51. Reporting and Cleanup of Small Spills and Overfills, Subsection B of 20.5.7.11 NMAC (40 CFR §280.53[b])	*Owners and operators of storage tank systems must contain and immediately clean up a spill or overfill of a petroleum product that is less than 25 gallons and a spill or overfill of a hazardous substance that is less than the RQ. If cleanup cannot be accomplished within 24 hours, owners and operators must immediately notify the implementing agency.* Small spills and overfills have been properly contained and cleaned up. There were no significant spills or overfills from the WIPP USTs during this reporting period. DOE procedures address the requirement with respect to petroleum UST systems and releases that exceed an RQ under the CERCLA. No UST systems are used to contain hazardous substances at the WIPP facility.
52. Temporary Closure, 20.5.8.9 NMAC (40 CFR §280.70)	*When a storage tank system is temporarily closed, owners and operators must continue operation and maintenance of corrosion protection in accordance with 20.5.5.501 NMAC, and any release detection in accordance with 20.5.6 NMAC. Owners and operators shall also comply with 20.5.7 NMAC, 20.5.12 NMAC, and 20.5.13 NMAC. However, release detection is not required as long as the storage tank system is empty. When a storage tank system is temporarily closed for three months or more, the vent lines must be left open and functioning, and all other lines, pumps, manways, and ancillary equipment must be capped and secured.* No temporary closures have taken place during this reporting period.

Table 30: Status of Compliance with the UST Regulatory Requirements Under 20.5 NMAC

Regulatory Requirement	WIPP Project Compliance
53. Corrective Action, Subsection B of 20.5.8.12 NMAC (40 CFR §280.72[b])	*If contaminated soils, contaminated groundwater, or free product as a liquid or vapor are discovered, owners and operators must begin corrective action in accordance with 20.5.12 NMAC or 20.5.13 NMAC.* No releases or suspected releases occurred at the WIPP facility during this reporting period.
54. Applicability of Financial Responsibility, 20.5.9.900 NMAC (40 CFR §280.90)	*State and federal government entities whose debts and liabilities are the debts and liabilities of a state or the United States are exempt from the requirements of 20.5.9 NMAC, "Financial Responsibility."* As the owner of the WIPP facility, the DOE is exempt from the financial responsibility requirements of this part.
55. Cleanup Requirements for Releases from Storage Tank Systems, Subsection A of 20.5.12.8 NMAC	*All releases must be cleaned up through soil remediation, ground and surface-water remediation, and any other appropriate procedures in a manner protective of health, public welfare, and the environment.* No releases occurred from the WIPP USTs during this reporting period.

26.0 NEW MEXICO SOLID WASTE ACT

26.1 Summary of the Law

With the enactment of the New Mexico Solid Waste Act (74-9-1 through 74-9-43 NMSA) in 1978, the New Mexico Legislature authorized and directed the establishment of a comprehensive and integrated solid waste management program at both the state and local levels. This legislation directs the planning and regulation of the reduction, storage, collection, transportation, and disposal of solid waste and authorizes the establishment of a system of permits for the construction, operation and, if applicable, closure and post-closure maintenance of solid waste facilities.

The New Mexico Solid Waste Act is implemented by the New Mexico Solid Waste Management Regulations (SWMRs) contained within 20.9 NMAC. These regulations are applicable to WIPP because infectious wastes are generated at the facility, because soil(s) may become contaminated from unintentional releases of petroleum products, and because WIPP is allowed to receive asbestos wastes for disposal. A construction debris landfill is operational at the site, but is exempt under §108 of the SWMRs.

26.2 Status of Compliance with the Regulatory Requirements

Table 31 summarizes the applicable requirements and their compliance status under the New Mexico Sold Waste Act.

Table 31: Status of Compliance with the Regulatory Requirements of the New Mexico Solid Waste Act

Regulatory Requirement	WIPP Project Compliance
1. General Requirements, 20.9.2.8 NMAC	*Generators of solid waste must provide containers for the solid waste except for construction and demolition debris, yard refuse, and appliances.* A construction debris landfill is operational at the WIPP site. The construction landfill is on property owned by the DOE and receives nonhazardous material generated on the property from construction activities. No hazardous wastes or materials are allowed in the landfill. The landfill is covered by the exemption found in §108 of the SWMRs. The requirements and rules of operation for the landfill are described in a DOE procedure. Use of this procedure ensures operation of the construction landfill in a manner that is protective of human health and the environment and in compliance with applicable local, state, and federal laws and regulations. Infectious wastes are generated at the facility and are managed in accordance with the applicable requirements of §700F of the SWMRs. Infectious wastes generated at the site are shipped off-site for disposal. Petroleum-contaminated soils generated at the facility are managed in accordance with the applicable requirements of §700H of the SWMRs. Petroleum contaminated soil is shipped off-site for disposal or remediation. The WIPP project provides containers for solid waste in accordance with the applicable requirements.
2. Prohibited Acts, 20.9.2.10 NMAC	*Section 20.9.2.10 NMAC specifies prohibited acts including the following: disposal of solid waste in places other than a permitted solid waste facility; disposal of regulated waste such as special waste, hazardous waste, radioactive materials, and petroleum waste at a facility not permitted for that kind of waste disposal of bulk liquids; and disposal of any solid wastes that are known to be harmful to the environment or hazardous to public health or safety.* The following wastes are excluded from disposal in the WIPP facility construction landfill: • Radioactive materials • Hazardous or other regulated materials, including petroleum products • Liquids, or containers that contain liquids • Any recyclable materials as determined by the DOE • Municipal solid waste Construction debris that may be disposed of in the landfill is material generally considered to be non-water-soluble and nonhazardous in nature and includes timbers, pipes, excavation soil (if not contaminated with hazardous materials/wastes), concrete, packing materials, sheet metal, glass, and wood. Site-generated wastes subject to these prohibitions are sent to licensed, off-site facilities for disposal.
3. Exceptions 20.9.2.11C	*This part does not apply to disposal of construction and demolition debris or yard refuse by a person in possession of property if the material was generated on the property and if the disposal of the solid waste does not violate any provision of 20.9.2 - 20.9.10 NMAC.* The WIPP facility construction landfill falls within this exemption. The DOE is not required to obtain a landfill permit for construction debris generated and disposed of at the WIPP facility.

Table 31: Status of Compliance with the Regulatory Requirements of the New Mexico Solid Waste Act

Regulatory Requirement	WIPP Project Compliance
4. Record Keeping and Annual Reports, 20.9.5.16 NMAC	*Operators of solid waste facilities shall make and maintain records during the active life of the facility. Operators shall submit annual reports to the Secretary of the NMED within 45 days after each calendar year.* The WIPP facility construction landfill is covered by the exemption found in the SWMR, 20.9.2.11C NMAC. Although the WIPP facility construction landfill is exempt from recordkeeping requirements, records for the landfill are maintained. The DOE construction debris disposal form is used to record the name, company, date, description, and estimated volume of debris, and signatures of the landfill user and of the landfill custodian. No permit is required; therefore, no annual report is necessary.
5. Facilities, Entry by Department, Availability of Records to Department and Others, 20.9.2.12 NMAC	*The Secretary or any authorized representative, employee or agent of the Department may enter any solid waste facility at any reasonable times for the purpose of making an inspection.* The NMED personnel will be provided access to the facility during normal business hours to conduct an inspection.
6. Solid Waste Facility Permits, 20.9.3.8 NMAC	*Any person seeking a permit to construct, operate, or modify a solid waste facility must file an application.* Section 20.9.2.11 NMAC provides an exemption for the WIPP facility construction landfill. The regulations do not apply to disposal of construction and demolition debris if the material is generated on the property, and the disposal of the solid waste does not violate any provision of the regulations. The WIPP facility construction landfill is exempted from permit application requirements because it receives construction debris only and because it is located at the same site where the construction debris is generated. No permit is required.
7. Registration of Commercial Haulers, 20.9.3.31 NMAC	*Transporters of special waste shall register with the NMED, submit a description of the solid waste facilities used, submit a contingency plan to the Secretary, and carry a copy of the plan and appropriate cleanup kits in the vehicle.* Transportation of special waste generated at the WIPP facility is accomplished by an off-site contractor that meets the requirements.
8. Solid Waste Facility Operation Requirements, 20.9.5.8 NMAC	*A solid waste facility must be located and operated so that it does not cause a public nuisance or create a potential hazard to public health or welfare.* The WIPP facility construction landfill is covered by the 20.9.2.11C exemption contained in the SWMR. In order to ensure compliance with the SWMR, the WIPP facility construction landfill is operated according to DOE procedures that ensure protection of public health and welfare.
9. Closure and Post Closure Requirements, 20.9.6.8 NMAC	*Section 20.9 NMAC specifies a number of solid waste facility closure and post-closure requirements including the installation of a final cover, preparing and implementing a land-use plan, a schedule for completing all closure work, an approved post-closure care and monitoring plan, and annual reports.* The WIPP facility construction landfill is exempted from these requirements because it receives construction debris only and because it is located at the same site where the construction debris is generated. Closure and post-closure requirements are not applicable.

Table 31: Status of Compliance with the Regulatory Requirements of the New Mexico Solid Waste Act

Regulatory Requirement	WIPP Project Compliance
10. Operator Certification, 20.9.7.8 NMAC	*Section 20.9.7.8 NMAC provides requirements for operator certification. The amount and type of personnel training and experience are specified for landfills and for other types of facilities.* The WIPP facility construction landfill is exempted from these requirements because it receives construction debris only and because it is located at the same site where the construction debris is generated. Operator certification is not required.
11. Asbestos Waste, 20.9.8.12 NMAC	*This section specifies a number of requirements for transportation and disposal of asbestos waste, including transporter and labeling requirements.* These requirements are adequately addressed in the WIPP Permit. In a letter from the NMED dated July 14, 2000 (NMED, 2000), the NMED stated that the standards for the management, storage, and disposal of waste in the WIPP Permit exceed the standards specified for asbestos in 20.9.8.12 NMAC; therefore, no additional conditions are necessary for disposal of TRU waste containing asbestos at the WIPP facility. The WIPP facility does not have asbestos-containing material on-site and thus, there was no disposal of site-generated, asbestos-containing material during the reporting period.
12. Storage and Containment of Infectious Waste, 20.9.8.13 NMAC	*Section 20.9.8.13 NMAC specifies infectious waste storage and containment requirements, including waste segregation; specifications for container integrity; container labeling and marking; and storage and containment area access, integrity, and marking.* The following practices are ongoing at the WIPP facility: • Access to the infectious waste collection and storage area is limited to trained and inoculated medical and waste management personnel. • Special containers are easily identifiable through the use of internal red biohazard bags and external biohazard labels. • All sharps are sealed in containers that are leak-proof, puncture-proof, and tamper-proof. These containers are then placed in properly labeled, rigid, plastic containers. • All containment bags are red to ensure that they are clearly identifiable as specified by 29 CFR §1910.145. • No infectious waste containers are reused. • Storage and containment areas are in an enclosed, clearly marked environment. • No compaction or grinding devices are used to reduce the volume of infectious waste. No inspections of the infectious waste storage area and the medical clinics at the WIPP site and the Skeen-Whitlock Building were conducted by regulatory agencies during this reporting period.

Table 31: Status of Compliance with the Regulatory Requirements of the New Mexico Solid Waste Act

Regulatory Requirement	WIPP Project Compliance
13. Infectious Waste Treatment, Storage, and Disposal Facilities, 20.9.8.13E NMAC	*This section specifies operational requirements for infectious waste treatment, storage, and disposal facilities. Included is a requirement for the preparation and maintenance of a management plan that identifies the type of waste generated or handled; the segregation, packaging, labeling, collection, storage, and transportation procedures to be implemented; the treatment or disposal methods to be used; the transporter and disposal facility to be used; and the person responsible for the management of the infectious waste.* The DOE transportation manual, special waste management plan, and the occupational health manual address the operational requirements for infectious waste as specified in this part.
14. Treatment and Disposal of Infectious Waste, 20.9.8.13F-G NMAC	*Several methods are specified for the treatment and disposal of infectious waste. These methods include controlled incineration, heat sterilization, discharge to a sewage treatment system, or other methods as approved by the NMED.* Infectious waste is sent to an off-site facility for incineration or autoclaving.
15. Petroleum Contaminated Soil, 20.9.8.15 NMAC	*Section 20.9.8.15 NMAC specifies sampling requirements, disposal prohibitions, storage requirements, and remediation allowances for all petroleum contaminated soils.* Petroleum-contaminated soils at the WIPP facility are sampled and analyzed for total petroleum hydrocarbons and other constituents as deemed necessary by the NMED or the DOE. Petroleum-contaminated soils are sent to an off-site facility for disposal or remediation.
16. Manifest Requirements, 20.9.8.19 NMAC	*A manifest must accompany each shipment of special waste. Each manifest must include information on the waste generator, transporter, waste treatment facility, the type of waste, and any special instructions.* Special waste shipments are accompanied by a standardized EPA shipment manifest that includes the required information.

27.0 NEW MEXICO GROUND WATER PROTECTION ACT

27.1 Summary of the Law

The New Mexico GWPA was enacted in 1990 in response to the threat facing public health and safety and the environment from pollution of groundwater resources from leaking USTs. The purpose of this act includes the provision of substantive direction that allows the State of New Mexico to take corrective action at sites contaminated by leakage from USTs.

The GWPA is implemented by the regulations of the NMED, 20.5 NMAC, Petroleum Storage Tanks, discussed in section 25.0. These regulations provide guidelines for the payment or reimbursement of the costs of a minimum site assessment and corrective action and specify the requirements for owners or operators of leaking storage tank

systems. The GWPA prohibits expenditures from the Corrective Action Fund (20.5.17 NMAC) for federally owned and operated sites.

The DOE has installed two USTs at WIPP that meet the state's standards and requirements for USTs. Procedures are in place for routine operations regarding the tanks and for mitigating any spills or releases from the UST systems.

27.2 Status of Compliance with the Regulatory Requirements

Table 32 provides compliance status with the New Mexico GWPA.

Table 32: Status of Compliance with the Regulatory Requirements of the New Mexico Ground Water Protection Act

Regulatory Requirement	WIPP Project Compliance
1. Status of Compliance with the Regulatory Requirements	*The owners or operators of USTs that release a regulated substance must take appropriate corrective action. The NMED will reimburse certain costs associated with performing a minimum site assessment and other corrective actions taken for spills or releases from USTs.* There were no releases from USTs at the WIPP facility during this reporting period.

28.0 NEW MEXICO AIR QUALITY CONTROL ACT

28.1 Summary of the Law

In 1978, the New Mexico Air Quality Control Act (74-2-1 through 74-2-17 NMSA 1978) was enacted. The NMED implements the New Mexico Air Quality Control Act under 20.2 NMAC. The New Mexico Air Quality Control Act and 20.2 NMAC are based primarily on the CAA (see section 6.0), with the New Mexico act generally not being more stringent than the CAA.

Under 40 CFR Part 70, operating permits are required for both area and major sources. The NMED implements the federal requirements under 20.2.70 NMAC, which describes the operating permit program; and 20.2.71 NMAC, which describes the fee and structure for the operating permit program.

28.2 Status of Compliance with the Regulatory Requirements

Table 33 summarizes DOE compliance with the applicable requirements of 20.2 NMAC. The WIPP facility has no sources of air emissions that require a permit under 20.2.70 NMAC. However, it should be noted that although not required, the DOE obtained a permit (Permit No. 310-M-2) in December 1993 for two emergency backup diesel generators (NMED, 1993). In fact, 20.2.72.202 NMAC exempts standby generators from needing an air quality permit provided that they are (1) operated only during the unavoidable loss of power; (2) operated less than 500 hours per year; and (3) either are the only source of air emissions at the site or are accompanied by sufficient

record keeping to verify that the standby generator is operated less than 500 hours per year.

Table 33: Status of Compliance with the Regulatory Requirements of the New Mexico Air Quality Control Act

Regulatory Requirement	WIPP Project Compliance
1. Sampling Equipment, 20.2.1.113 NMAC	*Sampling equipment on stacks or other openings through which emissions are released to the atmosphere will be used as required.* The sampling equipment required for measuring emissions from the WIPP facility backup diesel generators was specified by the NMED in §3(b) of the permit. Sampling ports, safe sampling platforms, safe access to sampling platforms, and utilities for sampling and testing equipment have been provided. A 0.25-inch stainless steel sampling line adjacent to the sampling ports, which extends down to within 4 feet above ground level, has been installed as required by the permit. This sampling line provides access for future audits by the NMED.
2. Excess Emissions During Malfunction, Start-Up, Shutdown, or Scheduled Maintenance, 20.2.7 NMAC	*Excess emissions during malfunction, start-up, shutdown, or scheduled maintenance must be minimized.* Special attention is paid during start-up, shutdown, scheduled maintenance, and any malfunction of the generators to ensure that emissions are minimized. The release of excess emissions is unlikely. However, a redundant system is in place, and the second backup generator will be used, as appropriate, to reduce potential emissions. If excess emissions occur, reporting will be performed as required by 20.2.7 NMAC. No problems were detected during this reporting period.
3. Emissions Leaving New Mexico, 20.2.8 NMAC	*Emissions leaving New Mexico must not exceed the standards and regulations of the receiving state.* Title 40 CFR Part 70 and 20.2.1.8 NMAC apply to major sources, HAPs, acid rain, and other sources designated by the Administrator. The WIPP facility is not subject to these requirements based on the latest air emissions inventory.
4. Oil Burning Equipment-Particulate Matter, 20.2.18 NMAC	*Standards have been established for particulate-matter emissions from oil-burning equipment with a rated heat capacity exceeding 250 million British thermal units (BTUs) per hour.* No oil-burning equipment at the WIPP facility exceeds this rated heat capacity. The rated heat capacity of each of the generators is 139.6 million BTUs per hour.
5. Oil Burning Equipment-Nitrogen Dioxide, 20.2.34 NMAC	*Standards have been established for nitrogen dioxide emissions from oil-burning equipment with a rated heat capacity of 1,000,000 million BTUs per hour.* No oil-burning equipment at the WIPP facility exceeds this rated heat capacity.
6. Regulations to Control Open Burning, 20.2.60 NMAC	*Open burning is allowed for the instruction and training of fire-fighting and rescue personnel when a permit is obtained from the NMED.* Firefighting training was not conducted at the WIPP facility during this reporting period; therefore, no open-burning permit was required.

Table 33: Status of Compliance with the Regulatory Requirements of the New Mexico Air Quality Control Act

Regulatory Requirement	WIPP Project Compliance
7. Regulations to Control Smoke and Visible Emissions, 20.2.61 NMAC	*No person owning or operating stationary combustion equipment shall permit, cause, or allow visible emissions from stationary combustion equipment to equal or exceed an opacity of 20 percent. No emissions of smoke with an opacity greater than 30 percent shall be released into the open air for any period greater than 10 seconds from any diesel-powered vehicle operating below 8,000 feet mean sea level. Opacity emissions shall be determined using Method 9 described in Appendix A of 40 CFR Part 60 (minimum time period for taking opacity reading: 10 minutes).* Opacity measurements are not required for the backup diesel generators because no opacity measurements are specifically required under the permit. However, opacity testing has been performed on the generators and was found to be less than the 20 percent opacity limit. Other diesel equipment is present on-site that does not require a permit under 20.2.72 NMAC because this equipment represents such a small source of emissions. The inventory on the equipment was submitted to the NMED with the permit application for the backup generators. The emissions from the diesel equipment fall well below the permit thresholds.
8. Compliance Plan, 20.2.70.300 NMAC	*Submittal of a compliance plan is required as part of the operating permit application for 40 CFR Part 70 sources.* No operating permit is required for the WIPP facility. The WIPP facility does not have processes that result in the emissions of HAPs to the atmosphere, other than those that are exempt from permitting and listed on the NMED List of Trivial Activities. Examples include paint dispensed from aerosol cans of 16 ounces or less, or routine calibration of laboratory equipment or other analytical instruments.
9. Semiannual Operating Permit Reports and Progress Reports on the Compliance Plan, 20.2.70.300 NMAC	*Semiannual operating permit reports and progress reports on the compliance plan will be filed, if applicable.* The only reporting requirement under the permit for the backup diesel generators is an annual air emissions inventory upon request by the NMED. The NMED last requested DOE to submit an air emissions inventory in 2003 (WRES, 2003) for CY 2002.
10. Permits, 20.2.72 NMAC	*A permit is required for facilities that emit criteria pollutants or toxic air pollutants at rates that meet or exceed the threshold levels specified in 20.2.72 NMAC.* The WIPP facility has no sources of air emissions that require a permit under 20.2.70 NMAC. As mentioned earlier and, although not required, the WIPP facility did obtain a permit (Permit No. 310-M-2) in December 1993 for two emergency backup diesel generators (NMED, 1993). The permit remains in effect and requires that the sum of the hours of operation for both generators shall not exceed 480 hours per year. In 2005, an inventory of fugitive dust emissions from salt mining and handling activities was conducted to evaluate increased emissions that would result from the construction of a new haul road to transport salt tailings and provide access to a new salt storage area (SSA). The AQB was contacted to determine if any permits would be necessary for fugitive emissions from WIPP material handling processes. On March 31, 2006, the AQB issued a determination that no permit is required.

Table 33: Status of Compliance with the Regulatory Requirements of the New Mexico Air Quality Control Act

Regulatory Requirement	WIPP Project Compliance
11. Permit Fees, 20.2.75 NMAC	*Permit fees must be paid with the submittal of a permit application.* The permit fee for the diesel generators ($10,100) was submitted with the permit application in July 1993.
12. Stack Height Requirements, 20.2.80 NMAC	*Stack height requirements must be met.* WIPP meets the requirement for stack height. The state approved the Permittees calculations and modeling with the issuance of Air Quality Permit No. 310-M-2 (NMED, 1993).

28.3 Status of Compliance with the Permit Conditions

The permit for the backup diesel generators, which was issued to DOE on December 7, 1993, is the only permit issued under the authority of 20.2 NMAC. The permit conditions and compliance status of each are provided below.

28.3.1 Permit for Backup Diesel Generators, Permit No. 310-M-2

The conditions specified by Air Quality Permit No. 310-M-2 (NMED, 1993) for the backup diesel generators at WIPP are described in table 34.

Table 34: Status of Compliance with the Permit Conditions for the Permit for Backup Diesel Generators, Permit No. 310-M-2

Regulatory Requirement	WIPP Project Compliance
1. Construction and Operation, Condition 1	*The plant (i.e., the diesel generators) shall be constructed and operated as described in the permit application dated June 18, 1993, and with the air quality modeling information that was submitted on September 22, 1993, unless modified by the conditions of this permit. The facility consists of two Caterpillar diesel generators with a rated capacity of 1,500 horsepower. Only one Caterpillar diesel generator is authorized to operate at one time for 20 hours per month and 12 months per year, each for a total of 240 hours per year. The sum of hours of operation for both generators shall not exceed 480 hours per year. Changes in plans, specifications, and other representations provided in the application documents shall not be made if they cause a change in the method of control of emissions or in the character of the emissions, or will increase the discharge of emissions. Any such proposed change must be submitted as a revision or modification of the permit in accordance with the condition.* The equipment described in the permit is operated in accordance with the terms and conditions of the permit and the manufacturer's specifications, and is maintained in accordance with the manufacturer's specifications. Each diesel generator at the WIPP facility operated less than 20 hours per year during this reporting period.

Table 34: Status of Compliance with the Permit Conditions for the Permit for Backup Diesel Generators, Permit No. 310-M-2

Regulatory Requirement	WIPP Project Compliance
2. Emission Rates, Condition 2	*The NMED has specified maximal emission rates for nitrogen dioxide, carbon monoxide, sulfur dioxide, and particulate matter. The rates specified are in terms of pounds per hour and tons per year from each engine and from the facility (i.e., both engines).* The emissions were established during emissions testing in 1992. Currently, the only requirement the permit specifies with regard to emission rates is that the equipment be operated less than 480 hours per year. The limit on operating hours for the diesel generators is a control to limit the emissions to the emission rates specified in the permit. Each generator operated less than 20 hours per year during this reporting period.
3. Compliance Test Methods, Conditions 3-4	*Initial compliance tests for all four pollutants described for Condition 2 are required for one of the diesel generators. Compliance tests may be reimposed if noncompliance is indicated or if the tests were technically unsatisfactory. The tests shall be conducted within 60 days after achieving the maximal production rate at which the generator will normally be operated. If the maximal production rate does not occur within 120 days of source start-up, the tests must be conducted no later than 180 days after the initial start-up of the source.* *The tests shall be conducted in accordance with EPA Reference Methods 1-4, Method 5 (particulate matter), Method 6 (sulfur dioxide), Method 7 (A-E) (nitrogen dioxide), and Method 10 (carbon monoxide) contained in 40 CFR Part 60, Appendix A, and with the requirements of 40 CFR §60.8(f). The oxygen in the stack gas shall be determined by using EPA Method 3.* *The NMED shall be notified of the date and time of compliance testing at least 30 days before the planned test date so the NMED may have an observer present during testing. The permittee will arrange a pretest meeting with the NMED at least 30 days prior to the anticipated test date and shall observe the pretesting and testing procedures described in detail under this condition. These requirements include submitting a written test protocol to the NMED at least one week prior to the testing date for approval and providing appropriate equipment and access to the NMED observer for sampling. Several parameters (i.e., engine revolutions per minute, exhaust static pressure, exhaust manifold temperature, fuel consumption, and horsepower as indicated by kilowatt output) shall be monitored and recorded during the compliance testing and the results will be included in the test report submitted to NMED. Flow straighteners shall be installed where necessary to prevent cyclonic flow in the stack. The tests shall be conducted at 90 percent of full load or greater and at additional loads as specified by NMED personnel at the test or pretest meeting.* *Two copies of the compliance test report must be submitted to the NMED within 30 days after completion of testing.* Compliance with these conditions was achieved and reported in the compliance test report, Emission Sampling Report, Backup Diesel Generator (IT Corporation, 1994), which was submitted to the NMED AQB on March 6, 1994, and approved on May 12, 1994.

Table 34: Status of Compliance with the Permit Conditions for the Permit for Backup Diesel Generators, Permit No. 310-M-2

Regulatory Requirement	WIPP Project Compliance
4. Revisions and Modifications, Condition 5	*Any future changes shall be preceded by the submittal of a permit application to the NMED in accordance with 20.2.72 NMAC. No modifications shall be made prior to the issuance of the revised permit.* There have been no revisions or modifications to the equipment or its operation during this reporting period.
5. Notification to Subsequent Owners, Condition 6	*If there is any change in control or ownership of the facility, the permittee shall notify the succeeding owner of the permit and its conditions and shall notify the NMED of the change in ownership within 15 days of the change.* There has been no change in ownership or control of the permitted equipment during this reporting period.
6. Right to Access Property and Review Records, Condition 7	*The NMED will be given the right to enter the facility at all reasonable times to verify the terms and conditions of the permit. Upon receipt of a verbal or written request from any authorized representative of the NMED, the company will produce any records or information necessary to demonstrate that the terms and conditions of the permit are being met.* Upon request, NMED representatives will be allowed entry to the site and will be provided with appropriate records and information. No NMED personnel requested entry to the site to verify the terms and conditions of the permit for the diesel generators within this reporting period.
7. Posting of the Permit, Condition 8	*A copy of the permit will be posted and in view of the plant site at all times. It will be made available to NMED personnel for inspection upon request.* A copy of the permit is posted at the WIPP facility.
8. Recordkeeping, Condition 9	*The DOE will maintain an operational log in which the date, time, and hours of operation will be recorded for each engine. The records will be maintained on-site for at least two years from the time of recording and will be made available to NMED personnel upon request.* Completion and maintenance of operational logs are carried out as prescribed by Permittee procedures. CMR logs contain information about the diesel generators. The run times for the generators are recorded automatically by the Central Monitoring System. The records are maintained on-site for at least two years.
9. Reporting, Condition 10	*The permittee will notify the NMED in writing or provide the NMED with the following information:* - *The anticipated date of the initial start-up of each new or modified emission source at least 30 days prior to that date* - *The actual date of the initial start-up of each new or modified source within 15 days after the start-up date* - *The date when each new or modified emission source reaches the maximal production rate at which it will operate within 15 days after that date* - *Any change of operators within 15 days after the change* - *Any necessary update or correction no more than 60 days after the operator knows or should have known of the*

Table 34: Status of Compliance with the Permit Conditions for the Permit for Backup Diesel Generators, Permit No. 310-M-2

Regulatory Requirement	WIPP Project Compliance
	condition necessitating the update or correction of the permit. Notice of the initial start-up of each source was submitted to the AQB in December 1993. No modifications necessitating reporting to the state were made during this reporting period.
10. Permit Cancellations (Permit)	*The NMED will cancel the permit automatically if any source ceases operation for at least five years or if the construction or modification of a source is not initiated within two years from the date of issuance if work on construction or modification is suspended for a total of one year.* The state did not cancel the permit.
11. Notice of Intent and Emission Inventory (Permit)	*Requirements related to Notice of Intent (NOI) and emission inventory are contained in 20.2.73 NMAC which states, an annual emission inventory is required annually for any stationary source permitted under 20.2.72 NMAC (except for those sources that are permitted only for toxic air pollutant emissions). Other sources that are required to file an annual emission inventory are those that must file a NOI under 20.2.73 NMAC or that emit in excess of one ton of lead or ten tons of total suspended particulates, particulate matter with an aerodynamic diameter of 10 µm or less (i.e., PM_{10}), sulfur dioxide, nitrogen dioxide, carbon monoxide, or Volatile Organic Compounds in any calendar year including and subsequent to 1990.* Because Air Quality Permit Number 310-M-2 (NMED, 1993) applies to the operation of two standby diesel generators that are not required to have a permit, annual inventories are not required. However, the NMED has the authority to request an annual inventory from facilities pursuant to 20.2.73.300 NMAC. The last NMED request for an annual inventory was for CY 2002 (WRES, 2003).

29.0 NEW MEXICO WATER QUALITY ACT

29.1 Summary of the Law

The New Mexico Water Quality Act (74-6-1 through 74-6-17 NMSA 1978) created the New Mexico Water Quality Control Commission, tasked with the development of regulations to protect New Mexico ground and surface water. New Mexico water quality regulations for ground and surface water protection are contained in 20.6.2 NMAC, Ground and Surface Water Protection. The Ground and Surface Water Protection Regulations, 20.6.2 NMAC, include water quality standards for groundwater and surface water and regulations regarding discharges that may impact groundwater. The WIPP facility does not have any discharges to surface water, but does have a discharge permit (DP-831) to prevent impacts to groundwater from the sewage treatment system (Evaporation Ponds B and C) and the H-19 Evaporation Pond for the management of miscellaneous nonhazardous wastewaters, and to minimize impacts to groundwater from the management of salt tailings generated from the construction and maintenance of the geologic repository.

On January 16, 1992, the NMED issued the original DP-831 for the WIPP facility sewage treatment facility (NMED, 1992a). The discharge permit is renewed every five years, and several discharge permit modifications have been submitted. In 1997, DP-831 was renewed and modified to add authorization for the disposal of up to 8,000 gallons per day (gpd) of nonhazardous wastewater to the synthetically lined H-19 Evaporation Pond. The 1997 discharge permit renewal also authorized the discharge of up to 2,000 gpd of nonhazardous wastewater to Evaporation Pond B in the sewage treatment system. The last discharge permit renewal was on September 9, 2008 (NMED, 2008).

The most significant modification to the discharge permit was issued December 2003 (NMED, 2003), and was the result of the NOI submitted in October 2002 describing an anthropogenic lens of shallow subsurface water beneath the WIPP site at a depth of less than 100 feet below ground surface. This water was not present when the shafts for the repository were constructed and is believed to have originated from the management of storm water run-off in unlined evaporation ponds. Water in the northern portion of this shallow water lens contains a total dissolved solids (TDS) concentration above 100,000 milligrams per liter (mg/l), which is believed to be the result of storm water infiltrating the salt pile just north of the Property Protection Area. Based on the NOI, the Ground Water Quality Bureau (GWQB) determined that a modified discharge permit was necessary. The modification included a groundwater quality and groundwater level monitoring program as well as the construction of controls to minimize the infiltration of storm water to the subsurface.

The infiltration controls to minimize recharge of the subsurface shallow water proposed by the DOE in the April 5, 2010, discharge permit modification are listed below.

The existing 18-acre SSA was graded with a 2 percent slope from the center, capped with an high-density polyethylene liner, 2 feet of soil, and seeded with a BLM-approved seed mix to establish native vegetation. The SSA was graded such that water would drain to the Salt Pile run-off ditch and the Salt Pile Evaporation Pond (SPEP), which was lined with a 60-mil high-density polyethylene liner.

A new SSA, called the salt storage extension (SSE) area, was constructed north of the SSA. The SSE was constructed with a prepared subgrade and 2 percent slope to the center, which contains a perforated pipe that conveys storm water from the SSE area west to a double-lined pond, Salt Storage Extension Basin I (SSEB-I), with a leak detection system.

Due to a large amount of storm water exceeding the design capacity of the SSEB-I, a Salt Storage Extension Basin II (SSEB-II) was constructed to contain overflow of the SSEB-I. Storm water runoff to the interconnected SSEB-I and SSEB-II is 2,752,831 gpd based on a 25-year/24-hour storm event (3.90 inches). The SSEB-II was completed and added to the discharge permit in 2010.

Currently, the discharge permit authorizes the following activities:

- The discharge of up to 23,000 gpd of domestic wastewater and non-hazardous industrial wastewater from two compressed air systems to the sewage lagoon system.
- The Evaporation Ponds B, C, and H-19 are also permitted for the discharge of up to 50,000 gpd into each pond of miscellaneous nonhazardous wastewater for evaporation as long as a minimum of 1 foot of freeboard is maintained.
- The water depth of the SSEB-II shall be measured monthly to the nearest tenth of a foot (0.1 ft).
- All general requirements of the September 9, 2008, DP-831 discharge permit remain intact. These requirements include monitoring and reporting, recordkeeping, inspection and entry, duty to provide information, spills, leaks and other unauthorized discharges, retention of records, enforcement, and modification and/or amendments.

An application for permit renewal was submitted to the NMED GWQB on May 9, 2013. On June 13, 2013, public notice was made, and the application was deemed administratively complete by the GWQB on May 15, 2013. The GWQB is still reviewing the application in preparation of issuing the permit.

29.2 Status of Compliance with the Regulatory Requirements

Table 35 provides the regulatory requirements and their compliance status under the New Mexico Water Quality Act.

Table 35: Status of Compliance with the Regulatory Requirements of the New Mexico Water Quality Act

Regulatory Requirement	WIPP Project Compliance
1. Notice of Intent to Discharge, 20.6.2.1201 NMAC	*Any party intending to make a new water contaminant discharge or to alter the character or location of an existing water contaminant discharge, unless the discharge is being made or will be made into a community sewer system or subject to the Liquid Waste Disposal Regulations adopted by the New Mexico Environmental Improvement Board, shall file a notice with the Ground Water Quality Bureau of the NMED for discharges that may affect groundwater, and/or the Surface Water Quality Bureau of the department for discharges that may affect surface water.* The initial NOI for the WIPP facility sewage treatment system was submitted in 1983; a discharge plan or permit was not required at that time. A revised NOI was submitted in 1989 that resulted in the determination that a discharge plan was required. In October 2002, an NOI was submitted as a result of the formation of anthropogenic shallow subsurface water beneath the WIPP site. This resulted in a modified discharge permit issued in December 2003 (NMED, 2003), which incorporated the infiltration controls into the permit and groundwater monitoring program for the shallow subsurface anthropogenic water.

Table 35: Status of Compliance with the Regulatory Requirements of the New Mexico Water Quality Act

Regulatory Requirement	WIPP Project Compliance
2. Filing of Plans and Specifications - Sewerage Systems, 20.6.2.1202 NMAC	*Any party proposing to construct a sewerage system or proposing to modify any sewerage system in a manner that will change the quantity or quality of the discharge from the system substantially must file plans and specifications for the construction or modification with the Ground Water Quality Bureau of the NMED for discharges that may affect groundwater, and/or the Surface Water Quality Bureau of the department for discharges that may affect surface water.* Plans and specifications for the sewage treatment system, the H-19 Evaporation Pond and the infiltration controls were included in the Discharge Permit Renewal Application submitted to the NMED on May 9, 2013, as well as in previous discharge permit modifications and renewals. Through the end of this BECR reporting period, the NMED was reviewing the renewal application.
3. Notification of Discharge - Removal, 20.6.2.1203 NMAC	*Requirements for reporting, notifications, and corrective action with respect to any discharge from any facility of oil or other water contaminant, in such quantity as may with reasonable probability injure or be detrimental to human health, animal or plant life, or property, or unreasonably interfere with the public welfare or the use of property are specified.* In the event of an unauthorized discharge of oil or other potentially harmful water contaminants, notification, reporting, and corrective action are performed in accordance with the WIPP environmental incident reporting procedure. No unauthorized discharge requiring notification occurred during this BECR reporting period.
4. General Requirements, 20.6.2.2101 NMAC	*General discharge limitations and sampling/analytical requirements for the discharge of effluents to a watercourse must be met.* WIPP wastewater and storm water management facilities do not discharge to a watercourse; therefore, this regulation is not applicable to the WIPP facility.
5. Discharge Permit Required, 20.6.2.3104 NMAC	*No person shall cause or allow effluent or leachate to discharge so that it may move directly or indirectly into groundwater unless he is discharging pursuant to a discharge permit issued by the Secretary. When a permit has been issued, discharges must be consistent with the terms and conditions of the permit.* The DOE proposed conservative and robust mitigative action in the infiltration controls proposed in the December 2003 modification to DP-831 to meet this requirement when the DOE and the Permittees became aware that the most likely source of subsurface shallow groundwater containing elevated TDS was the salt stockpile and infiltration from other storm water discharges. The DOE has continued to comply with this requirement through the 2013 Discharge Permit Renewal Application process.
6. Application for Discharge Permits and Renewals, 20.6.2.3106 NMAC	*Any person who intends to begin discharging any listed water contaminants or any toxic pollutant so that they may move directly or indirectly into groundwater must have a discharge permit as required.* All discharges at the WIPP facility are consistent with the terms and conditions of DP-831.

Table 35: Status of Compliance with the Regulatory Requirements of the New Mexico Water Quality Act

Regulatory Requirement	WIPP Project Compliance
7. Monitoring, Reporting, and Other Requirements, 20.6.2.3107 NMAC	*Requirements include periodic reporting to the Secretary of any information that may be required as set forth in the discharge permit, and notifying the NMED of any facility expansion, production increase, or process modifications that would result in the discharge of water contaminants.* The DOE has submitted semiannual discharge monitoring reports to the NMED to demonstrate compliance with the inspection, monitoring, and reporting requirements identified in the discharge permit by July 31 and January 31 of each year. The discharge permit requires semiannual sampling and analysis of the sewage system influent for nitrate, total Kjeldahl nitrogen (TKN), TDS, chlorides, and sulfate. The sewage lagoons north evaporation pond, south evaporation pond, and the H-19 Evaporation Pond are sampled semiannually for TDS, chloride, and sulfate. The volumes of waters discharged to the sewage lagoons and evaporation ponds are also monitored and reported as required by the discharge permit. The stormwater Evaporation Ponds 1 and 2, Pond A, the SPEP, and the SSEB-I and SSEB-II are sampled annually for TDS, nitrate, sulfate, and chlorides. The water level in 20 shallow water monitoring wells or piezometers are monitored for depth to groundwater to the nearest hundredth of a foot quarterly and sampled for TDS, chlorides, sulfate and field parameters (temperature, conductivity and pH) semiannually in 11 shallow water monitoring wells as designated in the discharge permit. One well, WQSP 6A, is also sampled semiannually for nitrates and TKN. The results of monitoring and analysis are reported in the semiannual discharge monitoring report for the period within which samples are collected. Monitoring requirements of the September 9, 2008, discharge permit remain intact. The April 4, 2010, modified discharge permit added the operation of a new pond SSEB-II along with the requirement to measure the SSEB-II to the nearest tenth of a foot (0.1 ft) and reporting the approximate volume of storm water calculated annually.
8. Public Notice and Participation, 20.6.2.3108 NMAC	*Within 15 days of receipt of an application for a discharge permit, modification or renewal, the NMED shall review the application for administrative completeness. When the application is deemed administratively complete, the NMED shall notify the applicant in writing. Within 30 days of notification of a proposed discharge permit, or modification or renewal of an approved discharge permit, the applicant must ensure that the public and affected governmental agencies are notified.* Public notices have been provided in accordance with NMED protocols for discharge permit applications, modifications, and renewals. Public notices for the May 9, 2013, discharge permit renewal were posted by NMED on June 3, 2013. On June 9, 2013, a public notice was printed in the Carlsbad Current-Argus newspaper, and the adjacent land owners were notified by mail.
9. Secretary Approval, Disapproval, Modification, or Termination of Discharge Permits and Requirements for Abatement Plans, 20.6.2.3109 NMAC	*If the monitoring data submitted indicate that these regulations are being or may be violated or that the standards in 20.6.2.3103 NMAC, "Standards for Ground Water of 10,000 mg/l [milligrams/liter] TDS [total dissolved solids] Concentration or Less," are being or will be exceeded in groundwater at any place of withdrawal for the present or reasonably foreseeable future due to the discharge, it may be necessary to modify the discharge permit.* There were no discharges from the WIPP facility that exceeded the standards of NMAC 20.6.2.3103 during this reporting period.

Table 35: Status of Compliance with the Regulatory Requirements of the New Mexico Water Quality Act

Regulatory Requirement	WIPP Project Compliance
10. Water Quality Standards for Interstate and Intrastate Surface Waters in New Mexico, 20.6.4 NMAC	*The state has set a number of water quality standards for interstate and intrastate surface waters in New Mexico.* The water quality standards for interstate and intrastate surface waters in New Mexico do not apply to the WIPP facility because there are no surface waters, either intermittent or permanent, that will be affected by the WIPP facility.
11. Utility Operator Certification, 20.7.4 NMAC	*The state requires that operators of public water supply systems and public wastewater facilities be certified to the educational and experience requirements of 20.7.4 NMAC.* Under these regulations, the WIPP facility water supply system is classified as a Class 2 public water supply system because of the population served (501 to 5,000). See section 30.0 for more information. The WIPP facility wastewater treatment facility is considered a Class 1 facility because of the population served and because the treatment process comprises a facultative lagoon system and evaporation ponds. Since these systems require certified operators, the DOE employs operators and supervisors certified to the applicable requirements. Operators undergo recertification and training every three years; training and certification records are maintained by the DOE at the WIPP facility.

29.3 Status of Compliance with the Permit Requirements

Table 36 summarizes the specific and general requirements from the discharge permit for the WIPP facility (DP-831) and their compliance status.

Table 36: Status of Compliance with the Discharge Permit Requirements

Regulatory Requirement	WIPP Project Compliance
1. Operations Condition 2.a. (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*The DOE is permitted to discharge no more than 23,000 gpd of domestic effluent and nonhazardous wastewater from two compressed air systems to the Facultative Lagoon System for treatment and evaporation.* The design capacity of 23,000 gpd, authorized in the discharge permit, has not been exceeded.
2. Operations Condition 2.b. (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*The DOE is permitted to discharge no more than 50,000 gpd of brine, purge waters and miscellaneous nonhazardous wastewaters to the H-19 Evaporation Pond. The Pond Capacity is 346,085 gallons allowing for one foot of freeboard.* DOE operating procedures require that an Authorization to Discharge Form be filled out and approved before discharging water into the H-19 Evaporation Pond. No exceedances of the permitted 50,000 gpd have occurred.

Table 36: Status of Compliance with the Discharge Permit Requirements

Regulatory Requirement	WIPP Project Compliance
3. Operations Condition 2.c. (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*The DOE is permitted to discharge no more than 50,000 gpd of brine, purge waters and miscellaneous nonhazardous wastewaters to Evaporation Pond B up to the capacity of the pond with one foot of freeboard.* The DOE met this requirement during the reporting period. The daily discharge limit is incorporated into an administrative procedure, WP 02RC-3108, Request for Disposal (NWPI), to track discharge quantities.
4. Operations Condition 2.d. (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*The DOE is permitted to discharge no more than 50,000 gpd of brine, purge waters and miscellaneous nonhazardous wastewaters to Evaporation Pond C up to the capacity of the pond with one foot of freeboard.* The DOE met this requirement during the reporting period. The daily discharge limit is incorporated into an administrative procedure, WP 02RC-3108, Request for Disposal (NWPI), to track discharge quantities.
5. Operations Condition 2.e. (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*The DOE is permitted to collect storm water runoff from the Salt Pile to the SPEP at a designed flow of 1,677,633 gpd based on a 25 year/24 hour storm event (3.90 inches).* The DOE met this requirement by building and conducting ongoing maintenance on the covered Salt Pile and Salt Pile runoff ditches that direct run-off into the synthetically lined SPEP. No storm events exceeding the design capacity occurred during this reporting period. The pond capacity is 5,506,989 gallons not allowing for any freeboard.
6. Operations Condition 2.f. (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*The DOE is permitted to collect storm water runoff from the Salt Storage Extension to the SSEB at a designed flow of 2,547,202 gpd and to the SSEB-II at a designed flow of 2,752,831 gpd based on a 25-year/24-hour storm event (3.90 inches).* The DOE is in compliance with this requirement by having built and conducting on-going maintenance on the synthetically lined SSE Area and SSE Evaporation Basin. No storm events exceeding design capacity occurred during this reporting period. The pond capacity is 4,170,732 gallons not allowing for any freeboard.
7. Operations Condition 2.g. (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*The DOE is permitted to place mined salt and associated minerals from the excavated panels, drifts and shafts in the nuclear waste repository into Salt Storage Extension Cells A and B.* The DOE met this condition without incident during the reporting period.
8. Operations Condition 3 Pond Maintenance and Inspections (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*The DOE shall properly operate and maintain all impoundments covered by this permit. The DOE shall maintain the capacity of the H-19 Evaporation Pond, the Facultative Lagoon System, SSEB, SSEB-II and SPEP to store and evaporate the maximum daily discharge volume allowed by this discharge permit while maintaining one foot of freeboard at all times. In the event that a minimum of one foot of freeboard cannot be maintained at all times, the DOE shall submit a corrective action plan to manage discharge volumes to the NMED for approval. [20.6.2.3109 NMAC]* The required 1 foot freeboard has been maintained.

Table 36: Status of Compliance with the Discharge Permit Requirements

Regulatory Requirement	WIPP Project Compliance
9. Operations Condition 4 Pond Maintenance and Inspections (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*The DOE shall measure the thickness of the sludge blanket in each pond of the facultative lagoon system every five years. When sludge accumulation exceeds one-third of the total depth of any pond, the DOE shall remove the sludge in a manner, which is protective of the pond liner. Removed sludge shall be contained, transported, and disposed in accordance with all local, state, and federal (e.g., 40 CFR Part 503) regulations. [20.6.2.3109 NMAC]* This requirement was added when the DP-831 permit was renewed in April 2003 (NMED, 2003). The WIPP facility facultative lagoon system is very effective and, historically, attempts to sample sludge have been unsuccessful due to the minimal amount of sludge that accumulates in the ponds. The sewage lagoon liners have been replaced in all seven sewage treatment system ponds. Procedures were devised to measure the sediment in all sewage treatment system ponds during the fall of 2011.
10. Operations Condition 5 Pond Maintenance and Inspections (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*The DOE shall perform visual inspection of the facultative lagoon system, H-19 Pond and surrounding berms on a monthly basis. The water surface of the ponds shall be kept free of floating plants and debris. Berms surrounding the ponds shall be kept free of all deep-rooted plants. Berms shall be inspected for signs of wind or water erosion and damage from burrowing animals. In the event berms show signs of damage, the DOE shall submit to the NMED for approval a plan for protection of the berms, which may include the emplacement of rip rap or other methods for armoring the berms. [20.6.2.3109 NMAC]* The berms are inspected weekly and after severe rain storms to protect against storm water run-on and runoff and to ensure that the berms are free of all deep-rooted vegetation and the water surface is free of all floating plants. All berms are in good condition.
11. Operations Condition 6 Pond Maintenance and Inspections (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*Within 180 days of the issuance of this Discharge Permit, the DOE shall submit, for NMED approval, a plan for controlling storm water and minimizing erosion of the earthen cover of the Salt Pile. The plan shall assess and potentially incorporate options including, but not limited to (1) rock armoring of the side slopes, (2) recontouring of the top surface, (3) the use of alternate borrow sources for cover material, and (4) revegetation of the top surface and side slopes. [20.6.2.3109 NMAC]* *The erosion controls project for the covered Salt Pile was completed in July 2010.*
12. Operations Condition 7 Cover Maintenance and Inspections (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*The DOE shall conduct regular maintenance of the earthen covers on the Salt Pile and the SPDV pile. Inspections shall be conducted monthly and after storm events of 1 inch or greater in a 12-hour period to evaluate potential erosion and vegetation success of the cover. In the event of significant erosion or failure of vegetative success, the DOE shall provide a plan and schedule for repair within 90 days of discovery. General observations and cover repairs shall be reported to the NMED pursuant to Condition 14 below. [20.6.2.3109 NMAC]* Improvements to reduce the amount of maintenance on the Salt Pile were addressed in the March 6, 2009, Plan for Controlling Storm Water and Minimizing Erosion of the Salt Pile (DOE, 2009b). Repair of holes and tears in the conveyance liner around the Salt Pile were made in the late summer of 2013.

Table 36: Status of Compliance with the Discharge Permit Requirements

Regulatory Requirement	WIPP Project Compliance
13. Monitoring and Reporting Condition 8	*The DOE shall conduct the following monitoring, reporting, and other requirements listed below in accordance with the WQCC Regulations at 20.6.2.3107 NMAC and the monitoring plan submitted by the DOE dated December 20, 2007. A summary of monitoring requirements is attached to this permit as Table 1. A monitoring schedule is attached as Table 2. [20.6.2.3107 NMAC]* This table contains the specific monitoring and reporting requirements per DP-831 and describes DOE's compliance with each requirement.
14. Monitoring and Reporting Condition 9.a. Sampling and Field Measurements (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*The volume of domestic effluent discharged to the Facultative Lagoon System shall be measured using a totalizing flow meter on the influent to the system or the totalizing meter that measures total domestic water usage. Volumes of other authorized discharges to the facultative lagoon system shall be calculated by a time/volume method or volumetric measurement of the transport container(s). The NMED may require comprehensive laboratory analyses of such wastewater prior to discharge when the NMED determines that additional information is needed. Monthly meter readings, the units of measurement, monthly discharge volumes and other volumetric calculations for the previous 6-month period shall be submitted to the NMED semiannually in the monitoring reports required in Condition 14 below.* The DOE meets these requirements by conducting daily readings of the volumetric flow meter for sewage effluent from the facility. Weekly readings of the volumetric flow meter for total domestic water usage are conducted and used in the event of malfunctions on the sewage effluent flow meter. The data are compiled and submitted to the NMED in semiannual discharge monitoring reports submitted by January 31 and July 31 of each year.
15. Monitoring and Reporting Condition 9.b. Sampling and Field Measurements (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*The volume and origin of all wastewater discharged to the H-19 Evaporation Pond that is derived from miscellaneous nonhazardous sources shall be measured and reported to the NMED. Discharge volumes to the H-19 Evaporation Pond shall be calculated by a time/volume method or volumetric measurement of the transport container(s). The NMED may require comprehensive laboratory analyses of such wastewater prior to discharge when the NMED determines that additional information is needed. Monthly discharge volumes and other volumetric calculations for the previous six-month period shall be submitted to the NMED semiannually in the monitoring reports required in Condition 14 below.* The DOE meets this requirement by maintaining a log and database that track the source and volume of all water discharged to the H-19 Evaporation Pond. The data are compiled and submitted to the NMED in semiannual discharge monitoring reports submitted by January 31 and July 31 of each year.

Table 36: Status of Compliance with the Discharge Permit Requirements

Regulatory Requirement	WIPP Project Compliance
16. Monitoring and Reporting Condition 10.a. Sampling and Field Measurements (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*The water depth shall be measured monthly to the nearest tenth of a foot (0.1 ft) in the SSEB, SSEB-II, SPEP, and Storm Water Infiltration Control (SWIC) Ponds A, 1 and 2. The approximate volume of storm water shall be calculated and a water quality sample collected in each of the five storm water collection ponds once per year after a selected significant storm event where a sufficient quantity of water has collected in the respective ponds. Water quality sampling shall be conducted as required in Condition 9b.* Staff gauges graduated in tenth of a foot increments have been placed in each SWIC pond. Water-level readings are taken during the monthly inspections and when the annual samples are collected. These data are provided to the NMED in the semiannual discharge monitoring reports submitted by January 31 and July 31 of each year.
17. Monitoring and Reporting Condition 10.b. Sampling and Field Measurements (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*Confirmation of one foot of freeboard shall be conducted monthly on the H-19 Evaporation Pond and each impoundment in the Facultative Lagoon System.* During the monthly inspections of the infiltration control ponds, the inspector confirms that greater than 1 foot of freeboard is maintained. Additionally, DOE conducts freeboard checks on these ponds at least weekly, and the results are recorded on round sheets.
18. Monitoring and Reporting Condition 10.c. Sampling and Field Measurements (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*Samples shall be collected from the influent to the Facultative Lagoon System semiannually and analyzed for the parameters in Groups 2 and 3 listed in Condition 11 below and Table 1, Monitoring Summary. Samples shall be collected semiannually from the H-19 Evaporation Pond and analyzed for the parameters in Group 2 listed in Condition 11 below and Table 1, Monitoring Summary. A single sample shall be collected annually after a selected significant storm event from each of the storm water ponds, SSEB, SSEB-II, SPEP, and SWIC Ponds A, 1 and 2 and analyzed for the parameters in Group 2 listed in Condition 12 below and Table 1, Monitoring Summary.* The sewage lagoon influent is sampled semiannually for sulfate, TDS, nitrate and TKN. Evaporation Ponds B and C are sampled semiannually for sulfate, chloride, and TDS. The SWIC ponds (SSEB, SSEB-II, SPEP and SWIC ponds 1, 2, and A) are sampled annually. These data are provided to the NMED in the semiannual discharge monitoring reports submitted by January 31 and July 31 of each year.
19. Monitoring and Reporting Condition 11.a. Sampling and Field Measurements (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*Depth to the water table shall be measured to the nearest hundredth of a foot (0.01 ft) above msl [mean sea level], quarterly in piezometers/monitoring wells PZ-1, PZ-2, PZ-3, PZ-4, PZ-5, PZ-6, PZ-7, PZ-8, PZ-9, PZ-10, PZ-11, PZ-12, PZ-13, PZ-14, PZ-15, C-2505, C-2506, C-2507, C-2811 and WQSP-6A.* The depth to water in each of the required monitoring wells is sampled semiannually and the information is reported to the NMED in the semiannual discharge monitoring reports submitted by January 31 and July 31 of each year. As previously discussed, water levels appear to be receding, indicating that the infiltration controls have been effective in reducing recharge of the subsurface shallow water.

Table 36: Status of Compliance with the Discharge Permit Requirements

Regulatory Requirement	WIPP Project Compliance
20. Monitoring and Reporting Condition 11.b. Sampling and Field Measurements (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*Samples shall be collected from piezometers/monitoring wells PZ-1, PZ-5, PZ-6, PZ-7, PZ-9, PZ-10, PZ-11, PZ-12, PZ-13, C-2507, C-2811 and WQSP-6A semiannually and analyzed for the parameters in Groups 1 and 2 listed in Condition 12 below.* The referenced piezometers/monitoring wells are sampled semiannually and analyzed for the appropriate field parameters (water level, temperature, pH and electrical conductivity) and general chemistry parameters (chlorides, sulfate, and TDS). Monitoring results are reported to the NMED in the semiannual discharge monitoring reports submitted by January 31 and July 31 of each year.
21. Monitoring and Reporting Condition 11.c. Sampling and Field Measurements (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*Samples shall be collected from monitoring well WQSP-6A semiannually and analyzed for the parameters in Group 3 listed in Condition 12 below.* WQSP-6a is also sampled and analyzed for nitrate-nitrogen and TKN. Monitoring results are reported to the NMED in the semiannual discharge monitoring reports submitted by January 31 and July 31 of each year.
22. Monitoring and Reporting Condition 12 Sampling and Field Measurements (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*The DOE shall analyze samples of groundwater and water from surface impoundments for the specific parameters listed below and based on the schedule in the attached Table 1. Samples of groundwater from monitoring wells shall be analyzed for the parameters listed in Groups 1, 2, and 3 as noted below. Samples collected from surface impoundments shall be analyzed for the parameters listed in Group 2.* *Group 1: Field parameters (analysis to be performed in the field): water level, temperature, pH and electrical conductivity.* *Group 2: General chemistry parameters: sulfate, chloride and total dissolved solids.* *Group 3: Nitrate-nitrogen and TKN.* *Copies of signed laboratory analysis sheets shall be maintained at the WIPP facility and made available to NMED staff upon request. [20.6.2.3107 NMAC]* Compliance with these provisions relative to the sampling and analysis of the piezometers/monitoring wells is discussed in Condition 11.c above. Grab samples are taken annually from each infiltration control pond and analyzed for sulfate, chloride, and TDSs. Monitoring results are reported to the NMED in the semiannual discharge monitoring reports submitted by January 31 and July 31 of each year.

Table 36: Status of Compliance with the Discharge Permit Requirements

Regulatory Requirement	WIPP Project Compliance
23. Monitoring and Reporting Condition 13 Methodology (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*Unless otherwise approved in writing by the NMED, the DOE shall conduct sampling and analysis in accordance with the most recent editions of the following documents. [20.6.2.3107 NMAC]* *a. American Public Health Association, Standard Methods for Examination of Water and Wastewater* *b. U.S. Environmental Protection Agency, Methods for Chemical Analysis of Water and Waste* *c. U.S. Geological Survey, Techniques for Water Resource Investigations of the U.S. Geological Survey* *d. American Society for Testing and Materials, Annual Book of ASTM Standards, Part 31, Water* *e. U.S. Geological Survey, et al., National Handbook of Recommended Methods for Water Data Acquisition.* *f. Surface water monitoring must also be conducted according to test procedures approved under 40 CFR Part 136.* *g. New Mexico Environment Department, Hazardous Waste Bureau Position Paper, Use of Low-Flow and Other Non-Traditional Sampling Techniques for RCRA Compliant Groundwater Monitoring.* Contracts with laboratories specify the appropriate EPA analytical methods. Low-flow sampling techniques recommended by the NMED are used for sampling piezometers and monitoring wells because most wells do not produce enough water for standard sampling methodologies.
24. Monitoring and Reporting Condition 14.a. through 14.g. Reporting (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*The DOE shall submit to the NMED semiannual monitoring reports by the last day of January and July of each year. Reports shall include the following information. [20.6.2.3107 NMAC]* Discharge volumes, a summary of activities related to permitted discharges, monitoring results, hydrographs and a potentiometric map illustrating water-level data are reported to the NMED in a semiannual discharge monitoring report submitted by January 31 and July 31 of each year, as required by Conditions 14.a through 14.g.
25. Condition 15 Contingency Measures (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*In the event that monitoring indicates groundwater standards as defined in Section 20.6.2.3103 NMAC are exceeded in groundwater in wells that previously did not exceed groundwater standards, or the extent or magnitude of any existing concentrations of water contaminants is significantly increasing, the DOE shall collect a confirmatory sample from the monitoring well(s) within 15 days to confirm the initial sampling results. Within 30 days of confirmation of groundwater contamination, the DOE shall submit an abatement plan to the NMED, which includes a site investigation to define the source, nature and extent of contamination; a proposed abatement option; and a schedule for its implementation. The site investigation and selection of an abatement option shall be consistent with the requirements and provisions of 20.6.2.4101, 4103, 4106.C and E, 4107, 4108, and 4112 NMAC. [20.6.2.3107A(10) NMAC]* Monitoring data during this reporting period indicate that the infiltration controls have reduced groundwater levels. Monitoring results show that high TDS subsurface water has not impacted natural Dewey Lake Red Beds Formation water south of the site at well WQSP-6a.

Table 36: Status of Compliance with the Discharge Permit Requirements

Regulatory Requirement	WIPP Project Compliance
26. Condition 16 Contingency Measures (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*In the event of a pipeline break, pump failure, pond overflow or other system failure at the WIPP facility, discharged water shall be contained, pumped and transferred to areas of the facility that impose minimal impacts to groundwater quality. Failed components shall be repaired or replaced as soon as possible and no later than 72 hours from the time of failure. For good cause shown, the DOE may request NMED approval of an extension of the schedule for the repair or replacement of a failed component. [20.6.2.3107A(10) NMAC]* In the event of a failure, the Contingency Plan requirements of the discharge permit will be implemented. There were no events that occurred during this BECR reporting period.
27. Condition 17 Contingency Measures (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*In the event of a spill or release that is not authorized by this Discharge Permit Renewal and Modification, the DOE shall initiate the notification and corrective actions required in 20.6.2.1203 NMAC. The DOE shall take immediate corrective action to contain and remove or mitigate the damage caused by the discharge. Within 24 hours of discovery of the discharge, the DOE shall verbally notify the NMED and provide the information outlined in 20.6.2.1203.A.1 NMAC. Within seven days of discovering the discharge, the DOE shall submit a written report to the NMED verifying the oral notification and providing any additional information or changes. The DOE shall submit a corrective action report within 15 days after the discovery of the discharge. [20.6.2.1203 NMAC]* During a monthly inspection, the inspector noticed a tear in the liner at the influent to Pond A. Waste water from the domestic water system collected underneath the pond liner. The DOE contacted the NMED about the issue within 24 hours. The NMED stated that since the water was domestic drinking water, there would be no issue to the release. The DOE employed a subcontractor to repair the liner.
28. Closure Condition 18 (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*The DOE shall close the facilities covered under this Discharge Permit Renewal and Modification in accordance with the closure plan in the March 4, 2005, discharge permit application, the closure plan in the WIPP Hazardous Waste Facility Permit (HWFP) dated January 30, 2003, and the WIPP Land Management Plan as conditioned by this Discharge Permit Renewal and Modification. [20.6.2.3107A(11) NMAC]* The closure plan will be implemented as described in the discharge permit when any of the sewage lagoons or evaporation ponds are removed from service.

Table 36: Status of Compliance with the Discharge Permit Requirements

Regulatory Requirement	WIPP Project Compliance
29. Closure Condition 19 Surface Impoundments (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*Upon cessation of operation, the DOE shall close all impoundments at the facility covered by this Discharge Permit. Remaining liquids in each impoundment shall be removed and/or evaporated. All sludge shall be sampled to determine if hazardous constituents exist and managed and/or disposed of in accordance with applicable regulations. All piping and other ancillary components shall be plugged or removed. Synthetic liners shall be removed or ripped in place. All impoundments shall be backfilled with clean fill materials and graded to create positive drainage. The final regraded surface shall be contoured to surrounding topography and shall be revegetated with natural grasses that include a seed mix approved by the NMED. [20.6.2.3107A(11) NMAC]* As noted above, the ponds will be closed in accordance with this discharge permit when they are removed from service.
30. Closure Condition 20 Salt Piles and Salt Storage Area (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*Upon cessation of operation, all mined salt at the WIPP facility shall be removed from the site. The DOE is permitted to use the mined salt as backfill in shafts and as interior fill material in berms and permanent markers after closure. All mined salt remaining after backfilling and after construction of surface structures shall be removed from the site. The DOE shall submit a plan and schedule for salt tailings removal to the NMED for approval within 120 days prior to the facility closure. The WIPP Land Management Plan reflects the Land Withdrawal Act's requirements for disposition of the salt. Section I-1d of the WIPP's Hazardous Waste Facility permit also addresses closure activities that include closure of the salt storage areas in accordance with the provisions of the WIPP Land Management Plan. The salt storage area will be reclaimed in the manner described in these documents. [20.6.2.3107A(11) NMAC]* A detailed closure plan will be developed and submitted to the NMED for approval 120 days prior to closure of the WIPP facility. Stored salt will be removed from the site and the SSA reclaimed to approximately the same contours as prior to operation. The conditions are required by the CCA, the WIPP Permit, and this discharge permit.
31. Closure Condition 21 Post-Closure Monitoring (September 9, 2008, Discharge Permit Renewal and Modification and April 5, 2010, Permit Modification)	*The DOE shall continue groundwater monitoring in all wells covered under DP-831 as described in Condition 10 of this Permit Renewal and Modification for two years after the closure activities described in Conditions 18 and 19 are completed to confirm the absence of groundwater contamination. If monitoring results show that the groundwater standards in Section 20.6.2.3103 NMAC are being exceeded, the DOE shall implement the contingency plan described in Condition 15 of this Discharge Permit Renewal and Modification. Following notification from the NMED that post-closure monitoring may cease, the DOE shall submit a plan to plug and abandon specified monitoring wells not needed for long-term monitoring. Upon NMED approval, the DOE shall plug and abandon the wells in accordance with NMED Guidelines for Monitoring Well Construction and Abandonment or alternative methods approved by the NMED. When all post-closure requirements have been met, the DOE may request to terminate the discharge permit. [20.6.2.3107A(11) NMAC]* The DOE will conduct post-closure monitoring as required by the discharge permit following closure.

30.0 NEW MEXICO DRINKING WATER REGULATIONS

30.1 Summary of the Regulations

NMAC 20.7.10 contains the regulations for protecting public water-supply systems within the state. This section identifies the various categories of water-supply systems and establishes operating requirements for each system. It also establishes the maximum contaminant levels for water-supply systems and monitoring and analytical requirements for each system. The regulations adopt, by reference, 40 CFR Part 141, "National Primary Drinking Water Regulations," and 40 CFR Part 143, "National Secondary Drinking Water Regulations." The remaining NMAC language applicable to WIPP and not referenced in the CFR language addresses the prevention of contamination and the authority to require additional sampling.

30.2 Status of Compliance with the Regulatory Requirements

The NMED notified the DOE on September 9, 1992 (NMED, 1992b), that the WIPP facility water supply system is considered a public water supply and classified the system as a nontransient, noncommunity water supply for reporting and testing under the requirements of the New Mexico safe drinking water regulations. The DOE subsequently corresponded with the NMED to obtain a determination of the specific water sampling requirements for the WIPP facility water supply system. This direction was requested because the DOE obtains water from the Double Eagle Water Line, which is owned and operated by the City of Carlsbad.

On March 11, 1994, the NMED provided specific direction on the type of source sampling required for the WIPP facility water supply system (NMED, 1994). The NMED determined that "since the Carlsbad Municipal Public Water Supply (WSS206-08) provides WIPP with its water and since Carlsbad already tests the various constituents at each Double Eagle well field source, WIPP is exempted from taking these samples." In addition, the NMED determined that DOE is required to obtain point-of-use system samples, including lead, copper, and total coliform bacteria. The NMED requirements were updated in a letter to DOE dated March 4, 2004 (NMED, 2004), specifying requirements for trihalomethanes sampling, chlorine residual monitoring, and frequency of coliform bacteria sampling.

The specific requirements under 20.7.10 NMAC that are applicable to the WIPP facility and the compliance status of each are provided in table 37. Federal regulatory references are listed first, along with the title of the requirements, as 20.7.10.100 NMAC adopts federal regulations by reference and would not be descriptive of the specific applicable requirements.

Table 37: Status of Compliance with the Regulatory Requirements of the New Mexico Drinking Water Regulations

Regulatory Requirement	WIPP Project Compliance
1. Coliform Sampling, 40 CFR §141.21	*Title 40 CFR §141.21(a)(2) requires collection of a minimum of one total coliform sample per month.* Coliform samples are collected monthly and are analyzed by a State of New Mexico certified laboratory.
2. Inorganic Chemical Sampling and Analytical Requirements, 40 CFR §141.23; Organic Chemicals, Sampling and Analytical Requirements, 40 CFR §141.24; Monitoring Frequency and Compliance Requirements for Radionuclides in Community Water Systems, 40 CFR §141.26; Monitoring of Consecutive Public Water Systems, 40 CFR §141.29	*Title 40 CFR §141.23 addresses the monitoring requirements for inorganic chemicals to determine compliance with the maximum contaminant levels. Title 40 CFR §141.24 addresses the analyses for the organic chemical contaminants. Title 40 CFR §141.26 addresses monitoring and compliance requirements for gross alpha particle activity, radium-226, radium-228, and uranium. However, 40 CFR §141.29," Monitoring of Consecutive Public Water Systems," allows the NMED to modify sampling requirements of interconnected public water systems as justified.* Based on 40 CFR §141.29, the NMED does not require DOE to sample under 40 CFR §§141.23, 141.24, and 141.26, because the source of the WIPP facility water is a well field owned and operated by the City of Carlsbad.
3. Total Trihalomethanes Sampling, Analytical and Other Requirements 40 CFR §141.132	*Systems must take all samples during normal operating conditions. Systems may consider multiple wells drawing water from a single aquifer as one treatment plant for determining the minimum number of trihalomethanes and haloacetic acid (HAA5) samples required, with State approval in accordance with criteria developed under CFR §142.16(h)(5) of this section.* On September 11, 2012, trihalomethane and haloacetic acid samples were taken of the treated drinking water system.
4. Monitoring Requirements for Lead and Copper in Tap Water, 40 CFR §141.86	*Title 40 CFR §141.86 requires periodic sampling for lead and copper at representative taps. The frequency of sampling is based on concentrations of lead and copper found.* The WIPP facility qualifies for a reduced monitoring schedule under 40 CFR §141.86(d)(4), and is required to sample for lead and copper every three years. The most recent sampling was conducted in August 2011, with results being below action levels. The next triennial compliance sampling will be conducted during the next BECR reporting period.
5. General Operating Requirements, 20.7.10.400 NMAC	General performance requirements applicable to the WIPP facility include the following: • Prevention of contamination of water in the system while undergoing routine maintenance or replacement of electrical or mechanical equipment. • Prevention of unauthorized entry to, and contamination of, the water supply. • Protection of finished water facilities from flooding, infiltration, entry of birds, insects, rodents, and other vermin. This includes provision of pipe and vent screening, and watertight covers. • Notification to the NMED and implementation of corrective measures, should measures to prevent contamination and unauthorized entry be found inadequate or compromised. • Disinfection following construction or modification. • Coatings shall be suitable for contact with potable water. Structures

Table 37: Status of Compliance with the Regulatory Requirements of the New Mexico Drinking Water Regulations

Regulatory Requirement	WIPP Project Compliance
	shall be flushed, then disinfected subsequent to maintenance or recoating. • Prohibition of iodine as disinfectant. • Additives to water must be ANSI/National Sanitation Foundation certified or compliant with the most recent applicable safety standards. • Cross-connections must have backflow prevention. The DOE documents its compliance with these requirements as part of the work package process for performing maintenance and modifications to the WIPP facility water infrastructure.
6. Sampling Requirements, 20.7.10.500 NMAC	*Section 20.7.10.500 NMAC gives the NMED the discretion to order sampling over and above that required by 40 CFR Part 141.* To date, the NMED has not required sampling beyond that mandated by 40 CFR Part 141.

31.0 NEW MEXICO HAZARDOUS CHEMICALS INFORMATION ACT

31.1 Summary of the Law

The New Mexico Hazardous Chemicals Information Act (HCIA) (74-4E-1 through 74-4E-9 NMSA 1978) was enacted to ensure that current information on the nature and location of hazardous chemicals is available to LEPCs, emergency responders, and the public as required by SARA Title III. The HCIA created the SERC and directs facility owners or operators to notify the New Mexico Department of Public Safety under certain conditions, including the presence of extremely hazardous substances at or above a specified quantity at a facility, and the release of any chemical substance that has occurred at or above RQs determined by the state. The HCIA specifies reports to be submitted to the state, including toxic chemical release and hazardous material inventory reports.

31.2 Status of Compliance with the Regulatory Requirements

Table 38 provides more detail for each applicable requirement and its compliance status under the HCIA.

Table 38: Status of Compliance with the Regulatory Requirements of the New Mexico Hazardous Chemicals Information Act

Regulatory Requirement	WIPP Project Compliance
1. Notice of Extremely Hazardous Substance, §74-4E-5(A)(1)	*Facility owners or operators must notify the public safety department that an extremely hazardous substance, at or above the TPQ, is present at a facility.* The DOE submits a list of hazardous chemicals to the SERC, the LEPC, and all local fire departments with which the DOE maintains an MOU whenever additional substances are received above the TPQ, or 500 pounds, or if significant new information is received about an item for which a list was provided. A revised list of hazardous chemicals was submitted to these organizations in August 1999 (Westinghouse Electric Corporation, Waste Isolation Division, 1999). The listing comprised extremely hazardous substances present in amounts equal to or greater than the TPQ, or 500 pounds, whichever is less, and all substances classified as hazardous under the Occupational Safety and Health Act Hazard Communication Standard, with site inventories equal to or greater than 10,000 pounds. No additional reporting has been required since the 1999 submission.
2. Notice of Release of Chemical Substance(s), §74-4E-5(A)(2)	*Facility owners or operators must notify the public safety department of the release of a chemical substance when the release is at or above the RQ of the substance.* There were no releases in excess of an RQ during this reporting period.
3. Hazardous Material Inventory, §74-4E-5(A)(3)	*Facility owners or operators must submit to the state an inventory form containing Tier II information on or before March 1 of each year.* The DOE submitted the Emergency and Hazardous Chemical Inventory Report in February 2013 (DOE, 2013b) and February 2014 (DOE, 2014b) to the SERC, the LEPC, and all local fire departments.
4. Toxic Chemical Release Inventory, §74-4E-5(A)(4)	*Facility owners or operators employing at least 10 employees and with a covered Standard Industrial Classification code must submit a toxic chemical release form on or before July 1 of each year to the public safety department.* The DOE and MOC submitted Toxic Chemical Release Inventory Form R reports for the WIPP facility to the EPA and the NMED. The CY 2012 reports were submitted prior to July 1, 2013 (DOE, 2013c and NWPm). The reports for CY 2013 were submitted prior to July 1, 2014 (DOE, 2014c and NWPn).

32.0 NEW MEXICO EMERGENCY MANAGEMENT ACT

32.1 Summary of the Law

The New Mexico Emergency Management Act (74-4B-1 through 74-4B-14 NMSA 1978) was enacted to ensure the adequacy of hazardous material emergency management capabilities in the state to protect the health and safety of New Mexico citizens and the environment. The act delineates those state agencies that are responsible for responding to hazardous material accidents and providing control and management of such accidents. The act also provides for the formulation of a comprehensive hazardous materials emergency management plan.

32.2 Status of Compliance with the Regulatory Requirements

Table 39 provides more detail on the compliance status of each requirement under the New Mexico Emergency Management Act.

Table 39: Status of Compliance with the Regulatory Requirements of the New Mexico Emergency Management Act

Regulatory Requirement	WIPP Project Compliance
1. State Police Emergency Response Officer; Procedure for Notification; Cooperation of Other State Agencies and Local Governments, §74-4B-5	*State Police Emergency Response Officers shall be designated, trained, and available to answer an emergency response call from the first responder. The responsibilities of these officers and of the State Police Emergency Response Center are described. Any driver of a vehicle carrying hazardous materials involved in an accident which may cause injury to persons or property or any owner, shipper, or carrier of hazardous materials involved in an accident who has knowledge of such accident or any owner or person in charge of any building, premises, or facility where such an accident occurs shall immediately notify the New Mexico State Police Division of the Public Safety Department by the quickest means of communication available.* Should an accident involving a shipment of TRU waste to the WIPP facility occur, the New Mexico State Police Division of the Public Safety Department will be notified by the CMR operator, as outlined in a Permittees procedure and the Carrier Management Plan. In the event of an accident involving a TRU Type B package, contact with the CMR operator will be made through the TRANSCOM. The CMR operator will then contact the state police and other appropriate agencies. There were two minor traffic accidents involving shipments of TRU mixed waste in New Mexico during this reporting period. No loss of radioactive material or serious injuries occurred as a result of the accidents. The required notifications were made. DOE will contact the SERC in the event of a spill that could endanger human health or the environment. The SERC will, in turn, contact the NMED for assistance, if needed.
2. Clean-Up, §74-4B-10	*Nothing in the Emergency Management Act shall be construed to relieve hazardous materials owners, shippers, or carriers of their responsibilities and liability in the event of an accident. Such persons shall assist the state as requested in responding to an accident and are responsible for restoring the scene of the accident to the satisfaction of the state.* The selected carrier for the shipment is responsible for providing emergency response and recovery/restoration assistance, if required. The CBFO Incident/Accident Response Team is available to provide technical advice and assistance to local authorities, and the National Nuclear Security Administration Radiological Assistance Program teams are available to assist in the assessment of a radiological release. No cleanup activity was conducted during this reporting period.

33.0 NEW MEXICO PREHISTORIC AND HISTORIC SITES PRESERVATION ACT

33.1 Summary of the Law

The provisions of the federal NHPA are further advanced in the State of New Mexico through the New Mexico Prehistoric and Historic Sites Preservation Act (18-8-1 through 18-8-8 NMSA 1978). The purpose of this act is the acquisition, stabilization, restoration, or protection of significant prehistoric and historic sites by the State of New Mexico and corporations. This act is administered by the SHPO in consultation with the Cultural Properties Review Committee.

The Prehistoric and Historic Sites Preservation Act is implemented by 4.10.12 NMAC, Implementation of the Prehistoric and Historic Sites Preservation Act, which established procedures for acquiring, stabilizing, restoring, or protecting significant prehistoric and historic sites. Section 4.10.12 NMAC also established procedures and guidelines to evaluate alternatives to programs and projects requiring the use of land from significant prehistoric and historic sites and to determine whether all possible planning has been implemented to preserve and protect such sites. Detailed requirements for a long-term management plan for any site acquired, stabilized, restored, or protected are included under this rule.

33.2 Status of Compliance with the Regulatory Requirements

Table 40 provides more detail on compliance status under the New Mexico Prehistoric and Historic Sites Preservation Act.

Table 40: Status of Compliance with the Regulatory Requirements of the New Mexico Prehistoric and Historic Sites Preservation Act

Regulatory Requirement	WIPP Project Compliance
1. Status of Compliance with the Regulatory Requirements	The DOE complies with the New Mexico statutes and regulations regarding cultural properties in accordance with edicts provided by the SHPO. The DOE contracts for archeological surveys and consults with the SHPO each time an action is proposed that would impact a previously undisturbed area. Detailed instructions for compliance with applicable cultural resource management requirements are contained in the LMP. Prior to the issuance of the LWA, the BLM was responsible for archaeological resource management on the WIPP site and served as the DOE's liaison with the SHPO. Following the issuance of the LWA, the BLM continued to serve in this capacity until July 19, 1994, when the MOU between the DOE and the DOI was finalized. At that time, the DOE began communicating directly with the SHPO regarding archeological concerns at the WIPP facility. There were no archaeological clearances required or conducted, and no requests for mitigation submitted to the SHPO during this reporting period.

34.0 NEW MEXICO STATE TRUST LANDS

34.1 Summary of the Law

The spirit and purpose of the federal legislation to protect and preserve the quality of public lands is furthered by law in the State of New Mexico. In 1912, the New Mexico Legislature created the State Land Office and directed that the Office's executive officer, the Commissioner of Public Lands (the Commissioner), execute jurisdiction over, and provide for the management, care, control, and disposition of, public lands owned and subsequently acquired by the state. The Commissioner was authorized to grant rights-of-way and easements over, upon, or across state lands for highways, power lines, mining, or other purposes.

The regulation of right-of-way and easement grants is addressed in 19.2.10 NMAC, “Easements and Rights-of-Way.”

34.2 Status of Compliance with the Regulatory Requirements

Table 41 provides more detail on compliance status under the New Mexico State Trust Lands.

Table 41: Status of Compliance with the Regulatory Requirements of the New Mexico State Trust Lands

Regulatory Requirement	WIPP Project Compliance
Status of Compliance with the Regulatory Requirements	The DOE continues to comply with all standard stipulations regarding survey plat, easement or right-of-way dimension, construction reports, and affidavits of completion, and will comply with those regarding renewal, reclamation, and restoration when required.

35.0 NEW MEXICO STATE IMPLEMENTATION OF THE BALD AND GOLDEN EAGLE PROTECTION ACT

35.1 Summary of the Law

The Bald and Golden Eagle Protection Act makes it unlawful to take (i.e., capture, kill, or destroy), possess, molest, or disturb living or dead bald eagles or golden eagles, their parts, their nests, or their eggs anywhere in the United States. A permit must be obtained from the DOI to relocate any nest that interferes with resource development or recovery operations. In addition, a permit may be obtained that authorizes taking, possessing, or transporting eagles or their parts, nests, or eggs.

Chapter 17 of the New Mexico statutes establishes rules and regulations to protect raptors. In particular, §17-2-14, “Hawks, vultures and owls, taking, possessing, trapping, destroying, maiming or selling prohibited; exception by permit; penalty,” authorizes the Director of the New Mexico Department of Game and Fish (NMDG&F) to issue permits to allow any person to take, possess, trap, ensnare, or destroy any bird protected by

this section. Permits may be granted for several purposes, including scientific purposes, in accordance with the law and the State Game Commission regulations. In addition, §§17-2-37 through 17-2-46 of the Wildlife Conservation Act also further the purpose of the Bald and Golden Eagle Protection Act with respect to the bald eagle as an endangered species.

35.2 Status of Compliance with the Regulatory Requirements

Table 42 provides more detail on compliance status under the New Mexico State implementation of the Bald and Golden Eagle Protection Act.

Table 42: Status of Compliance with the Regulatory Requirements of the New Mexico State Implementation of the Bald and Golden Eagle Protection Act

Regulatory Requirement	WIPP Project Compliance
1. Status of Compliance with the Regulatory Requirements	At present, no bald or golden eagles are nesting within the WIPP land withdrawal area; however, individual eagles may, at times, overwinter in the WIPP area. No permit regarding bald or golden eagles is required. If it becomes necessary, a permit application will be submitted, and all applicable permit requirements will be met. For the construction of the South Access Road, the NEPA Mitigation Plan stated: *…surveys for raptor nests, including burrows, and nesting structures are performed by the BLM CFO multiple times before and throughout the project. A 100-meter avoidance buffer will be employed around inactive raptor nests and a 200- meter buffer will be employed around active raptor nests. Portions of the project within these distances can be either delayed until the nest fledges or up to 90 days.* BLM CFO was consulted to determine locations of raptor nests prior to issuance of notice to proceed with construction activities and at weekly intervals during construction activities.

36.0 NEW MEXICO WILDLIFE CONSERVATION ACT, SUPPLEMENTING THE ENDANGERED SPECIES ACT

36.1 Summary of the Law

The federal ESA was enacted in 1973 to prevent the extinction of many species of animals and plants. The act provides strong measures to help alleviate the loss of species and their habitats. It places restrictions on a wide range of activities impacting endangered and threatened animals and plants to help ensure their continued survival. With limited exceptions, the act prohibits activities impacting these protected species unless authorized by a permit from the USFWS.

The intent of the Congressional endangered species legislation is further advanced in the New Mexico Wildlife Conservation Act, which was enacted to protect the state's rare animals in 1974 (the New Mexico Endangered Plant Species Act [75-6-1 NMSA] protects rare plants). The current sections of the state's Wildlife Conservation Act reside

in 17-2-37 through 17-2-46 NMSA 1978. The Wildlife Conservation Act directs that endangered species of wildlife that are indigenous to New Mexico should be managed and maintained and, to the extent possible, their numbers enhanced within the carrying capacity of the habitat. The state is directed to assist in the management of endangered and threatened species of wildlife, including those which are federally listed.

Protection under the Wildlife Conservation Act extends to native species of crustaceans, mollusks, fish, amphibians, reptiles, birds, and mammals that are listed by the State Game Commission in 19.33.6 NMAC.

Section 17-2-41 NMSA, "Endangered Species," states that "except as otherwise provided in this act, it is unlawful to take, possess, transport, export, process, sell or offer for sale, or ship" any species or subspecies of wildlife that appears on the following lists: (1) wildlife indigenous to the state determined to be endangered within the state as set forth by regulations of the Game Commission of the State of New Mexico (the Commission) and (2) the federal lists of endangered species as set forth in the ESA to the extent that such lists are adopted by regulations of the Commission.
Section 17-2-38L NMSA defines "take" to include harass, hunt, capture, or kill.

In 17-2-42 NMSA, "Management Programs," the Director of the NMDG&F is directed to perform the following: (1) establish programs deemed necessary by the Commission for the management of endangered species; (2) work with federal and state entities or with private individuals in the administration and management of programs for the management of endangered species; (3) authorize by permit the taking, possession, transportation, or shipment of species or subspecies deemed to need management for purposes including scientific, zoological, or educational; and (4) authorize by permit the removal, capture, and destruction of endangered species where necessary to prevent damage to property or to protect human health.

The intent of the congressional legislation protecting migratory birds under the Migratory Bird Treaty Act is also addressed in chapter 17 of the New Mexico statutes. In particular, 17-2-3 NMSA, "Protected wildlife species and game fish defined," specifies that all of the migratory bird family Anatidae (waterfowl) is protected. Section 17-2-14 NMSA addresses the protection of hawks, vultures, and owls. Section 17-2-13 NMSA protects many species of songbirds. The hunting, taking, capturing, killing, or possession or the attempt to hunt, take, capture, or kill these species is regulated by the Commission.

Section 19.33.2 NMAC, "Removal, Capture or Destruction of Endangered Species," was adopted in 1975. This regulation specifies that any person who does not possess a permit and who removes, captures, or destroys any wildlife species classified as threatened or endangered by Commission regulations, must report any such incident to the NMDG&F.

Section 19.33.6 NMAC, "List of Threatened and Endangered Species," lists threatened and endangered wildlife in the state. The regulation was last amended in 2006. The 2006 changes down-listed two species from endangered to threatened and up-listed four species from threatened to endangered.

The amended listing of threatened and endangered wildlife of New Mexico added a number of endangered or threatened species that could be found at WIPP and were specified in the FEIS (DOE, 1980) or the SEIS (DOE, 1990a). These include two species of reptiles (western ribbon snake, sand dunes lizard) and five species of birds (aplomado falcon, peregrine falcon, bald eagle, Baird's sparrow, varied bunting).

Section 19.36.2 NMAC, “Taking and Possession of Protected Wildlife for Scientific and Educational Purposes,” contains the requirements for obtaining and using state permits and authorizations for taking and possessing wildlife for scientific and educational purposes. Permits and authorizations are issued to individuals rather than to parties or organizations; however, a permittee may have qualified subpermittees. “Protected wildlife” is defined as all wild species of mammals, birds, reptiles, amphibians, and fishes and endangered mollusks and crustaceans taken by a nonresident of New Mexico, or as pikas, marmots, and game, fur-bearing, and endangered mammals; all birds except rock doves, European starlings, and house sparrows; horned lizards if sacrificed, retained, and/or transported out of state; endangered reptiles; bullfrogs and endangered amphibians; game and endangered fishes; and endangered mollusks and crustaceans taken by a resident.

36.2 Status of Compliance with the Regulatory Requirements

Table 43 provides more detail on compliance status under the New Mexico Wildlife Conservation Act, supplementing the ESA.

Table 43: Status of Compliance with the Regulatory Requirements of the New Mexico Wildlife Conservation Act, Supplementing the Endangered Species Act

Regulatory Requirement	WIPP Project Compliance
1. Status of Compliance with the Regulatory Requirements	In 1989, the DOE consulted with the NMDG&F regarding the state-listed endangered species in the vicinity of the WIPP site. At that time, the department communicated to the DOE its opinion of which state-listed endangered species “occur or are likely to occur at the WIPP site.” The NMDG&F subsequently concurred that proposed WIPP activities would probably have no significant impacts on state-listed species in the area. To ensure that WIPP environmental protection programs were current in their consideration of sensitive and protected species, the *Waste Isolation Pilot Plant Threatened and Endangered Species Survey* (DOE, 1996b) was conducted from August to November 1996. No threatened or endangered species were found within the WIPP land withdrawal area boundaries during the 1996 survey. Consequently, no current activities impacting endangered species are conducted at the WIPP facility. No permits, biological assessments, or formal consultations are required. In addition, there have been no known habitat changes within the WIPP land withdrawal area through 2013 that would indicate a need for an updated review for threatened or endangered species on WIPP lands.

37.0 NEW MEXICO PESTICIDE CONTROL ACT

37.1 Summary of the Law

The Pesticide Control Act (76-4-1 through 76-4-39 NMSA 1978) is administered and enforced by the New Mexico State Department of Agriculture under the direction of the Board of Regents of New Mexico State University, Las Cruces, New Mexico. This act provides for the registration, labeling, distribution, storage, transportation, application, use, and disposal of pesticides and pesticide-related devices in order to protect the environment and the public health and welfare. It provides for the licensing of pesticide dealers, consultants, applicators, and operators of pesticide apparatus and allows for penalties for noncompliance with requirements.

The New Mexico Pesticide Control Act is implemented through 21.17.50 NMAC. The regulations establish requirements for licensing and for applying pesticides in New Mexico.

37.2 Status of Compliance with the Regulatory Requirements

Table 44 provides more detail on compliance status under the New Mexico Pesticide Control Act.

Table 44: Status of Compliance with the Regulatory Requirements of the New Mexico Pesticide Control Act

Regulatory Requirement	WIPP Project Compliance
1. Status of Compliance with the Regulatory Requirements	*There are 17 categories of licenses granted by the state of New Mexico. Each one establishes the scope of the certification examinations that must be taken by commercial, noncommercial, and public applicators and by pest-management consultants for licenses to apply specific types of pesticides.* The WIPP facility is not a commercial, noncommercial or public applicator, or a pest-management consultant. Licensed, certified applicators are contracted to apply pesticides at the WIPP facility and are required to produce proof of licensing as part of the procurement process. The DOE reviews the pesticides to be applied by the subcontractor before the application to ensure that such application is according to the applicator's license. A copy of the subcontractor's current license is maintained by the DOE. The WIPP site may be inspected periodically by the New Mexico Department of Agriculture, division of Agriculture and Environmental Services Bureau of Pesticide Management, to determine compliance with this act. There were no inspections during the reporting period.

REFERENCES

10 CFR Part 71, "Packaging and Transportation of Radioactive Material." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.
10 CFR Part 490, "Alternative Fuel Transportation Program." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.
10 CFR Part 830, "Nuclear Safety Management." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.
10 CFR Part 835, "Occupational Radiation Protection." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.
10 CFR Part 851, "Worker Safety and Health Program." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.
10 CFR Part 1021, "National Environmental Policy Act Implementing Procedures." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.
29 CFR Part 1910, "Occupational Safety and Health Standards." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.
30 CFR Part 57, "Safety and Health Standards, Underground Metal and Non-Metal Mines." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.
30 CFR Part 62, "Occupational Noise Exposure." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.
36 CFR Part 800, "Protection of Historic Properties." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.
40 CFR Part 50, "National Primary and Secondary Ambient Air Quality Standards." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.
40 CFR Part 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 60, "Standards of Performance for New Stationary Sources." Code of Federal Regulations. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 61, "National Emission Standards for Hazardous Air Pollutants." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 63, "National Emission Standards for Hazardous Air Pollutants for Source Categories." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 68, "Chemical Accident Prevention Provisions." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 70, "State Operating Permit Programs." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 80, "Regulation of Fuels and Fuel Additives." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 82, "Protection of Stratospheric Ozone." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 86, "Control of Emissions from New and In-Use Highway Vehicles and Engines." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 112, "Oil Pollution Prevention." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 122, "EPA Administered Permit Programs: The National Pollutant Discharge Elimination System." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 141, "National Primary Drinking Water Regulations." *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 142, “National Primary Drinking Water Regulations Implementation.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 143, “National Secondary Drinking Water Regulations.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 144, “Underground Injection Control Program.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 152, “Pesticide Registration and Classification Procedures.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 156, “Labeling Requirements for Pesticides and Devices.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 191, “Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 192, “Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 194, “Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance With the 40 CFR Part 191 Disposal Regulations.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 260, “Hazardous Waste Management System - General.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 261, “Identification and Listing of Hazardous Waste.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 262, “Standards Applicable to Generators of Hazardous Waste.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 263, “Standards Applicable to Transporters of Hazardous Waste.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 264, “Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 265, “Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 266, “Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 267, “Standards for Owners and Operators of Hazardous Waste Facilities Operating Under a Standardized Permit.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 268, “Land Disposal Restrictions.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 270, “EPA Administered Permit Programs: the Hazardous Waste Permit Program.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 273, “Standards for Universal Waste Management.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 280, “Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 281, “Approval of State Underground Storage Tank Programs.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 282, “Approved Underground Storage Tank Programs.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 300, “National Oil and Hazardous Substances Pollution Contingency Plan.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 302, “Designation, Reportable Quantities, and Notification.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Parts 350-399, “Emergency Planning and Community Right-to-Know Act.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 503, “Standards for the Use or Disposal of Sewage Sludge.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Part 761, “Polychlorinated Biphenyls Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

40 CFR Parts 1500-1508, “Council on Environmental Quality.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

43 CFR Part 7, “Protection of Archaeological Resources.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

43 CFR Parts 1600-1610, “Planning, Programming, Budgeting.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

43 CFR Parts 2800-2809, “Rights-of-Way Principles and Procedures.” *Code of Federal Regulations.* Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

43 CFR Parts 4100-4190, “Grazing Administration--Exclusive of Alaska.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

49 CFR Part 171, “General Information, Regulations, and Definitions.“ *Code of Federal Regulations.* Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

49 CFR Part 172, “Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans.” *Code of Federal Regulations.* Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

49 CFR Part 173, “Shippers - General Requirements for Shipments and Packagings.” *Code of Federal Regulations.* Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

49 CFR Part 175, “Carriage by Aircraft.” *Code of Federal Regulations.* Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

49 CFR Part 177, “Carriage by Public Highway.” *Code of Federal Regulations.* Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

49 CFR Part 178, “Specifications for Packagings.” *Code of Federal Regulations.* Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

49 CFR Part 397, “Transportation of Hazardous Materials; Driving and Parking Rules.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

50 CFR Part 10, “General Provisions.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

50 CFR Part 13, “General Permit Procedures.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

50 CFR Part 17, “Endangered and Threatened Wildlife and Plants.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

50 CFR Part 21, “Migratory Bird Permits.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

50 CFR Part 22, “Eagle Permits.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

50 CFR Part 402, “Interagency Cooperation - Endangered Species Act of 1973, as Amended.” *Code of Federal Regulations*. Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

4.10.12 NMAC, “Implementation of the Prehistoric and Historic Sites Preservation Act.” Title 4, *New Mexico Administrative Code*. Santa Fe, NM.

19.2.10 NMAC, “Easements and Rights-of-Way.” Title 19, New Mexico Administrative Code. Santa Fe, NM.

19.33.2 NMAC, “Removal, Capture or Destruction of Endangered Species.” Title 19, *New Mexico Administrative Code*. Santa Fe, NM.

19.33.6 NMAC, “List of Threatened and Endangered Species.” Title 19, *New Mexico Administrative Code.* Santa Fe, NM.

19.36.2 NMAC, “Taking and Possession of Protected Wildlife for Scientific and Educational Purposes.” Title 19, *New Mexico Administrative Code*. Santa Fe, NM.

20.2 NMAC, “Air Quality (Statewide).” Title 20, *New Mexico Administrative Code*. Santa Fe, NM.

20.4.1 NMAC, “Hazardous Waste Management.” Title 20, *New Mexico Administrative Code*. Santa Fe, NM.

20.4.2 NMAC, “Hazardous Waste Permit and Corrective Action Fees.” Title 20, *New Mexico Administrative Code*. Santa Fe, NM.

20.4.3 NMAC, “Annual Hazardous Waste Fees.” Title 20, *New Mexico Administrative Code*. Santa Fe, NM.

20.5 NMAC, “Petroleum Storage Tanks.” Title 20, *New Mexico Administrative Code*. Santa Fe, NM.

20.6.2 NMAC, “Ground and Surface Water Protection.” Title 20, *New Mexico Administrative Code*. Santa Fe, NM.

20.6.4 NMAC, “Standards for Interstate and Intrastate Surface Waters.” Title 20, *New Mexico Administrative Code*. Santa Fe, NM.

20.7 NMAC, “Waste Water and Water Supply Facilities.” Title 20, *New Mexico Administrative Code.* Santa Fe, NM.

20.7.4 NMAC, “Utility Operator Certification.” Title 20, *New Mexico Administrative Code*. Santa Fe, NM.

20.7.10 NMAC, “Drinking Water.” Title 20, *New Mexico Administrative Code*. Santa Fe, NM.

20.9 NMAC, “Solid Waste.” Title 20, *New Mexico Administrative Code*. Santa Fe, NM.

21.17.50 NMAC, “Pesticides.” Title 21, *New Mexico Administrative Code*. Santa Fe, NM.

7 U.S.C. §§136, et seq., Federal Insecticide, Fungicide, and Rodenticide Act. United States Code. U.S. Government Printing Office, Washington, D.C.

15 U.S.C. §§2601, et seq., Toxic Substances Control Act. United States Code. U.S. Government Printing Office, Washington, D.C.

16 U.S.C. §§470, et seq., National Historic Preservation Act. United States Code. U.S. Government Printing Office, Washington, D.C.

16 U.S.C. §§668-668d, Bald and Golden Eagle Protection Act. United States Code. U.S. Government Printing Office, Washington, D.C.
16 U.S.C. §§703, et seq., Migratory Bird Treaty Act. United States Code. U.S. Government Printing Office, Washington, D.C.
30 U.S.C. §§601, et seq., Materials Act of 1947. United States Code. U.S. Government Printing Office, Washington, D.C.
33 U.S.C. §§1251, et seq., Federal Water Pollution Control Act Amendments of 1972. *United* States Code. U.S. Government Printing Office, Washington, D.C.
33 U.S.C. §1321(d), Oil and Hazardous Substance Liability. United States Code. U.S. Government Printing Office, Washington, D.C.
42 U.S.C. §§300f, et seq., Safe Drinking Water Act. United States Code. U.S. Government Printing Office, Washington, D.C.
42 U.S.C. §§2011, et seq., Atomic Energy Act of 1954, as amended. United States Code. U.S. Government Printing Office, Washington, D.C.
42 U.S.C. §2210, Price-Anderson Act. United States Code. U.S. Government Printing Office, Washington, D.C.
42 U.S.C. §§3251, et seq., Solid Waste Disposal Act. United States Code. U.S. Government Printing Office, Washington, D.C.
42 U.S.C. §§4321, et seq., National Environmental Policy Act. United States Code. U.S. Government Printing Office, Washington, D.C.
42 U.S.C. §§4901, et seq., Noise Control Act of 1972. United States Code. U.S. Government Printing Office, Washington, D.C.
42 U.S.C. §§6901-6992, et seq., Solid Waste Disposal Act. United States Code. U.S. Government Printing Office, Washington, D.C.
42 U.S.C. §§6924, et seq., Hazardous and Solid Waste Amendments of 1984. United States Code. U.S. Government Printing Office. Washington, D.C.
42 U.S.C. §§6937, et seq., Inventory of Federal Agency Hazardous Waste Facilities. United States Code. U.S. Government Printing Office. Washington, D.C.

42 U.S.C. §§7401, et seq., Clean Air Act. United States Code. U.S. Government Printing Office, Washington, D.C.

42 U.S.C. §§9601, et seq., Comprehensive Environmental Response, Compensation, and Liability Act (including the *Superfund Amendments and Reauthorization Act of 1986*). United States Code. U.S. Government Printing Office, Washington, D.C.

42 U.S.C. §§9602, et seq., Designation of Additional Hazardous Substances and Establishment of Reportable Released Quantities. United States Code. U.S. Government Printing Office, Washington, D.C.

42 U.S.C. §§9603, et seq., Notification Requirements Respecting Released Substances. United States Code. U.S. Government Printing Office, Washington, D.C.

42 U.S.C. §§9620(c), et seq., Federal Agency Hazardous Waste Compliance Docket. United States Code. U.S. Government Printing Office. Washington, D.C.

42 U.S.C. §§11001, et seq., Emergency Planning and Notification. United States Code. U.S. Government Printing Office, Washington, D.C.

43 U.S.C. §§315, et seq., Taylor Grazing Act. United States Code. U.S. Government Printing Office, Washington, D.C.

43 U.S.C. §§1701, et seq., Federal Land Policy and Management Act of 1976. United States Code. U.S. Government Printing Office, Washington, D.C.

43 U.S.C. §§1901, et seq., Public Rangelands Improvement Act of 1978. United States Code. U.S. Government Printing Office, Washington, D.C.

49 U.S.C. §§1801, et seq., Hazardous Materials Transportation Act. United States Code. U.S. Government Printing Office, Washington, D.C.

49 U.S.C. §§5101, et seq., Transportation of Hazardous Materials. United States Code. U.S. Government Printing Office, Washington, D.C.

American Society of Mechanical Engineers, 1989. *Quality Assurance Program Requirements for Nuclear Facilities* (with Addenda). NQA-1-1989.

DOE, 1980, *Final Environmental Impact Statement, Waste Isolation Pilot Plant*. DOE/EIS-0026, 2 Volumes. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 1981, *Record of Decision for the Final Environmental Impact Statement, Waste Isolation Pilot Plant*. 46 Fed. Reg. 9162 through 9164.

DOE, 1990a, *Final Supplement Environmental Impact Statement for the Waste Isolation Pilot Plant*. DOE/EIS-0026-FS, 13 Volumes.

DOE, 1990b, *Results of the U.S. Department of Energy Indoor Radon Study*. DOE/ID/12584-75, 2 Volumes.

DOE, 1990c, *Record of Decision for the Supplement Environmental Impact Statement, Waste Isolation Pilot Plant*. 55 Fed. Reg. 25689 through 25692.

DOE, 1991, *Mitigation Action Plan for the Records of Decision for the Waste Isolation Pilot Plant*. DOE/WIPP-91-030. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 1995, Transmittal Letter and Memorandum of Understanding Between the U.S. Environmental Protection Agency and the U.S. Department of Energy Concerning the Clean Air Act Emission Standards for Radionuclides 40 CFR Part 61, Including Subparts H, I, Q, and T. Transmittal Letter from R. Berube, Deputy Assistant Secretary for Environment, to E. Ramona Travato, Director, Office of Radiation and Indoor Air, Environmental Protection Agency, May 16.

DOE, 1996a, *40 CFR Part 191 Compliance Certification Application for the Waste Isolation Pilot Plant*. DOE/WIPP 96-2184. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 1996b, *1996 WIPP Threatened and Endangered Species Survey*. DOE/WIPP-97-2228. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 1997a, *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement*. DOE/EIS-0026-S-2, three volumes. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 1997b, *Joint Powers Agreement among United States Department of Energy, New Mexico Department of Game and Fish, New Mexico Energy, Minerals and Natural Resources, New Mexico Office of Cultural Affairs, and New Mexico State Land Office on Management of the WIPP Withdrawal Area*. 97-521.01-186.

DOE, 1997c, *Waste Isolation Pilot Plant Resource Conservation and Recovery Act Part B Permit Application*, Volumes 1-13. DOE/WIPP-91-005. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 1998, *Record of Decision for the Department of Energy's Waste Isolation Pilot Plant Disposal Phase*. 63 Fed. Reg. 3623 through 3629.

DOE, 1999a, Notification of Startup Letter from K. Klein, Acting Manager, Carlsbad Area Office, to S. Page, EPA, Office of Radiation and Indoor Air. Unique No. 9900271, January 20.

DOE, 1999b, Notification of Waste Isolation Pilot Plant Start-Up Required by 40 CFR §61.09. Letter to S. Page, EPA, Office of Radiation and Indoor Air, from K. Klein, Acting Manager, Carlsbad Area Office. Unique No. 9901349.

DOE, 2002, *Waste Isolation Pilot Plant Initial Report for PCB Disposal Authorization* (40 CFR §761.75[c]). DOE/WIPP-02-3196. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2003, WIPP TRU Waste Transportation Security Plan, DOE/WIPP-03-3233, Waste Isolation Pilot Plant.

DOE, 2004a, *Title 40 CFR Part 191 Subparts B and C Compliance Recertification Application 2004*. DOE/WIPP-04-2131. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2004b, *Specific Administrative Controls*. DOE-STD-1186-2004. U.S. Department of Energy, Washington, D.C.

DOE, 2006, *Preparation Guide for U.S. DOE Non-Reactor Nuclear Facility Safety Analysis Reports*. DOE-STD-3009. U.S. Department of Energy, Washington, D.C.

DOE, 2007, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*. DOE-STD-5506-2007. U.S. Department of Energy, Washington, D.C.

DOE, 2009a, *Title 40 CFR Part 191 Subparts B and C Compliance Recertification Application 2009.* DOE/WIPP-09-3424. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2009b, *Plan for Controlling Storm Water and Minimizing Erosion of the Salt Pile*. Waste Isolation Pilot Plant, Carlsbad, NM. Unique No. 0226.

DOE, 2010a, *Supplement Analysis for the Packaging and Handling of Remote-Handled Transuranic Waste in Shielded Containers*. DOE/EIS-0026-SA-08. Carlsbad Field Office.

DOE, 2010b, *Quality Assurance Program Document*. DOE/CBFO-94-1012. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2011a, Draft *Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste.* (DOE/EIS-0375-D). U.S. Department of Energy, Washington, D.C.

DOE, 2011b, 72-B Cask *Safety Analysis Report*. NRC Docket 71-9212.

DOE, 2011c, *Remote Handled Transuranic Waste Authorized Methods for Payload Control (RH-TRAMPAC)*. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2012a, *Contractor Oversight Plan.* DOE/CBFO 04-3299. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2012b, *Implementation Plan for 40 CFR 191*, Subpart A. DOE/WIPP-00-3121. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2012c, *Compliance Monitoring Implementation Plan for 40 CFR §191.14(b), Assurance Requirement*. DOE/WIPP-99-3119. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2012d, *Annual Change Report – 2011-2012*. Waste Isolation Pilot Plant, Carlsbad, NM. DOE/WIPP 12-3496

DOE, 2012e, Planned Change Notice for Placement of Magnesium Oxide Superstacks. Letter to A. Perrin, EPA, Office of Air and Radiation, from J. Franco, Manager, Carlsbad Field Office.

DOE, 2012f, WIPP Chemical Waste Landfill Reuthorization Application. Letter to C. Edlund, Director of Multimedia Planning and Permitting Division, EPA, from J. Franco, Manager, Carlsbad Field Office.

DOE, 2012g, Notice of Change in Waste Isolation Pilot Plant Facility Operator. Letter to C. Edlund, Director of Multimedia Planning and Permitting Division, EPA, from J. Franco, Manager, Carlsbad Field Office.

DOE, 2012h, *2012 Annual Mitigation Report for the Waste Isolation Pilot Plant*, DOE/CBFO-12-3322. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2012i, Categorical Exclusion: Agricultural Research Service, Wind Erosion and Water Conservation Research Unit Wind Erosion Study, 08/22/2012.

DOE, 2012j, Categorical Exclusion: Routine Replacement of High Efficiency Particulate Air (HEPA) Filters, 09/11/2012.

DOE, 2012k, *Contact Handled Transuranic Waste Authorized Methods for Payload Control (CH-TRAMPAC)*.

DOE, 2012l, TRUPACT-III Transuranic Waste Authorized Methods for Payload Control (TRUPACT-III TRAMPAC).

DOE, 2013a, *Waste Isolation Pilot Plant Environmental Monitoring Plan*. DOE/WIPP 99-2194. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2013b, *Tier II Emergency and Hazardous Chemical Inventory Report*. Reporting Period January 1, 2012 to December 31, 2012. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2013c, *Waste Isolation Pilot Plant 2012 Toxic Chemical Release Inventory Report*. From G. Basabilvaso to D. Shainin, NMDHS. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2013d, *Annual Change Report – 2012-2013*. DOE/WIPP 13-3513. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2013e, *Annual Report of Air Emissions from the Waste Isolation Pilot Plant for the Calendar Year 2012*. Letter from J. Franco to C. Edlund, Director of Multimedia Planning and Permitting Division, EPA. Unique No. 1301533.

DOE, 2013f, *2013 Annual Mitigation Report For The Waste Isolation Pilot Pant*, DOE/CBFO-13-3322. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2013g, *Supplemental Environmental Impact Statement for the Long-Term Management and Storage of Elemental Mercury*. EIS-0423-S1. U.S. Department of Energy, Washington, D.C.

DOE, 2013h, Categorical Exclusion: DOE Grant for the City of Carlsbad Improvement of the Double Eagle Well Field, 02/05/2013.

DOE, 2013i, Categorical Exclusion: Lease of Office Space to Support Waste Isolation Pilot Plant Activities, 03/25/2013.

DOE, 2013j, Categorical Exclusion: Routine Replacement of HEPA Filters, 8/12/2013.

DOE, 2013k, *Waste Isolation Pilot Plant Documented Safety Analysis, November 2013*. DOE/WIPP-07-3372. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2013l, *WIPP Fire Hazard Analysis for the Waste Isolation Pilot Plant, November 2013*. WIPP-023. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2013m, Site Sustainability Plan Waste Isolation Pilot Plant, November 2013. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2013n, *Waste Isolation Pilot Plant Ten-Year Site Plan FY 2014 – FY 2023, June 2013.* DOE/WIPP 04-3327. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2013o, *TRUPACT-II Safety Analysis Report*. NRC Docket 71-9218.

DOE, 2013p, *TRUPACT-III Safety Analysis Report*. NRC Docket 71-9305.

DOE, 2013q, *HalfPACT Safety Analysis Report*. NRC Docket 71-9279

DOE, 2013r, *Waste Isolation Pilot Plant Technical Safety Requirements, November 2013.* DOE/WIPP-07-3373. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2013s, *Waste Isolation Pilot Plant Land Management Plan*, Reprint 01/08/2013. DOE/WIPP-93-004. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2014a, *Treatment, Storage, and Disposal Facility Biennial Report*. Submitted to the NMDHS on EPA Form 8700-13A/B.6.

DOE, 2014b, *Tier II Emergency and Hazardous Chemical Inventory Report*. Reporting Period January 1, 2013 to December 31, 2013. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2014c, *Waste Isolation Pilot Plant 2013 Toxic Chemical Release Inventory Report*. From G. Basabilvaso to D. Shainin, NMDHS. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2014d, *Title 40 CFR Part 191 Subparts B and C Compliance Recertification Application 2014.* DOE/WIPP-14-3503. Waste Isolation Pilot Plant, Carlsbad, NM.

DOE, 2014e, *Annual Report of Air Emissions from the Waste Isolation Pilot Plant for the Calendar Year 2013*. Letter from J. Franco to C. Edlund, Director of Multimedia Planning and Permitting Division, EPA. Unique No. 1301533

DOE, 2014f, *Supplement Analysis for a Proposal to Temporarily Store Defense Transuranic Waste Prior to Disposal at the Waste Isolation Pilot Plant*. DOE/EIS-0026-SA-09. U.S. Department of Energy, Washington, D.C.

DOE, 2014g, *Accident Investigation Report: Underground Salt Haul Truck Fire at the Waste Isolation Pilot Plant February 5, 2014*. U.S. Department of Energy, Washington, D.C.

DOE O 151.1C, 2005. *Comprehensive Emergency Management System*. U.S. Department of Energy, Washington, D.C.

DOE O 225.1B, 2011. *Accident Investigations*. U.S. Department of Energy, Washington, D.C.

DOE O 231.1B Admin Chg 1, 2012*. Environment, Safety and Health Reporting*. U.S. Department of Energy, Washington, D.C.

DOE O 414.1D Admin Chg 1, 2013. *Quality Assurance*. U.S. Department of Energy, Washington, D.C.

DOE O 420.1B, Admin Change 1, 2010. *Facility Safety*. U.S. Department of Energy, Washington, D.C.

DOE O 420.1C, 2012. *Facility Safety*. U.S. Department of Energy, Washington, D.C.

DOE O 435.1 Change 1, 2001. *Radioactive Waste Management*. U.S. Department of Energy, Washington, D.C.

DOE O 436.1, 2011. *Departmental Sustainability*, U.S. Department of Energy, Washington, D.C.

DOE O 451.1B Admin Change 3, 2012. *National Environmental Policy Act Compliance Program – Admin Change 3*. U.S. Department of Energy, Washington, D.C.

DOE O 458.1 Admin Chg 3, 2013. *Radiation Protection of the Public and the Environment*. U.S. Department of Energy, Washington, D.C.

DOE O 460.1C, 2010. *Packaging and Transportation Safety.* U.S. Department of Energy, Washington, D.C.

DOE O 460.2A, 2004. *Departmental Materials Transportation and Packaging Management*. U.S. Department of Energy, Washington, D.C.

DOE G 423.1-1A, 2010. *Implementation Guide for Use in Developing Technical Safety Requirements*. U.S. Department of Energy, Washington, D.C.

DOE G 424.1-1B Admin Change 1, 2013. *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements*. U.S. Department of Energy, Washington, D.C.

Energy Solutions, 2013. *Consolidated Safety Analysis Report for Model 10-160B Type B Radwaste Shipping Cask.* Energy Solutions.

EPA, 1996, *Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations*. Final Rule. 61 Fed. Reg. 5224 through 5245.

EPA, 1997, *Guidance For The Implementation Of EPA's Standards For Management And Storage Of Transuranic Waste (40 CFR Part 191, Subpart A) At The Waste Isolation Pilot Plant.* EPA 402-R-97-001

EPA, 1998, *Criteria for the Certification and Recertification of the Waste Isolation Plant's Compliance with the Disposal Regulations: Certification Decision*. Final Rule. 63 Fed. Reg. 27354 through 27406.

EPA, 2003, *Conditions of Approval for Disposal of PCB/TRU and PCB/TRU Mixed Waste at the U.S. Department of Energy (DOE) Waste Isolation Pilot Plant (WIPP) Carlsbad, New Mexico*. Environmental Protection Agency Region VI.

EPA, 2013, United States Environmental Protection Agency (EPA) Region 6 Re-authorization Approval to the Waste Isolation Pilot Plant (WIPP) for the Storage and Disposal of Polychlorinated Biphenyls (PCBs) at this Plant Located in Carlsbad, New Mexico.. Letter to J. Franco, Manager, Carlsbad Field Office, from W. Stenger, Director of Multimedia Planning and Permitting Division, EPA Region VI.

IT Corporation, 1994. *Emission Sampling Report, Backup Diesel Generator*.

NMED, 1992a, Discharge Plan Approval, DP-831. Letter from New Mexico Environment Department, to A. E. Hunt, Manager, WIPP. Unique No. 9200001, January 16.

NMED, 1992b, Water Supply System Notification to WIPP. Letter from New Mexico Environment Department, Carlsbad Field Office, to Dr. Mewhinney. DOE-ALO. Unique No. 9200041.

NMED, 1993, *Operating Permit for Two Backup Diesel Generators*. Permit No. 310-M-2.

NMED, 1994, Type of Safe Drinking Water Act Sampling Required for WIPP Water Supply System. Letter from B. Birch, New Mexico Environment Department, Carlsbad Field Office, to W. Bodily, Manager, WIPP Environmental & Industrial Safety, Providing Specific Direction to CBFO. File No. WIPPSPLS.MAR.

NMED, 1999, *Waste Isolation Pilot Plant Hazardous Waste Facility Permit*. NM4890139088.

NMED, 2000, Disposal of Asbestos Waste at WIPP. Letter from G. Lewis to Dr. Triay and Mr. Epstein. EPA I.D. No. NM4890139088.

NMED, 2003, Discharge Permit Renewal, DP-831, Waste Isolation Pilot Plant. Letter from M. Leavitt, Chief, New Mexico Environment Department, Ground Water Quality Bureau, to I. Triay, CBFO Manager. Unique No. 0302742.

NMED, 2004, Applicability Determination - Disinfectant and Disinfection Byproducts Rule. Letter from R. Johnson, New Mexico Environment Department – Drinking Water Bureau, to J. Franco, WIPP Water System.

NMED, 2008, RE: Discharge Permit DP-831 Renewal and Modification.

NMED, 2010a, *Waste Isolation Pilot Plant Hazardous Waste Facility Permit*. NM4890139088.

NMED, 2010b, RE: DP-831 Permit Modification. Discharge Modification Approval. Modification approval will expire on September 9, 2013.

NMED, 2014, Administrative Order Under the New Mexico Hazardous Waste Act§ 74-4-13 dated February 27, 2014. State of New Mexico Environment Department, Sante Fe, New Mexico.

NMSA 1978, §17-2. *Hunting and Fishing Regulations*. New Mexico Statutes Annotated 1978. State of New Mexico, Santa Fe, NM.

NMSA 1978, §§18-8-1 through 18-8-8. *New Mexico Prehistoric and Historic Sites Preservation Act*. New Mexico Statutes Annotated 1978. State of New Mexico, Santa Fe, NM.

NMSA 1978, §§50-9-1 through 50-9-25. *Occupational Health and Safety Act.* New Mexico Statutes Annotated 1978. State of New Mexico, Santa Fe, NM.

NMSA 1978, §§74-1-1 through 74-1-16. *New Mexico Environmental Improvement Act.* New Mexico Statutes Annotated 1978. State of New Mexico, Santa Fe, NM.

NMSA 1978, §§74-2-1 through 74-2-22. *Air Quality Control Act*. New Mexico Statutes Annotated 1978. State of New Mexico, Santa Fe, NM.

NMSA 1978, §§74-2-37 through 74-2-46. *Wildlife Conservation Act*, New Mexico Statutes Annotated 1978. State of New Mexico, Santa Fe, NM.

NMSA 1978, §§74-4-1 through 74-4-14. *Hazardous Waste Act*. New Mexico Statutes Annotated 1978. State of New Mexico, Santa Fe, NM.

NMSA 1978, §§74-4B-1 through 74-4B-14. *New Mexico Emergency Management Act*. New Mexico Statutes Annotated 1978. State of New Mexico, Santa Fe, NM.

NMSA 1978, §§74-4E-1 through 74-4E-9. *Hazardous Chemicals Information Act.* New Mexico Statutes Annotated 1978. State of New Mexico, Santa Fe, NM.

NMSA 1978, §§74-6-1 through 74-6-17. *New Mexico Water Quality Act.* Statutes Annotated 1978. State of New Mexico, Santa Fe, NM.

NMSA 1978, §§74-6B-1 through 74-6B-14. *Ground Water Protection Act.* New Mexico Statutes Annotated 1978. State of New Mexico, Santa Fe, NM.

NMSA 1978, §§74-9-1 through 74-9-43. *Solid Waste Act.* New Mexico Statutes Annotated 1978. State of New Mexico, Santa Fe, NM.

NMSA 1978, §75-6-1. *New Mexico Endangered Plant Species Act*. New Mexico Statutes Annotated 1978. State of New Mexico, Santa Fe, NM.

NMSA 1978, §§76-4-1 through 76-4-39. *Pesticide Control Act*. New Mexico Statutes Annotated 1978. State of New Mexico, Santa Fe, NM.

NRC, 2005, *Establishing Quality Assurance Programs for Packaging Used in the Transport of Radioactive Material*. U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, Regulatory Guide 7.10.

NRC, 2011, Certificate of Compliance RH-TRU 72-B Shipping Package. No. 9212.

NRC, 2013a, Certificate of Compliance for the TRUPACT-II. No. 9218.

NRC, 2013b, Certificate of Compliance for the TRUPACT-III. No. 9305.

NRC, 2013c, Certificate of Compliance for the HalfPACT Shipping Package. No. 9279.

NRC, 2013d, Certificate of Compliance 10-160 Type B Radwaste Shipping Cask. No. 9204.

NWPa, Event Investigation. WP 15-MD3102. Waste Isolation Pilot Plant, Carlsbad, NM.

NWPb, Root Cause Analysis. WP 15-GM1001. Waste Isolation Pilot Plant, Carlsbad, NM.

NWPc, Nuclear Waste Partnership LLC Quality Assurance Program Description. WP 13-1. Waste Isolation Pilot Plant, Carlsbad, NM.

NWPd, Radiological Release of Potentially Contaminated Materials, Waste, and Items. WP 12-RE3003. Waste Isolation Pilot Plant, Carlsbad, NM.

NWPe, Graded Approach to Application of QA Controls. WP 09-CN3005. Waste Isolation Pilot Plant, Carlsbad, NM.

NWPf, Unreviewed Safety Question Determination. WP 02-AR3001. Waste Isolation Pilot Plant, Carlsbad, NM.

NWPg, WIPP Quality Assurance Program Plan for Type “B” Packaging. WP 08-PT.03. Waste Isolation Pilot Plant, Carlsbad, NM.

NWPh, NWP Transporation Program. WP 08-NT.12. Waste Isolation Pilot Plant, Carlsbad, NM.

NWPi, WIPP Training Program. WP 14-TR.01. Waste Isolation Pilot Plant, Carlsbad, NM.

NWPj, WIPP Groundwater Monitoring Program Plan. WP 02-1. Waste Isolation Pilot Plant, Carlsbad, NM.

NWPk, Operation of Surface Fuel Station Storage Tanks. WP 04-GC1605. Waste Isolation Pilot Plant, Carlsbad, NM.

NWPl, Request for Disposal. WP 02-RC3108. Waste Isolation Pilot Plant, Carlsbad, NM.

NWPm, *Waste Isolation Pilot Plant 2012 Toxic Chemical Release Inventory Report.* From F. Sharif, NWP Project Manager, to D. Shainin, NMDHS. Waste Isolation Pilot Plant, Carlsbad, NM.

NWPn, *Waste Isolation Pilot Plant 2013 Toxic Chemical Release Inventory Report.* From R. McQuinn, NWP Project Manager, to D. Shainin, NMDHS. Waste Isolation Pilot Plant, Carlsbad, NM.

Public Law 96-164, *Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1980.*

Public Law 97-425, *Nuclear Waste Policy Act of 1982* as amended.

Public Law 100-408, *Price Anderson Amendments Act of 1988*.

Public Law 100-582, *The Medical Waste Tracking Act of 1988.*

Public Law 101-380, *Oil Pollution Act of 1990.*

Public Law 101-549, *Clean Air Act Amendments of 1990.*

Public Law 101-615, *Hazardous Materials Transportation Uniform Safety Act of 1990.*

Public Law 102-386, *The Federal Facilities Compliance Act of 1992.*

Public Law 102-486, *Energy Policy Act of 1992.*

Public Law 102-579, *Waste Isolation Pilot Plant Land Withdrawal Act.*

Public Law 104-201 Subtitle F, *Waste Isolation Pilot Plant Land Withdrawal Act Amendments.*

Public Law 106-246 Section 201, *Military Construction and Appropriations Act of 2001.*

Public Law 108-137, *Energy and Water Development Appropriations Act of 2004.*

Public Law 108-447 Section 310, *Consolidated Appropriations Act of 2005*.

USFWS, 2012, Federal Fish and Wildlife Permit. MB155189-0. United States Fish and Wildlife Service, Albuquerque, NM.

Westinghouse Electric Corporation, Waste Isolation Division, 1999, Notice of Extremely Hazardous Substance.

WIPP, 2009, Underground Storage Tank Operations and Maintenance Plan for the Waste Isolation Pilot Plant. Waste Isolation Pilot Plant, Carlsbad, NM.

WRES, 2003, Air Emissions Inventory for Calendar Year 2002. WRES:03:032, UFC:5486.00, March 21. Waste Isolation Pilot Plant, Carlsbad, NM.

Appendix A – Calendar Year 2012 and 2013 WIPP Confirmatory Measurement Compliance Reports (Title 40 CFR Part 191, Subpart A, Environmental Standards for Management and Storage)

CY 2012 WIPP Confirmatory Measurement Compliance Report

CY 2012 Report Summary

CY 2012 CAP88-PC Output Data for the Maximum Exposed Individual at the DOE Exclusive Use Area Boundary (350 meters)

CY 2012 CAP88-PC Output Data for the Maximum Exposed Individual Near the DOE Land Withdrawal Area (7,500 meters)

CY 2013 WIPP Confirmatory Measurement Compliance Report

CY 2013 Report Summary

CY 2013 CAP88-PC Output Data for the Maximum Exposed Individual at the DOE Exclusive Use Area Boundary (350 meters)

CY 2013 CAP88-PC Output Data for the Maximum Exposed Individual Near the DOE Land Withdrawal Area (7,500 meters)

Annual Periodic Confirmatory Measurement Compliance Report for the U.S. Department of Energy Waste Isolation Pilot Plant

For Calendar Year 2012

As Required By
40 CFR Part 191, Subpart A,
"Environmental Standards for Management and Storage"

CALENDAR YEAR 2012 REPORT SUMMARY

This report satisfies the reporting requirements established by 40 CFR Part 191, Subpart A, "Environmental Standards for Management and Storage." Emission monitoring and compliance procedures for U.S. Department of Energy (DOE) facilities require the use of CAP88-PC (Clean Air Act Assessment Package - 1988) or AIRDOS-PC computer models, or other approved procedures, to calculate effective dose equivalent (EDE) values to members of the public.

The CAP88-PC computer model is a set of computer programs, databases and associated utility programs for estimation of dose and risk from radionuclide emissions to air. The CAP88-PC, Version 3.0 dose assessment computer model was used to estimate the dose(s) reported in this report. Copies of the output data from CAP88-PC are attached.

Year of Reporting Period: Calendar Year (CY) 2012

SUMMARY OF SOURCE TERM AND CALCULATED EFFECTIVE DOSE EQUIVALENT

Calculations made using the above referenced code indicate that the EDE value to the maximally exposed individual resulting from normal operations conducted at this facility is approximately 7.55×10^{-04} millirem (mrem) per year whole body and 1.75×10^{-03} mrem per year to the critical organ at 350 meters northwest from the Waste Isolation Pilot Plant (WIPP) facility. At 7500 meters northwest from the WIPP facility, the EDE value to the maximally exposed individual is 1.06×10^{-05} mrem per year whole body and 2.50×10^{-05} mrem per year to the critical organ.

These EDE values are in compliance with the standard from 40 Code of Federal Regulations (CFR) Part 191, Subpart A, which states that management and storage of spent nuclear fuel or high-level or transuranic radioactive wastes at all facilities for the disposal of such fuel or waste that are operated by the DOE shall be conducted in such a manner as to provide reasonable assurance that the combined annual dose equivalent to any member of the public in the general environment resulting from discharges of radioactive material and direct radiation from such management and storage shall not exceed 25 mrem to the whole body and 75 mrem to any critical organ.

FACILITY NAME AND LOCATION

Facility:	Waste Isolation Pilot Plant 34 Louis Whitlock Road PO Box 2078 Carlsbad, New Mexico 88221
Facility Location:	26 miles (42 kilometers [km]) east of Carlsbad, New Mexico Latitude 32.372, Longitude -103.792

RADIOACTIVE MATERIALS USED

The waste managed at the WIPP facility contains contact-handled and remote-handled transuranic (TRU) radionuclides. TRU waste is radioactive waste that contains alpha-emitting radionuclides of atomic numbers greater than 92, with half-lives longer than 20 years, and which are present in concentrations greater than 100 nanocuries per gram of waste.

During 2012, the WIPP radionuclides of interest are ^{238}Pu, $^{239/240}$Pu, ^{241}Am, ^{90}Sr, ^{137}Cs, $^{233/234}$U, and ^{238}U, as indicated in tables A-1 and A-2. Operations at the WIPP facility do not involve handling any uncontained radioactive material. Waste containers are closed at the waste-generating facilities and remain closed at the WIPP facility. Removable contamination on the exterior surfaces of containers is restricted to minimal levels in accordance with DOE/WIPP-02-3122, *Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, and does not present a significant source of radionuclides that would be subject to release in airborne effluents. During normal operating conditions, there is essentially no potential for airborne emissions of radionuclides contained in the TRU waste managed at the WIPP facility.

Table A-1: Summary of Radionuclide Effluents from Underground Storage Areas: Calendar Year 2012

Station	Radionuclide	Activity Released (Ci/Yr)	Particle Size (μm)[1]	Type (F, M, S)[2]
A	^{238}Pu	4.16×10^{-08}	1	M
A	$^{239/240}$Pu	4.85×10^{-07}	1	M
A	^{241}Am	4.29×10^{-08}	1	M
A	^{90}Sr	2.60×10^{-06}	1	M
A	^{137}Cs	3.24×10^{-05}	1	F
A	$^{233/234}$U	1.04×10^{-07}	1	M
A	^{238}U	8.29×10^{-08}	1	M
B	^{238}Pu	1.32×10^{-09}	1	M
B	$^{239/240}$Pu	1.10×10^{-09}	1	M
B	^{241}Am	1.66×10^{-09}	1	M
B	^{90}Sr	1.30×10^{-07}	1	M
B	^{137}Cs	1.54×10^{-06}	1	F
B	$^{233/234}$U	1.87×10^{-08}	1	M
B	^{238}U	1.71×10^{-08}	1	M

[1] The default particle size in micrometers (μm) for inhaled particles.

[2] Absorption Type: These are established to describe the absorption type of the materials from the respiratory tract into the blood for inhaled particles. The absorption types are F (fast), M (moderate), and S (slow), as defined in International Commission on Radiological Protection (ICRP) Publication 66. CAP88-PC Version 3 default radionuclide class types are used.

Table A-2: Summary of Radionuclide Effluents from the Waste Handling Building: Calendar Year 2012

Station	Radionuclide	Activity Released (Ci/Yr)	Particle Size (µm)[1]	Type (F, M, S)[2]
C	^{238}Pu	$1.33x10^{-08}$	1	M
C	$^{239/240}Pu$	$6.91x10^{-09}$	1	M
C	^{241}Am	$1.22x10^{-08}$	1	M
C	^{90}Sr	$1.06x10^{-06}$	1	M
C	^{137}Cs	$9.88x10^{-06}$	1	F
C	$^{233/234}U$	$1.45x10^{-08}$	1	M
C	^{238}U	$1.41x10^{-08}$	1	M

[1] The default particle size in µm for inhaled particles.

[2] Absorption Type: These are established to describe the absorption type of the materials from the respiratory tract into the blood for inhaled particles. The absorption types are F (fast), M (moderate), and S (slow), as defined in ICRP Publication 66. CAP88-PC Version 3 default radionuclide class types are used.

Small activity radioactive materials (sealed sources and plated sources) are used at the WIPP facility to calibrate and verify the operation of various radiation detection instrumentation and for quality assurance checks for the method of analysis. Some consumable radioactive standards are stored at the WIPP facility. These standards are used to make the laboratory control standards for isotopic analysis of samples. All are stored in a locked safe in a posted, access-controlled Radioactive Materials Area. This source of radioactive material does not have the potential to result in measurable off-site dose consequences.

DESCRIPTION OF OPERATIONS

The WIPP facility is a TRU waste disposal facility owned by the DOE, and managed and operated by Nuclear Waste Partnership LLC (NWP). The principal operation of the WIPP facility involves the receipt of CH/RH TRU waste and disposal in the underground repository. Only waste that conforms to the requirements of DOE/WIPP-02-3122 is accepted for management in the WIPP facility. Administrative controls prohibit the waste containers from being opened once they are accepted at WIPP facility.

DOE radioactive waste is handled and processed in a manner that is protective of workers, public health and safety, and the environment. The receipt and emplacement of TRU waste are safely performed and implemented by NWP personnel through approved and controlled waste management procedures, waste handling procedures, and by the engineering design of the Waste Handling Building (WHB) and equipment, and the underground disposal panel and room configurations.

EMISSION POINTS

The WIPP facility has three effluent air monitoring stations known as Stations A, B, and C. Stations A and B, when in use, measure the total exhaust from the underground and Station C measures all exhaust from the WHB. Immediately after passing Station A, unfiltered air is

exhausted from the repository. Prior to Station B, high-efficiency particulate air (HEPA) filters are first used to filter the exhaust from the repository. Both Stations A and B sample the same air when operated in the maintenance bypass, reduced, or minimum mode. Station C is used to sample the exhaust from the WHB. Prior to sampling activities at Station C, and then venting to the atmosphere, the collective air passes through the HEPA filters. Characteristics of WIPP emission points for CY 2012 are provided in table A-3.

A fixed air sampler unit located in the underground repository is Station D, which was designed according to the methodology specified by the ANSI N13.1-1999 Standard. Station D samples the exhaust air from the waste disposal area. The filter samples collected from this location are counted for gross alpha/beta activity and submitted for isotopic composite analysis as required. Radiochemistry results of Station D sampling activities would be used for confirmation (affirmation) only in the event of a release at any of the mine effluent air monitoring stations.

EFFLUENT CONTROLS

Continuous air monitors are maintained at strategic locations in the WHB and in the underground repository to monitor the real-time levels of airborne radioactivity. Readouts from the underground air monitors are displayed in the Central Monitoring Room, a continuously occupied location from which WIPP facility operations are monitored. During normal conditions, the underground repository effluent does not pass through HEPA filtration units before being discharged to the atmosphere. The WHB effluent, generated by surface waste handling operations, is subject to continuous HEPA filtration before being discharged to the environment. Underground ventilation and WHB HEPA filtration units are polyalphaolefin-tested annually and exhibit a minimum efficiency of 99.97 percent.

The WHB ventilation system maintains the interior of the WHB at a negative pressure relative to the outside environment. This provides a secondary confinement barrier against the release of radionuclides to the environment, where the waste containers themselves are considered the primary barrier. A negative pressure differential ensures that any leaks in the WHB structure will result in an in-leakage of outside air, which precludes the release of airborne contamination to the environment. WIPP's primary mitigation for failure of a waste container is HEPA filtration for the surface and automatic shift to filtration for the underground facility.

The WIPP facility uses fixed air samplers (FAS) at each effluent air monitoring station (Stations A, B, and C) to collect representative samples of airborne particulates. Each FAS has two independent vacuum pumps; one vacuum pump supplies the vacuum and the other functions as a backup unit. In the event of an external power failure, an uninterruptible power supply provides sufficient power to all FAS units for approximately 30 minutes. Diesel generators are available to supply electrical power should the electrical outage last longer than 30 minutes.

Approved and controlled operating procedures are used at the WIPP facility to ensure uniform methods are used to collect, package, and transport FAS filter samples. The use of such procedures provides a means for demonstrating quality assurance of air emission data. Station A FAS filter samples are collected as needed each working shift in order to assure a representative sample. Station B FAS filter samples are collected weekly and at the end of each underground effluent filtration event, as needed based on the information and situation. Station C FAS filter samples are collected weekly.

Filter samples from all three effluent air monitoring stations were analyzed for ^{238}Pu, $^{239/240}Pu$[1], ^{241}Am, ^{90}Sr, ^{137}Cs, $^{233/234}U$[2], and ^{238}U, during CY 2012 for TRU waste activities. The radionuclide ^{242}Pu is used as a tracer in the WIPP Laboratories. These results are being obtained from all three effluent air monitoring stations (Stations A, B, and C).

DISTANCES TO NEAREST RECEPTORS FROM RELEASE POINTS

The WIPP facility is located in an area of low population density that has fewer than 11 permanent residents living within a 10-mile (16-km) radius (DOE/WIPP 93-004). The area surrounding the WIPP facility is used primarily for livestock grazing and development of potash, oil, and gas resources. Land within the WIPP site boundary up to the "exclusive use area" is leased for livestock grazing, which is the only significant agricultural activity in the vicinity of the WIPP facility. Development of the natural resources results in a transient (nonpermanent) population consisting primarily of workers at two potash mines and numerous oil and gas wells located within 10 miles (16 km) of the WIPP facility.

In compliance with 40 CFR Part 191, Subpart A, the location of the maximally exposed individual is the location where an actual individual lives or works who receives the maximum annual radiation dose from the source. The document, *Guidance for Implementation of EPA's Standards for Management and Storage of Transuranic Waste (40 CFR Part 191, Subpart A) at the Waste Isolation Pilot Plant* (EPA 402-R-97-001), states, "The U.S. Environmental Protection Agency expects the DOE to examine radiation doses to individuals at any off-site point where there is a residence, school, business or office. At WIPP, consideration of business should include activities such as grazing, mining, or oil drilling in the vicinity of the site."

Based on this U.S. Environmental Protection Agency (EPA) guidance document and the WIPP facility's meteorological condition (i.e., the prevailing wind direction), the receptors selected are individuals (hypothetical) at the WIPP fence line located 350 meters to the northwest, and a residence off-site at 7500 meters in the west-northwest sector from the WIPP facility. These receptors have been selected as the locations for the maximally exposed individual. In CY 2012, the complete set of dose and risk factors used in CAP88-PC to calculate the EDE returned a value of 7.55×10^{-04} mrem per year whole body and 1.75×10^{-03} mrem per year to the critical organ at 350 meters northwest from the WIPP facility. At 7500 meters west-northwest from the WIPP facility, the EDE value to the maximally exposed individual is 1.06×10^{-05} mrem per year whole body and 2.50×10^{-05} mrem per year to the critical organ.

EPA 402-R-97-001 further states:

> In implementing Subpart A at the WIPP, the EPA expects the DOE to analyze potential exposure pathways and then examine demographic information and conduct field investigations to identify the locations of actual individuals who could be exposed via those pathways. As a conservative simplifying assumption, the DOE could conduct separate analyses of potential doses received from each exposure pathway, then assume that a

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[1] The main alpha peaks for ^{239}Pu and ^{240}Pu differ by less than 0.02 megaelectron-volt (MeV). Spectral resolution of these peaks is insufficient to discriminate individual isotopic contributions. Therefore, these two radionuclides are reported as $^{239/240}Pu$.

[2] The ^{233}U and ^{234}U spectral peaks are separated by less than 0.05 MeV. Resolution of these peaks is insufficient to discriminate the individual isotopic contributions. Results are reported as $^{233/234}U$.

member of the public resides at the single geographical point on the surface where the maximum dose would be received. This dose can be calculated by summing the dose from all pathways to calculate the maximum dose to a member of the public at the single geographic point.

Based on the above-referenced EPA guidance document, demographic information, and the WIPP facility's meteorological condition (i.e., the prevailing wind direction), the receptor selected is an individual at the Smith Ranch located 7500 meters from the WIPP facility, in the west-northwest sector. This receptor has been selected as the location for the maximally exposed individual.

Dose and risk factors used in the CAP88-PC, Version 3.0 to calculate the EDE values to members of the public is provided in Enclosure 2.

Table A-3: Characteristics of WIPP's Emission Points: Calendar Year 2012

Characteristics	Station A	Station B	Station C[5]
Effective station height (m)	7.7	6.7	20.0
Effective station diameter (m)	5.2	1.8	2.6
Station area (m^2)	21.2	2.6	6.8
Flow rate (ft^3/min) English equivalent	4.25×10^5	6.0×10^4	4.7×10^4 (top-end) 2.0×10^4 (low-end)
Flow rate (m^3/min)	1.2×10^4	1699	1331 (top-end) 566 (low-end)
Exit velocity (m/sec)	9.4	10.8	3.3 (top-end) 1.4 (low-end)
Effective exit velocity (m/sec)	6.7	NA	NA
Orientation	45° Angle	Vertical	Vertical
Shape	Rectangle	Round	Square
HEPA filtered	No	Yes	Yes

[5] For Station C, when a portion of the air in the WHB is being recirculated, it will yield a lower effluent flow rate and exit velocity. Although a range of flow rates and exit velocities are provided, the top-end values are provided as input into the CAP88-PC Version 3.0 source data. The recirculation system was implemented in March 2010.

INPUT DATA FOR CAP88-PC DOSE ASSESSMENT COMPUTER MODEL

Meteorological Data File: 2012VET.WND (Five-year average, 2008-2012)

Population Data File: WIPP2010.pop (Population data for WIPP region)

Annual precipitation: 17 cm/year (CY 2012)

Annual ambient temperature: 19°C (CY 2012)

Lid height: 1,000 m

Agricultural Scenario: Local

Absolute Humidity: 8 (grams/cu meter)

DESCRIPTION OF CONSTRUCTION AND MODIFICATIONS COMPLETED DURING REPORTING PERIOD

No construction or modifications were undertaken on the three effluent monitoring stations, Stations A, B, and C. Station C did receive instrumentation upgrade in CY 2011 as described below.

The Station C air monitoring system samples the ventilation exhaust from the WHB. The system was designed according to the ANSI N13.1-1969 standard. The flow control system was upgraded to currently available instrument models. The instrumentation was upgraded, but the isokinetic rake sampling system remains under the original 1969 design standard. The upgrade was basically an exchange to the vendor's current models with no change in the function and method of operation.

In mid-2013, it was found during a calibration check that the Station C sample flow control valve was biased to read higher than the actual flow through the valve. Since the emissions from WIPP exhaust points are dependent upon accurate ratios of sample flow to exhaust flow, the emissions from Station C were re-calculated assuming that the bias existed since equipment installation in May 2011. In CY 2011, the effects were calculated to be negligible (less than 1% change); in CY 2012, the increase in dose was estimated to be about 11% higher than originally reported.

The corrected emissions activities and dose calculations are included in this report for Station C effects for CY 2012 as re-calculated in 2014.

CY 2012 CAP88-PC Output Data for the Maximum Exposed Individual at the DOE Exclusive Use Area Boundary (350 meters)

C A P 8 8 - P C

Version 3.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
May 6, 2014 12:05 pmm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2012

Comments: CY 2012 WIPP Compliance Report bias corr
40 CFR part 191, Subpart A

Effective Dose Equivalent (mrem/year)
7.55E-04

At This Location: 350 Meters Northwest

Dataset Name: 2012-191SubpartA
Dataset Date: 5/6/2014 9:17:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\2012VET

May 6, 2014 12:05 pmm SYNOPSIS
Page 1

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 350 Meters Northwest
Lifetime Fatal Cancer Risk: 3.31E-10

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
Adrenals	5.15E-04
B Surfac	1.75E-03
Breasts	4.14E-04
St Wall	4.93E-04
ULI Wall	5.42E-04
Kidneys	4.96E-04
Lungs	5.05E-04
Ovaries	5.29E-04
R Marrow	9.17E-04
Spleen	4.96E-04
Thymus	4.82E-04
Uterus	5.30E-04
Bld Wall	5.33E-04
Brain	4.34E-04
Esophagu	4.85E-04
SI Wall	5.16E-04
LLI Wall	6.63E-04
Liver	5.53E-04
Muscle	4.62E-04
Pancreas	5.28E-04
Skin	4.24E-04
Testes	4.67E-04
Thyroid	4.81E-04
EFFEC	7.55E-04

RADIONUCLIDE EMISSIONS DURING THE YEAR 2012

Nuclide	Type	Size	Source #1 Ci/y	Source #2 Ci/y	Source #3 Ci/y	TOTAL Ci/y
Am-241	M	1	4.3E-08	1.7E-09	1.2E-08	5.7E-08
Pu-238	M	1	4.2E-08	1.3E-09	1.3E-08	5.6E-08
Pu-239	M	1	4.8E-07	1.1E-09	6.9E-09	4.9E-07
Sr-90	S	1	2.6E-06	1.3E-07	1.1E-06	3.8E-06
Cs-137	F	1	3.2E-05	1.5E-06	9.9E-06	4.4E-05
U-233	S	1	1.0E-07	1.9E-08	1.5E-08	1.4E-07
U-238	S	1	8.3E-08	1.7E-08	1.4E-08	1.1E-07

SITE INFORMATION

Temperature:	19	degrees C
Precipitation:	17	cm/y
Humidity:	8	g/cu m
Mixing Height:	1000	m

SOURCE INFORMATION

Source Number:	1	2	3
Stack Height (m):	7.70	6.70	20.00
Diameter (m):	5.20	1.80	2.60
Plume Rise Momentum (m/s): (Exit Velocity)	6.70	10.80	3.30

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	1.000	1.000	1.000
Fraction From Assessment Area:	0.000	0.000	0.000
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

350

C A P 8 8 - P C
Version 3.0

Clean Air Act Assessment Package - 1988

G E N E R A L D A T A
Non-Radon Individual Assessment
May 6, 2014 12:05 pmm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2012

Comments: CY 2012 WIPP Compliance Report bias corr
40 CFR part 191, Subpart A

Dataset Name: 2012-191SubpartA
Dataset Date: 5/6/2014 9:17:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\2012VET.WND

May 6, 2014 12:05 pmm GENERAL
Page 1

VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

Nuclide	Clearance Type	Particle Size (microns)	Scavenging Coefficient (per second)	Dry Deposition Velocity (m/s)
Am-241	M	1	1.70E-06	1.80E-03
Np-237	M	1	1.70E-06	1.80E-03
Pa-233	M	1	1.70E-06	1.80E-03
U-233	M	1	1.70E-06	1.80E-03
Th-229	S	1	1.70E-06	1.80E-03
Ra-225	M	1	1.70E-06	1.80E-03
Ac-225	M	1	1.70E-06	1.80E-03
Fr-221	M	1	1.70E-06	1.80E-03
At-217	M	1	1.70E-06	1.80E-03
Bi-213	M	1	1.70E-06	1.80E-03
Pu-238	M	1	1.70E-06	1.80E-03
U-234	M	1	1.70E-06	1.80E-03
Th-230	S	1	1.70E-06	1.80E-03
Ra-226	M	1	1.70E-06	1.80E-03
Rn-222	G	0	0.00E+00	0.00E+00
Pu-239	M	1	1.70E-06	1.80E-03
U-235	M	1	1.70E-06	1.80E-03
Th-231	S	1	1.70E-06	1.80E-03
Pa-231	M	1	1.70E-06	1.80E-03
Ac-227	M	1	1.70E-06	1.80E-03
Sr-90	S	1	1.70E-06	1.80E-03
Y-90	M	1	1.70E-06	1.80E-03
Cs-137	F	1	1.70E-06	1.80E-03
Ba-137m	M	1	1.70E-06	1.80E-03
U-233	S	1	1.70E-06	1.80E-03
U-238	S	1	1.70E-06	1.80E-03
Th-234	S	1	1.70E-06	1.80E-03
Pa-234m	M	1	1.70E-06	1.80E-03
Pa-234	M	1	1.70E-06	1.80E-03

VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

	DECAY CONSTANT (PER DAY)			TRANSFER COEFFICIENT	
Nuclide	Radio-active (1)	Surface	Water	Milk (2)	Meat (3)
Am-241	4.39E-06	5.48E-05	0.00E+00	2.00E-06	5.00E-05
Np-237	8.87E-10	5.48E-05	0.00E+00	1.00E-05	1.00E-03
Pa-233	2.57E-02	5.48E-05	0.00E+00	5.00E-06	5.00E-06
U-233	1.20E-08	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-229	2.58E-07	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Ra-225	4.68E-02	5.48E-05	0.00E+00	1.00E-03	2.00E-03
Ac-225	6.93E-02	5.48E-05	0.00E+00	2.00E-06	2.00E-05
Fr-221	2.08E+02	5.48E-05	0.00E+00	8.00E-03	3.00E-02
At-217	1.85E+06	5.48E-05	0.00E+00	1.00E-02	1.00E-02
Bi-213	2.19E+01	5.48E-05	0.00E+00	1.00E-03	2.00E-03
Pu-238	2.16E-05	5.48E-05	0.00E+00	1.00E-06	1.00E-04
U-234	7.76E-09	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-230	2.46E-08	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Ra-226	1.19E-06	5.48E-05	0.00E+00	1.00E-03	2.00E-03
Rn-222	1.81E-01	5.48E-05	0.00E+00	0.00E+00	0.00E+00
Pu-239	7.88E-08	5.48E-05	0.00E+00	1.00E-06	1.00E-04
U-235	2.70E-12	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-231	6.52E-01	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Pa-231	5.79E-08	5.48E-05	0.00E+00	5.00E-06	5.00E-06
Ac-227	8.71E-05	5.48E-05	0.00E+00	2.00E-06	2.00E-05
Sr-90	6.52E-05	5.48E-05	0.00E+00	2.00E-03	1.00E-02
Y-90	2.60E-01	5.48E-05	0.00E+00	6.00E-05	2.00E-03
Cs-137	6.32E-05	5.48E-05	0.00E+00	1.00E-02	5.00E-02
Ba-137m	3.91E+02	5.48E-05	0.00E+00	5.00E-04	2.00E-04
U-233	1.20E-08	5.48E-05	0.00E+00	4.00E-04	8.00E-04
U-238	4.25E-13	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-234	2.88E-02	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Pa-234m	8.53E+02	5.48E-05	0.00E+00	5.00E-06	5.00E-06
Pa-234	2.48E+00	5.48E-05	0.00E+00	5.00E-06	5.00E-06

FOOTNOTES:

(1) Fraction of animal's daily intake of nuclide which appears in each L of milk (days/L)

(2) Fraction of animal's daily intake of nuclide which appears in each kg of meat (days/kg)

VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

	CONCENTRATION UPTAKE FACTOR		GI UPTAKE FRACTION	
Nuclide	Forage (1)	Edible (2)	Inhalation	Ingestion
Am-241	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Np-237	1.00E-01	2.00E-02	5.00E-04	5.00E-04
Pa-233	1.00E-01	1.00E-02	5.00E-04	5.00E-04
U-233	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-229	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Ra-225	2.00E-01	4.00E-02	2.00E-01	2.00E-01
Ac-225	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Fr-221	1.00E-01	3.00E-02	1.00E+00	1.00E+00
At-217	9.00E-01	2.00E-01	1.00E+00	1.00E+00
Bi-213	5.00E-01	1.00E-01	5.00E-02	5.00E-02
Pu-238	1.00E-01	1.00E-03	5.00E-04	5.00E-04
U-234	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-230	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Ra-226	2.00E-01	4.00E-02	2.00E-01	2.00E-01
Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pu-239	1.00E-01	1.00E-03	5.00E-04	5.00E-04
U-235	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-231	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Pa-231	1.00E-01	1.00E-02	5.00E-04	5.00E-04
Ac-227	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Sr-90	4.00E+00	3.00E-01	3.00E-01	3.00E-01
Y-90	1.00E-01	2.00E-03	1.00E-04	1.00E-04
Cs-137	1.00E+00	2.00E-01	1.00E+00	1.00E+00
Ba-137m	1.00E-01	1.00E-02	2.00E-01	2.00E-01
U-233	1.00E-01	2.00E-03	2.00E-02	2.00E-02
U-238	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-234	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Pa-234m	1.00E-01	1.00E-02	5.00E-04	5.00E-04
Pa-234	1.00E-01	1.00E-02	5.00E-04	5.00E-04

FOOTNOTES: (1) Concentration factor for uptake of nuclide from soil for pasture and forage (in pCi/kg dry weight per pCi/kg dry soil)
(2) Concentration factor for uptake of nuclide from soil by edible parts of crops (in pCi/kg wet weight per pCi/kg dry soil)

DECAY CHAIN ACTIVITIES

Nuclide	Stack	Activity at 500. seconds	Activity at 100.00 years
Am-241	1	4.2900E-08	0.0000E+00
Am-241	2	1.6600E-09	0.0000E+00
Am-241	3	1.2200E-08	0.0000E+00
Np-237	1	0.0000E+00	0.0000E+00
Np-237	2	0.0000E+00	0.0000E+00
Np-237	3	0.0000E+00	0.0000E+00
Pa-233	1	0.0000E+00	0.0000E+00
Pa-233	2	0.0000E+00	0.0000E+00
Pa-233	3	0.0000E+00	0.0000E+00
U-233	1	0.0000E+00	0.0000E+00
U-233	2	0.0000E+00	0.0000E+00
U-233	3	0.0000E+00	0.0000E+00
Th-229	1	0.0000E+00	0.0000E+00
Th-229	2	0.0000E+00	0.0000E+00
Th-229	3	0.0000E+00	0.0000E+00
Ra-225	1	0.0000E+00	0.0000E+00
Ra-225	2	0.0000E+00	0.0000E+00
Ra-225	3	0.0000E+00	0.0000E+00
Ac-225	1	0.0000E+00	0.0000E+00
Ac-225	2	0.0000E+00	0.0000E+00
Ac-225	3	0.0000E+00	0.0000E+00
Fr-221	1	0.0000E+00	0.0000E+00
Fr-221	2	0.0000E+00	0.0000E+00
Fr-221	3	0.0000E+00	0.0000E+00
At-217	1	0.0000E+00	0.0000E+00
At-217	2	0.0000E+00	0.0000E+00
At-217	3	0.0000E+00	0.0000E+00
Bi-213	1	0.0000E+00	0.0000E+00
Bi-213	2	0.0000E+00	0.0000E+00
Bi-213	3	0.0000E+00	0.0000E+00
Pu-238	1	4.1600E-08	0.0000E+00
Pu-238	2	1.3200E-09	0.0000E+00
Pu-238	3	1.3300E-08	0.0000E+00
U-234	1	0.0000E+00	0.0000E+00
U-234	2	0.0000E+00	0.0000E+00
U-234	3	0.0000E+00	0.0000E+00
Th-230	1	0.0000E+00	0.0000E+00
Th-230	2	0.0000E+00	0.0000E+00
Th-230	3	0.0000E+00	0.0000E+00
Ra-226	1	0.0000E+00	0.0000E+00
Ra-226	2	0.0000E+00	0.0000E+00
Ra-226	3	0.0000E+00	0.0000E+00
Rn-222	1	0.0000E+00	0.0000E+00
Rn-222	2	0.0000E+00	0.0000E+00
Rn-222	3	0.0000E+00	0.0000E+00
Pu-239	1	4.8500E-07	2.2360E-07
Pu-239	2	1.1000E-09	0.0000E+00
Pu-239	3	6.9100E-09	0.0000E+00
U-235	1	0.0000E+00	0.0000E+00
U-235	2	0.0000E+00	0.0000E+00
U-235	3	0.0000E+00	0.0000E+00

Th-231	1	0.0000E+00	0.0000E+00
Th-231	2	0.0000E+00	0.0000E+00
Th-231	3	0.0000E+00	0.0000E+00
Pa-231	1	0.0000E+00	0.0000E+00
Pa-231	2	0.0000E+00	0.0000E+00
Pa-231	3	0.0000E+00	0.0000E+00
Ac-227	1	0.0000E+00	0.0000E+00
Ac-227	2	0.0000E+00	0.0000E+00
Ac-227	3	0.0000E+00	0.0000E+00
Sr-90	1	2.6000E-06	1.1900E-06
Sr-90	2	1.3000E-07	0.0000E+00
Sr-90	3	1.0600E-06	4.8520E-07
Y-90	1	3.9070E-09	1.1660E-06
Y-90	2	0.0000E+00	0.0000E+00
Y-90	3	1.5930E-09	4.7490E-07
Cs-137	1	3.2400E-05	1.4830E-05
Cs-137	2	1.5400E-06	7.0510E-07
Cs-137	3	9.8800E-06	4.5230E-06

Ba-137m	1	2.7460E-05	1.4030E-05
Ba-137m	2	1.3050E-06	6.6700E-07
Ba-137m	3	8.3740E-06	4.2790E-06
U-233	1	1.0400E-07	0.0000E+00
U-233	2	1.8700E-08	0.0000E+00
U-233	3	1.4500E-08	0.0000E+00
U-238	1	8.2900E-08	0.0000E+00
U-238	2	1.7100E-08	0.0000E+00
U-238	3	1.4100E-08	0.0000E+00
Th-234	1	0.0000E+00	0.0000E+00
Th-234	2	0.0000E+00	0.0000E+00
Th-234	3	0.0000E+00	0.0000E+00
Pa-234m	1	0.0000E+00	0.0000E+00
Pa-234m	2	0.0000E+00	0.0000E+00
Pa-234m	3	0.0000E+00	0.0000E+00
Pa-234	1	0.0000E+00	0.0000E+00
Pa-234	2	0.0000E+00	0.0000E+00
Pa-234	3	0.0000E+00	0.0000E+00

VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS

HUMAN INHALATION RATE	
Cubic centimeters/hr	9.17E+05
SOIL PARAMETERS	
Effective surface density (kg/sq m, dry weight) (Assumes 15 cm plow layer)	2.15E+02
BUILDUP TIMES	
For activity in soil (years)	1.00E+02
For radionuclides deposited on ground/water (days)	3.65E+04
DELAY TIMES	
Ingestion of pasture grass by animals (hr)	0.00E+00
Ingestion of stored feed by animals (hr)	2.16E+03
Ingestion of leafy vegetables by man (hr)	3.36E+02
Ingestion of produce by man (hr)	3.36E+02
Transport time from animal feed-milk-man (day)	2.00E+00
Time from slaughter to consumption (day)	2.00E+01
WEATHERING	
Removal rate constant for physical loss (per hr)	2.90E-03
CROP EXPOSURE DURATION	
Pasture grass (hr)	7.20E+02
Crops/leafy vegetables (hr)	1.44E+03
AGRICULTURAL PRODUCTIVITY	
Grass-cow-milk-man pathway (kg/sq m)	2.80E-01
Produce/leafy veg for human consumption (kg/sq m)	7.16E-01
FALLOUT INTERCEPTION FRACTIONS	
Vegetables	2.00E-01
Pasture	5.70E-01
GRAZING PARAMETERS	
Fraction of year animals graze on pasture	4.00E-01
Fraction of daily feed that is pasture grass when animal grazes on pasture	4.30E-01

VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS

ANIMAL FEED CONSUMPTION FACTORS	
Contaminated feed/forage (kg/day, dry weight)	1.56E+01
DAIRY PRODUCTIVITY	
Milk production of cow (L/day)	1.10E+01
MEAT ANIMAL SLAUGHTER PARAMETERS	
Muscle mass of animal at slaughter (kg)	2.00E+02
Fraction of herd slaughtered (per day)	3.81E-03
DECONTAMINATION	
Fraction of radioactivity retained after washing for leafy vegetables and produce	5.00E-01
FRACTIONS GROWN IN GARDEN OF INTEREST	
Produce ingested	1.00E+00
Leafy vegetables ingested	1.00E+00
INGESTION RATIOS:	
IMMEDIATE SURROUNDING AREA/TOTAL WITHIN AREA	
Vegetables	1.00E+00
Meat	1.00E+00
Milk	1.00E+00
MINIMUM INGESTION FRACTIONS FROM OUTSIDE AREA (Minimum fractions of food types from outside area listed below are actual fixed values.)	
Vegetables	0.00E+00
Meat	0.00E+00
Milk	0.00E+00
HUMAN FOOD UTILIZATION FACTORS	
Produce ingestion (kg/y)	1.76E+02
Milk ingestion (L/y)	1.12E+02
Meat ingestion (kg/y)	8.50E+01
Leafy vegetable ingestion (kg/y)	1.80E+01
SWIMMING PARAMETERS	
Fraction of time spent swimming	0.00E+00
Dilution factor for water (cm)	1.00E+00

C A P 8 8 - P C
Version 3.0

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S
Non-Radon Individual Assessment
May 6, 2014 12:05 pmm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2012

Comments: CY 2012 WIPP Compliance Report bias corr
40 CFR part 191, Subpart A

Dataset Name: 2012-191SubpartA
Dataset Date: 5/6/2014 9:17:00 AM
Wind File: . C:\Program Files\CAP88-PC30\WndFiles\2012VET.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
Adrenals	5.15E-04
B Surfac	1.75E-03
Breasts	4.14E-04
St Wall	4.93E-04
ULI Wall	5.42E-04
Kidneys	4.96E-04
Lungs	5.05E-04
Ovaries	5.29E-04
R Marrow	9.17E-04
Spleen	4.96E-04
Thymus	4.82E-04
Uterus	5.30E-04
Bld Wall	5.33E-04
Brain	4.34E-04
Esophagu	4.85E-04
SI Wall	5.16E-04
LLI Wall	6.63E-04
Liver	5.53E-04
Muscle	4.62E-04
Pancreas	5.28E-04
Skin	4.24E-04
Testes	4.67E-04
Thyroid	4.81E-04
EFFEC	7.55E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	5.60E-04
INHALATION	1.88E-04
AIR IMMERSION	2.18E-08
GROUND SURFACE	7.22E-06
INTERNAL	7.48E-04
EXTERNAL	7.24E-06
TOTAL	7.55E-04

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
Am-241	1.31E-05
Np-237	0.00E+00
Pa-233	0.00E+00
U-233	0.00E+00
Th-229	0.00E+00
Ra-225	0.00E+00
Ac-225	0.00E+00
Fr-221	0.00E+00
At-217	0.00E+00
Bi-213	0.00E+00
Pu-238	1.43E-05
U-234	0.00E+00
Th-230	0.00E+00
Ra-226	0.00E+00
Rn-222	0.00E+00
Pu-239	1.49E-04
U-235	0.00E+00
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Sr-90	6.86E-05
Y-90	1.12E-07
Cs-137	4.90E-04
Ba-137m	7.09E-06
U-233	7.99E-06
U-238	5.58E-06
Th-234	0.00E+00
Pa-234m	0.00E+00
Pa-234	0.00E+00
TOTAL	7.55E-04

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
Esophagu	5.22E-12
Stomach	1.86E-11
Colon	5.67E-11
Liver	1.78E-11
LUNG	6.25E-11
Bone	4.82E-12
Skin	3.92E-13
Breast	1.55E-11
Ovary	6.95E-12
Bladder	1.34E-11
Kidneys	2.70E-12
Thyroid	1.27E-12
Leukemia	5.72E-11
Residual	6.81E-11
Total	3.31E-10
TOTAL	6.62E-10

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	2.87E-10
INHALATION	4.02E-11
AIR IMMERSION	1.19E-14
GROUND SURFACE	3.84E-12
INTERNAL	3.27E-10
EXTERNAL	3.85E-12
TOTAL	3.31E-10

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
Am-241	2.07E-12
Np-237	0.00E+00
Pa-233	0.00E+00
U-233	0.00E+00
Th-229	0.00E+00
Ra-225	0.00E+00
Ac-225	0.00E+00
Fr-221	0.00E+00
At-217	0.00E+00
Bi-213	0.00E+00
Pu-238	2.48E-12
U-234	0.00E+00
Th-230	0.00E+00
Ra-226	0.00E+00
Rn-222	0.00E+00
Pu-239	2.35E-11
U-235	0.00E+00
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Sr-90	4.05E-11
Y-90	1.34E-14
Cs-137	2.48E-10
Ba-137m	3.83E-12
U-233	6.06E-12
U-238	4.22E-12
Th-234	0.00E+00
Pa-234m	0.00E+00
Pa-234	0.00E+00
TOTAL	3.31E-10

May 6, 2014 12:05 pmm SUMMARY
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INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)
Direction	350
N	3.9E-04
NNW	5.9E-04
NW	7.6E-04
WNW	5.1E-04
W	3.2E-04
WSW	2.3E-04
SW	2.3E-04
SSW	2.1E-04
S	1.9E-04
SSE	1.9E-04
SE	1.8E-04
ESE	2.1E-04
E	2.7E-04
ENE	2.7E-04
NE	2.5E-04
NNE	2.9E-04

May 6, 2014 12:05 pmm SUMMARY
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INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)
Direction	350
N	1.7E-10
NNW	2.6E-10
NW	3.3E-10
WNW	2.2E-10
W	1.4E-10
WSW	9.9E-11
SW	1.0E-10
SSW	9.3E-11
S	8.4E-11
SSE	8.4E-11
SE	8.1E-11
ESE	9.0E-11
E	1.2E-10
ENE	1.2E-10
NE	1.1E-10
NNE	1.3E-10

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Clean Air Act Assessment Package - 1988

W E A T H E R D A T A
Non-Radon Individual Assessment
May 6, 2014 12:05 pmm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2012

Comments: CY 2012 WIPP Compliance Report bias corr
40 CFR part 191, Subpart A

Dataset Name: 2012-191SubpartA
Dataset Date: 5/6/2014 9:17:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\2012VET.WND

May 6, 2014 12:05 pmm WEATHER
Page 1

HARMONIC AVERAGE WIND SPEEDS (WIND TOWARDS)

	Pasquill Stability Class							
Dir	A	B	C	D	E	F	G	Wind Freq
N	2.081	2.979	3.339	3.273	2.655	2.826	0.000	0.076
NNW	2.147	3.054	3.342	4.212	3.207	3.178	0.000	0.123
NW	2.126	2.864	3.139	4.325	3.463	3.019	0.000	0.168
WNW	1.665	2.231	2.334	3.828	3.708	3.187	0.000	0.113
W	1.541	1.986	2.217	3.993	3.810	3.011	0.000	0.060
WSW	1.497	2.154	2.352	4.067	3.314	3.039	0.000	0.043
SW	1.589	1.865	2.258	3.798	2.827	3.276	0.000	0.043
SSW	1.620	2.453	2.771	3.566	2.908	3.286	0.000	0.040
S	1.870	3.853	3.273	2.842	2.655	2.969	0.000	0.036
SSE	1.783	3.067	3.577	3.582	2.852	2.992	0.000	0.035
SE	1.635	2.345	2.803	3.196	2.660	2.343	0.000	0.031
ESE	1.532	2.089	2.520	3.776	3.524	1.210	0.000	0.033
E	1.646	2.665	3.563	5.270	4.774	2.572	0.000	0.052
ENE	1.784	2.986	3.841	4.757	3.158	0.897	0.000	0.050
NE	1.813	2.713	3.390	3.554	2.819	2.120	0.000	0.044
NNE	2.021	2.732	3.102	3.140	2.511	2.385	0.000	0.053

ARITHMETIC AVERAGE WIND SPEEDS (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	3.072	4.080	4.589	4.446	3.223	3.172	0.000
NNW	3.205	4.322	4.724	5.286	3.706	3.452	0.000
NW	3.204	4.283	4.699	5.320	3.932	3.349	0.000
WNW	2.650	3.560	3.770	4.913	4.229	3.606	0.000
W	2.446	3.252	3.641	5.509	4.577	3.592	0.000
WSW	2.385	3.437	3.847	5.916	4.364	3.514	0.000
SW	2.497	3.232	3.936	5.793	3.832	3.610	0.000
SSW	2.629	3.820	4.429	5.286	3.608	3.643	0.000
S	3.187	5.142	4.650	3.989	3.482	3.588	0.000
SSE	2.751	4.611	5.166	4.942	3.582	3.372	0.000
SE	2.477	3.376	4.040	4.679	3.600	2.998	0.000
ESE	2.351	3.119	3.728	5.871	5.021	1.852	0.000
E	2.564	4.048	5.472	7.463	5.913	2.572	0.000
ENE	2.723	4.178	5.407	6.256	3.772	1.132	0.000
NE	2.732	3.863	4.966	5.167	3.329	2.572	0.000
NNE	2.924	3.786	4.370	4.522	3.146	2.829	0.000

FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	0.2193	0.1405	0.2339	0.2783	0.1174	0.0106	0.0000
NNW	0.1316	0.0811	0.1559	0.4555	0.1613	0.0146	0.0000
NW	0.0804	0.0475	0.0886	0.5101	0.2426	0.0309	0.0000
WNW	0.0743	0.0345	0.0699	0.3933	0.3805	0.0476	0.0000
W	0.1129	0.0500	0.0957	0.4121	0.2959	0.0334	0.0000
WSW	0.1379	0.0543	0.1031	0.4058	0.2333	0.0656	0.0000
SW	0.1272	0.0550	0.1109	0.4118	0.2113	0.0839	0.0000
SSW	0.1561	0.0701	0.1468	0.3856	0.1855	0.0559	0.0000
S	0.2003	0.3233	0.2972	0.1358	0.0327	0.0107	0.0000
SSE	0.2103	0.1719	0.2762	0.2575	0.0713	0.0128	0.0000
SE	0.2549	0.1207	0.1978	0.2832	0.1239	0.0194	0.0000
ESE	0.2439	0.1039	0.1665	0.3275	0.1552	0.0030	0.0000
E	0.1875	0.0879	0.1696	0.3937	0.1607	0.0006	0.0000
ENE	0.2314	0.1318	0.2328	0.3693	0.0337	0.0010	0.0000
NE	0.2914	0.1557	0.2336	0.2647	0.0525	0.0021	0.0000
NNE	0.2679	0.1666	0.2424	0.2403	0.0774	0.0053	0.0000
TOTAL	0.1581	0.0948	0.1563	0.3792	0.1858	0.0258	0.0000

ADDITIONAL WEATHER INFORMATION

Average Air Temperature:	19.2 degrees C
	292.32 K
Precipitation:	17.0 cm/y
Humidity:	8.0 g/cu m
Lid Height:	1000 meters
Surface Roughness Length:	0.010 meters
Height Of Wind Measurements:	10.0 meters
Average Wind Speed:	4.442 m/s
Vertical Temperature Gradients:	
STABILITY E	0.073 k/m
STABILITY F	0.109 k/m
STABILITY G	0.146 k/m

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Clean Air Act Assessment Package - 1988

C O N C E N T R A T I O N T A B L E S
Non-Radon Individual Assessment
May 6, 2014 12:05 pmm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2012

Comments: CY 2012 WIPP Compliance Report bias corr
40 CFR part 191, Subpart A

Dataset Name: 2012-191SubpartA
Dataset Date: 5/6/2014 9:17:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\2012VET.WND

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
N	350	Am-241	5.52E-09	9.94E-16	5.96E-17	1.05E-15
N	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Pu-238	5.44E-09	9.80E-16	5.90E-17	1.04E-15
N	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Pu-239	4.87E-08	8.77E-15	5.18E-16	9.29E-15
N	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Sr-90	3.66E-07	6.60E-14	3.98E-15	6.99E-14
N	350	Y-90	5.24E-10	9.43E-17	5.78E-18	1.00E-16
N	350	Cs-137	4.27E-06	7.68E-13	4.60E-14	8.14E-13
N	350	Ba-137m	3.62E-06	6.51E-13	3.90E-14	6.90E-13
N	350	U-233	1.41E-08	2.54E-15	1.44E-16	2.68E-15
N	350	U-238	1.18E-08	2.12E-15	1.20E-16	2.24E-15
N	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Am-241	8.35E-09	1.50E-15	8.03E-17	1.58E-15
NNW	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Pu-238	8.20E-09	1.48E-15	7.96E-17	1.56E-15
NNW	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Pu-239	7.51E-08	1.35E-14	6.98E-16	1.42E-14
NNW	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
NNW	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Sr-90	5.50E-07	9.90E-14	5.36E-15	1.04E-13
NNW	350	Y-90	7.83E-10	1.41E-16	7.78E-18	1.49E-16
NNW	350	Cs-137	6.45E-06	1.16E-12	6.20E-14	1.22E-12
NNW	350	Ba-137m	5.46E-06	9.83E-13	5.26E-14	1.04E-12
NNW	350	U-233	2.17E-08	3.91E-15	1.94E-16	4.10E-15
NNW	350	U-238	1.81E-08	3.26E-15	1.61E-16	3.42E-15
NNW	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Am-241	1.06E-08	1.91E-15	1.03E-16	2.01E-15
NW	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Pu-238	1.04E-08	1.87E-15	1.02E-16	1.97E-15
NW	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Pu-239	9.59E-08	1.73E-14	8.97E-16	1.82E-14
NW	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Sr-90	6.96E-07	1.25E-13	6.90E-15	1.32E-13
NW	350	Y-90	9.86E-10	1.77E-16	1.00E-17	1.87E-16
NW	350	Cs-137	8.18E-06	1.47E-12	7.97E-14	1.55E-12
NW	350	Ba-137m	6.93E-06	1.25E-12	6.76E-14	1.32E-12
NW	350	U-233	2.80E-08	5.05E-15	2.50E-16	5.30E-15
NW	350	U-238	2.34E-08	4.21E-15	2.08E-16	4.42E-15
NW	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Am-241	7.07E-09	1.27E-15	7.70E-17	1.35E-15
WNW	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
WNW	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Pu-238	6.93E-09	1.25E-15	7.63E-17	1.32E-15
WNW	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Pu-239	6.37E-08	1.15E-14	6.69E-16	1.21E-14
WNW	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Sr-90	4.65E-07	8.37E-14	5.14E-15	8.88E-14
WNW	350	Y-90	6.55E-10	1.18E-16	7.46E-18	1.25E-16
WNW	350	Cs-137	5.46E-06	9.83E-13	5.94E-14	1.04E-12
WNW	350	Ba-137m	4.63E-06	8.34E-13	5.04E-14	8.84E-13
WNW	350	U-233	1.90E-08	3.41E-15	1.86E-16	3.60E-15
WNW	350	U-238	1.58E-08	2.85E-15	1.55E-16	3.01E-15
WNW	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Am-241	4.42E-09	7.95E-16	4.42E-17	8.39E-16
W	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Pu-238	4.33E-09	7.80E-16	4.38E-17	8.24E-16
W	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Pu-239	4.00E-08	7.19E-15	3.84E-16	7.58E-15
W	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Sr-90	2.90E-07	5.23E-14	2.95E-15	5.52E-14
W	350	Y-90	4.12E-10	7.42E-17	4.28E-18	7.85E-17
W	350	Cs-137	3.41E-06	6.14E-13	3.41E-14	6.48E-13
W	350	Ba-137m	2.89E-06	5.20E-13	2.89E-14	5.49E-13
W	350	U-233	1.16E-08	2.09E-15	1.07E-16	2.20E-15

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
W	350	U-238	9.68E-09	1.74E-15	8.88E-17	1.83E-15
W	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Am-241	3.17E-09	5.70E-16	3.30E-17	6.03E-16
WSW	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Pu-238	3.11E-09	5.60E-16	3.27E-17	5.93E-16
WSW	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Pu-239	2.86E-08	5.15E-15	2.86E-16	5.44E-15
WSW	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Sr-90	2.08E-07	3.75E-14	2.20E-15	3.97E-14
WSW	350	Y-90	2.96E-10	5.33E-17	3.20E-18	5.65E-17
WSW	350	Cs-137	2.45E-06	4.40E-13	2.55E-14	4.66E-13
WSW	350	Ba-137m	2.07E-06	3.73E-13	2.16E-14	3.95E-13
WSW	350	U-233	8.28E-09	1.49E-15	7.97E-17	1.57E-15
WSW	350	U-238	6.90E-09	1.24E-15	6.63E-17	1.31E-15
WSW	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Am-241	3.25E-09	5.85E-16	3.46E-17	6.19E-16
SW	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Pu-238	3.19E-09	5.74E-16	3.43E-17	6.08E-16
SW	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
SW	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Pu-239	2.92E-08	5.26E-15	3.00E-16	5.56E-15
SW	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Sr-90	2.14E-07	3.85E-14	2.31E-15	4.08E-14
SW	350	Y-90	3.04E-10	5.48E-17	3.35E-18	5.81E-17
SW	350	Cs-137	2.51E-06	4.51E-13	2.67E-14	4.78E-13
SW	350	Ba-137m	2.13E-06	3.83E-13	2.26E-14	4.05E-13
SW	350	U-233	8.49E-09	1.53E-15	8.36E-17	1.61E-15
SW	350	U-238	7.08E-09	1.27E-15	6.95E-17	1.34E-15
SW	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Am-241	2.98E-09	5.36E-16	3.18E-17	5.67E-16
SSW	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Pu-238	2.93E-09	5.27E-16	3.15E-17	5.58E-16
SSW	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Pu-239	2.66E-08	4.79E-15	2.76E-16	5.07E-15
SSW	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Sr-90	1.96E-07	3.54E-14	2.12E-15	3.75E-14
SSW	350	Y-90	2.80E-10	5.04E-17	3.08E-18	5.34E-17
SSW	350	Cs-137	2.30E-06	4.14E-13	2.45E-14	4.38E-13
SSW	350	Ba-137m	1.95E-06	3.51E-13	2.08E-14	3.71E-13
SSW	350	U-233	7.73E-09	1.39E-15	7.68E-17	1.47E-15
SSW	350	U-238	6.44E-09	1.16E-15	6.39E-17	1.22E-15
SSW	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Am-241	2.67E-09	4.81E-16	2.76E-17	5.09E-16
S	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
S	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Pu-238	2.64E-09	4.75E-16	2.73E-17	5.02E-16
S	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Pu-239	2.35E-08	4.23E-15	2.40E-16	4.47E-15
S	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Sr-90	1.78E-07	3.20E-14	1.84E-15	3.38E-14
S	350	Y-90	2.55E-10	4.60E-17	2.67E-18	4.86E-17
S	350	Cs-137	2.06E-06	3.71E-13	2.13E-14	3.93E-13
S	350	Ba-137m	1.75E-06	3.15E-13	1.80E-14	3.33E-13
S	350	U-233	6.68E-09	1.20E-15	6.67E-17	1.27E-15
S	350	U-238	5.57E-09	1.00E-15	5.54E-17	1.06E-15
S	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Am-241	2.68E-09	4.82E-16	2.72E-17	5.09E-16
SSE	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Pu-238	2.64E-09	4.75E-16	2.69E-17	5.02E-16
SSE	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Pu-239	2.38E-08	4.28E-15	2.36E-16	4.52E-15
SSE	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Sr-90	1.77E-07	3.19E-14	1.82E-15	3.38E-14

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
SSE	350	Y-90	2.55E-10	4.58E-17	2.64E-18	4.85E-17
SSE	350	Cs-137	2.07E-06	3.72E-13	2.10E-14	3.93E-13
SSE	350	Ba-137m	1.75E-06	3.16E-13	1.78E-14	3.33E-13
SSE	350	U-233	6.78E-09	1.22E-15	6.57E-17	1.29E-15
SSE	350	U-238	5.65E-09	1.02E-15	5.47E-17	1.07E-15
SSE	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Am-241	2.58E-09	4.65E-16	2.90E-17	4.94E-16
SE	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Pu-238	2.55E-09	4.58E-16	2.87E-17	4.87E-16
SE	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Pu-239	2.28E-08	4.10E-15	2.52E-16	4.35E-15
SE	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Sr-90	1.71E-07	3.09E-14	1.94E-15	3.28E-14
SE	350	Y-90	2.45E-10	4.41E-17	2.81E-18	4.69E-17
SE	350	Cs-137	2.00E-06	3.59E-13	2.24E-14	3.82E-13
SE	350	Ba-137m	1.69E-06	3.05E-13	1.90E-14	3.24E-13
SE	350	U-233	6.59E-09	1.19E-15	7.01E-17	1.26E-15
SE	350	U-238	5.50E-09	9.89E-16	5.83E-17	1.05E-15
SE	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Am-241	2.89E-09	5.20E-16	2.94E-17	5.50E-16
ESE	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
ESE	350	Pu-238	2.85E-09	5.12E-16	2.92E-17	5.41E-16
ESE	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Pu-239	2.59E-08	4.67E-15	2.56E-16	4.92E-15
ESE	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Sr-90	1.91E-07	3.44E-14	1.97E-15	3.63E-14
ESE	350	Y-90	2.73E-10	4.92E-17	2.85E-18	5.20E-17
ESE	350	Cs-137	2.23E-06	4.02E-13	2.27E-14	4.24E-13
ESE	350	Ba-137m	1.89E-06	3.41E-13	1.93E-14	3.60E-13
ESE	350	U-233	7.39E-09	1.33E-15	7.12E-17	1.40E-15
ESE	350	U-238	6.15E-09	1.11E-15	5.92E-17	1.17E-15
ESE	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Am-241	3.84E-09	6.91E-16	3.45E-17	7.25E-16
E	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Pu-238	3.77E-09	6.79E-16	3.42E-17	7.13E-16
E	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Pu-239	3.50E-08	6.30E-15	3.00E-16	6.60E-15
E	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Sr-90	2.52E-07	4.53E-14	2.30E-15	4.76E-14
E	350	Y-90	3.61E-10	6.49E-17	3.34E-18	6.83E-17
E	350	Cs-137	2.96E-06	5.32E-13	2.66E-14	5.59E-13
E	350	Ba-137m	2.51E-06	4.51E-13	2.26E-14	4.74E-13
E	350	U-233	9.83E-09	1.77E-15	8.34E-17	1.85E-15
E	350	U-238	8.17E-09	1.47E-15	6.93E-17	1.54E-15
E	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
E	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Am-241	3.76E-09	6.77E-16	3.58E-17	7.13E-16
ENE	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Pu-238	3.71E-09	6.67E-16	3.55E-17	7.02E-16
ENE	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Pu-239	3.38E-08	6.08E-15	3.11E-16	6.39E-15
ENE	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Sr-90	2.48E-07	4.47E-14	2.39E-15	4.71E-14
ENE	350	Y-90	3.57E-10	6.42E-17	3.47E-18	6.77E-17
ENE	350	Cs-137	2.90E-06	5.22E-13	2.76E-14	5.50E-13
ENE	350	Ba-137m	2.46E-06	4.43E-13	2.34E-14	4.66E-13
ENE	350	U-233	9.50E-09	1.71E-15	8.65E-17	1.80E-15
ENE	350	U-238	7.90E-09	1.42E-15	7.19E-17	1.49E-15
ENE	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Am-241	3.50E-09	6.31E-16	3.66E-17	6.67E-16
NE	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Pu-238	3.46E-09	6.22E-16	3.63E-17	6.58E-16
NE	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Pu-239	3.11E-08	5.60E-15	3.18E-16	5.92E-15
NE	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
NE	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Sr-90	2.32E-07	4.18E-14	2.44E-15	4.42E-14
NE	350	Y-90	3.34E-10	6.00E-17	3.55E-18	6.36E-17
NE	350	Cs-137	2.71E-06	4.87E-13	2.83E-14	5.15E-13
NE	350	Ba-137m	2.29E-06	4.13E-13	2.39E-14	4.37E-13
NE	350	U-233	8.83E-09	1.59E-15	8.84E-17	1.68E-15
NE	350	U-238	7.35E-09	1.32E-15	7.36E-17	1.40E-15
NE	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Am-241	4.09E-09	7.37E-16	4.40E-17	7.81E-16
NNE	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Pu-238	4.04E-09	7.27E-16	4.36E-17	7.70E-16
NNE	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Pu-239	3.61E-08	6.49E-15	3.82E-16	6.87E-15
NNE	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Sr-90	2.72E-07	4.89E-14	2.94E-15	5.19E-14
NNE	350	Y-90	3.90E-10	7.01E-17	4.26E-18	7.44E-17
NNE	350	Cs-137	3.16E-06	5.69E-13	3.40E-14	6.03E-13
NNE	350	Ba-137m	2.68E-06	4.82E-13	2.88E-14	5.11E-13
NNE	350	U-233	1.04E-08	1.86E-15	1.06E-16	1.97E-15
NNE	350	U-238	8.63E-09	1.55E-15	8.84E-17	1.64E-15
NNE	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00

C A P 8 8 - P C
Version 3.0

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K C O N V E R S I O N F A C T O R S
Non-Radon Individual Assessment
May 6, 2014 12:05 pmm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2012

Comments: CY 2012 WIPP Compliance Report bias corr
40 CFR part 191, Subpart A

Dataset Name: 2012-191SubpartA
Dataset Date: 5/6/2014 9:17:00 AM
Wind File: . C:\Program Files\CAP88-PC30\WndFiles\2012VET.WND

DOSE AND RISK FACTOR UNITS

The units for each type of dose rate conversion factor are shown below, by pathway:

Pathway	Units
Ingestion	millirem/picoCurie
Inhalation	millirem/picoCurie
Immersion	millirem-cubic cm/microCurie-year
Surface	millirem-square cm/microCurie-year

Risks for internal exposures (inhalation and ingestion) are the lifetime risk of premature death in a birth cohort of 100,000 people for a 1 picoCurie/year intake rate, where the average lifetime is 70.7565 years.
This is simplified to lifetime risk per 100,000 picoCuries.

The units for each type of risk conversion factor are shown below, by pathway:

Pathway	Units
Ingestion	lifetime risk/100,000 picoCuries
Inhalation	lifetime risk/100,000 picoCuries
Immersion	lifetime risk-cubic cm/100,000 picoCurie-years
Surface	lifetime risk-square cm/100,000 picoCurie-years

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* NUCLIDE Am-241 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.831E-06	5.321E-04	5.289E+07	1.713E+04
B Surfac	1.670E-03	3.149E-01	3.344E+08	1.083E+05
Breasts	2.831E-06	5.321E-04	1.247E+08	4.101E+04
St Wall	3.065E-06	5.321E-04	6.466E+07	2.097E+04
ULI Wall	6.371E-06	5.332E-04	5.277E+07	1.841E+04
Kidneys	8.540E-06	1.613E-03	7.002E+07	2.225E+04
Lungs	2.831E-06	6.849E-03	7.852E+07	2.342E+04
Ovaries	3.237E-05	6.109E-03	4.380E+07	1.724E+04
R Marrow	5.676E-05	1.072E-02	6.070E+07	1.957E+04
Spleen	2.831E-06	5.321E-04	6.524E+07	2.109E+04
Thymus	2.831E-06	5.321E-04	7.596E+07	2.283E+04
Uterus	2.831E-06	5.321E-04	4.520E+07	1.666E+04
Bld Wall	2.831E-06	5.321E-04	6.023E+07	2.062E+04
Brain	2.831E-06	5.321E-04	7.258E+07	1.806E+04
Esophagu	2.831E-06	1.731E-03	4.357E+07	1.386E+04
SI Wall	3.415E-06	5.324E-04	4.765E+07	1.713E+04
LLI Wall	1.322E-05	5.346E-04	4.835E+07	1.782E+04
Liver	1.023E-04	1.932E-02	6.571E+07	2.109E+04
Muscle	2.831E-06	5.321E-04	8.516E+07	3.285E+04
Pancreas	2.831E-06	5.321E-04	4.485E+07	1.608E+04
Skin	2.831E-06	5.321E-04	1.491E+08	9.693E+04
Testes	3.209E-05	6.053E-03	9.996E+07	3.786E+04
Thyroid	2.831E-06	5.321E-04	9.122E+07	2.575E+04
EFFEC	7.548E-04	1.543E-01	7.887E+07	2.714E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.366E-08	6.808E-06	5.009E-02	1.596E-05
Stomach	1.310E-07	1.399E-05	2.610E-01	8.470E-05
Colon	2.727E-06	2.727E-05	5.254E-01	1.876E-04
Liver	2.701E-06	4.366E-04	9.961E-02	3.192E-05
LUNG	2.941E-07	1.373E-03	7.677E-01	2.295E-04
Bone	2.031E-06	3.415E-04	3.180E-02	1.029E-05
Skin	2.960E-09	4.218E-07	1.491E-02	9.669E-06
Breast	5.587E-08	7.844E-06	6.023E-01	1.980E-04
Ovary	5.920E-07	1.032E-04	6.233E-02	2.458E-05
Bladder	1.073E-07	1.628E-05	1.456E-01	4.986E-05
Kidneys	8.843E-08	1.365E-05	3.646E-02	1.158E-05
Thyroid	8.214E-09	1.154E-06	2.901E-02	8.202E-06
Leukemia	3.226E-07	4.958E-05	3.402E-01	1.099E-04
Residual	3.545E-07	4.736E-05	9.075E-01	3.274E-04
Total	9.472E-06	2.438E-03	3.879E+00	1.293E-03

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* NUCLIDE Np-237 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	1.313E-06	2.471E-04	7.724E+07	2.027E+04
B Surfac	1.005E-03	1.898E-01	3.728E+08	9.273E+04
Breasts	1.313E-06	2.471E-04	1.468E+08	4.206E+04
St Wall	1.517E-06	2.472E-04	8.912E+07	2.318E+04
ULI Wall	4.396E-06	2.479E-04	7.794E+07	2.132E+04
Kidneys	3.564E-06	6.741E-04	9.343E+07	2.470E+04
Lungs	1.313E-06	5.273E-03	1.051E+08	2.540E+04
Ovaries	1.335E-05	2.522E-03	6.792E+07	2.015E+04
R Marrow	3.833E-05	7.248E-03	8.959E+07	2.353E+04
Spleen	1.313E-06	2.471E-04	9.052E+07	2.330E+04
Thymus	1.313E-06	2.471E-04	1.005E+08	2.423E+04
Uterus	1.313E-06	2.471E-04	7.025E+07	2.015E+04
Bld Wall	1.313E-06	2.472E-04	8.423E+07	2.365E+04
Brain	1.313E-06	2.471E-04	1.017E+08	2.062E+04
Esophagu	1.313E-06	1.341E-03	7.048E+07	1.759E+04
SI Wall	1.822E-06	2.472E-04	7.246E+07	2.004E+04
LLI Wall	1.035E-05	2.493E-04	7.316E+07	2.085E+04
Liver	1.595E-05	3.018E-03	9.087E+07	2.330E+04
Muscle	1.313E-06	2.471E-04	1.085E+08	3.495E+04
Pancreas	1.313E-06	2.471E-04	7.037E+07	1.911E+04
Skin	1.313E-06	2.471E-04	1.794E+08	9.739E+04
Testes	1.358E-05	2.566E-03	1.212E+08	3.938E+04
Thyroid	1.313E-06	2.471E-04	1.158E+08	2.854E+04
EFFEC	3.959E-04	8.399E-02	1.037E+08	2.936E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.401E-08	3.667E-06	8.108E-02	2.027E-05
Stomach	8.917E-08	8.510E-06	3.600E-01	9.355E-05
Colon	2.405E-06	1.783E-05	7.829E-01	2.179E-04
Liver	4.588E-07	7.400E-05	1.375E-01	3.530E-05
LUNG	1.739E-07	1.088E-03	1.028E+00	2.481E-04
Bone	1.288E-06	2.183E-04	3.542E-02	8.807E-06
Skin	1.757E-09	2.431E-07	1.794E-02	9.716E-06
Breast	3.567E-08	4.810E-06	7.095E-01	2.027E-04
Ovary	2.849E-07	4.921E-05	9.658E-02	2.866E-05
Bladder	5.772E-08	8.584E-06	2.039E-01	5.720E-05
Kidneys	4.514E-08	6.771E-06	4.858E-02	1.281E-05
Thyroid	5.069E-09	6.808E-07	3.681E-02	9.087E-06
Leukemia	2.331E-07	3.678E-05	5.033E-01	1.316E-04
Residual	2.264E-07	2.941E-05	1.270E+00	3.693E-04
Total	5.328E-06	1.547E-03	5.312E+00	1.445E-03

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* NUCLIDE Pa-233 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	3.552E-13	3.425E-11	8.365E+08	1.876E+05
B Surfac	8.443E-12	8.547E-10	2.423E+09	4.264E+05
Breasts	3.552E-13	3.425E-11	1.223E+09	2.342E+05
St Wall	3.553E-13	3.425E-11	9.064E+08	2.004E+05
ULI Wall	3.829E-13	3.430E-11	8.318E+08	1.957E+05
Kidneys	5.439E-12	4.965E-10	9.180E+08	2.015E+05
Lungs	3.552E-13	1.238E-09	1.035E+09	2.132E+05
Ovaries	3.175E-12	2.614E-10	7.549E+08	2.015E+05
R Marrow	8.795E-13	8.791E-11	9.635E+08	2.120E+05
Spleen	3.552E-13	3.425E-11	9.250E+08	2.015E+05
Thymus	3.552E-13	3.425E-11	9.704E+08	1.992E+05
Uterus	3.552E-13	3.425E-11	7.736E+08	1.922E+05
Bld Wall	3.554E-13	3.429E-11	8.563E+08	2.027E+05
Brain	3.552E-13	3.425E-11	1.073E+09	1.969E+05
Esophagu	3.552E-13	4.521E-10	8.097E+08	1.759E+05
SI Wall	3.564E-13	3.426E-11	7.910E+08	1.911E+05
LLI Wall	5.417E-13	3.441E-11	8.015E+08	1.969E+05
Liver	1.078E-12	1.093E-10	9.215E+08	2.004E+05
Muscle	3.552E-13	3.425E-11	1.012E+09	2.330E+05
Pancreas	3.552E-13	3.425E-11	7.864E+08	1.829E+05
Skin	3.552E-13	3.425E-11	1.934E+09	3.146E+05
Testes	3.224E-12	2.654E-10	1.067E+09	2.388E+05
Thyroid	3.552E-13	3.425E-11	1.073E+09	2.190E+05
EFFEC	3.247E-06	1.232E-05	9.984E+08	2.167E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	1.069E-11	6.845E-10	9.320E-01	2.027E-04
Stomach	6.290E-09	2.601E-09	3.658E+00	8.085E-04
Colon	4.366E-07	8.991E-08	8.458E+00	2.027E-03
Liver	1.720E-10	1.424E-09	1.398E+00	3.041E-04
LUNG	2.494E-10	9.546E-07	1.011E+01	2.085E-03
Bone	4.181E-11	2.102E-09	2.307E-01	4.054E-05
Skin	4.440E-12	1.820E-11	1.934E-01	3.134E-05
Breast	8.214E-11	2.420E-09	5.907E+00	1.131E-03
Ovary	1.454E-09	7.289E-10	1.074E+00	2.866E-04
Bladder	8.880E-10	4.921E-10	2.074E+00	4.905E-04
Kidneys	8.621E-11	7.733E-10	4.777E-01	1.048E-04
Thyroid	1.761E-12	9.398E-11	3.413E-01	6.978E-05
Leukemia	1.273E-09	1.698E-08	5.406E+00	1.188E-03
Residual	1.913E-09	7.326E-09	1.305E+01	2.994E-03
Total	4.514E-07	1.080E-06	5.336E+01	1.177E-02

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* NUCLIDE U-233 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	5.254E-06	2.607E-05	1.212E+06	3.087E+02
B Surfac	1.551E-04	7.929E-04	4.800E+06	1.549E+03
Breasts	5.254E-06	2.607E-05	2.586E+06	1.491E+03
St Wall	5.461E-06	2.611E-05	1.351E+06	3.483E+02
ULI Wall	8.306E-06	2.681E-05	1.200E+06	3.122E+02
Kidneys	5.383E-05	2.680E-04	1.410E+06	3.891E+02
Lungs	5.254E-06	5.132E-03	1.573E+06	3.728E+02
Ovaries	5.280E-06	2.635E-05	1.078E+06	3.390E+02
R Marrow	1.553E-05	7.826E-05	1.445E+06	4.206E+02
Spleen	5.254E-06	2.607E-05	1.375E+06	3.379E+02
Thymus	5.254E-06	2.607E-05	1.503E+06	3.728E+02
Uterus	5.254E-06	2.607E-05	1.103E+06	2.982E+02
Bld Wall	5.272E-06	2.615E-05	1.282E+06	3.542E+02
Brain	5.254E-06	2.607E-05	1.561E+06	3.076E+02
Esophagu	5.254E-06	1.131E-03	1.132E+06	2.633E+02
SI Wall	5.757E-06	2.619E-05	1.132E+06	2.971E+02
LLI Wall	1.421E-05	2.825E-05	1.146E+06	3.099E+02
Liver	2.049E-05	1.029E-04	1.375E+06	3.448E+02
Muscle	5.254E-06	2.607E-05	1.794E+06	1.038E+03
Pancreas	5.254E-06	2.607E-05	1.115E+06	2.819E+02
Skin	5.254E-06	2.607E-05	5.324E+06	6.920E+03
Testes	5.280E-06	2.635E-05	1.969E+06	1.212E+03
Thyroid	5.254E-06	2.607E-05	1.806E+06	5.149E+02
EFFEC	1.897E-04	1.314E-02	1.654E+06	6.990E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	8.177E-08	3.604E-07	1.305E-03	3.029E-07
Stomach	2.309E-07	8.399E-07	5.452E-03	1.410E-06
Colon	2.523E-06	2.176E-06	1.212E-02	3.215E-06
Liver	5.698E-07	2.464E-06	2.085E-03	5.231E-07
LUNG	5.735E-07	1.080E-03	1.538E-02	3.646E-06
Bone	3.622E-07	1.613E-06	4.555E-04	1.468E-07
Skin	5.883E-09	2.409E-08	5.312E-04	6.908E-07
Breast	1.128E-07	4.736E-07	1.247E-02	7.200E-06
Ovary	9.435E-08	4.366E-07	1.538E-03	4.823E-07
Bladder	2.002E-07	8.510E-07	3.099E-03	8.563E-07
Kidneys	6.438E-07	2.779E-06	7.328E-04	2.027E-07
Thyroid	1.650E-08	6.734E-08	5.755E-04	1.643E-07
Leukemia	9.176E-08	4.033E-07	8.108E-03	2.365E-06
Residual	7.363E-07	2.897E-06	2.039E-02	8.085E-06
Total	6.253E-06	1.095E-03	8.435E-02	2.924E-05

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* NUCLIDE Th-229 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	1.395E-05	3.048E-04	3.076E+08	7.468E+04
B Surfac	4.170E-03	9.487E-02	1.340E+09	2.726E+05
Breasts	1.395E-05	3.048E-04	5.149E+08	1.052E+05
St Wall	1.415E-05	3.050E-04	3.483E+08	8.283E+04
ULI Wall	1.722E-05	3.097E-04	3.099E+08	7.922E+04
Kidneys	5.839E-05	1.389E-03	3.588E+08	8.353E+04
Lungs	1.395E-05	9.235E-02	4.078E+08	8.901E+04
Ovaries	3.512E-05	7.977E-04	2.761E+08	7.584E+04
R Marrow	1.994E-04	4.677E-03	3.530E+08	8.365E+04
Spleen	1.395E-05	3.049E-04	3.553E+08	8.411E+04
Thymus	1.395E-05	3.048E-04	3.868E+08	8.225E+04
Uterus	1.395E-05	3.048E-04	2.831E+08	7.642E+04
Bld Wall	1.396E-05	3.051E-04	3.285E+08	8.341E+04
Brain	1.395E-05	3.048E-04	4.019E+08	7.771E+04
Esophagu	1.395E-05	3.677E-02	2.866E+08	6.839E+04
SI Wall	1.447E-05	3.051E-04	2.912E+08	7.584E+04
LLI Wall	2.426E-05	3.298E-04	2.936E+08	7.864E+04
Liver	2.018E-04	4.651E-03	3.553E+08	8.318E+04
Muscle	1.395E-05	3.048E-04	4.031E+08	9.996E+04
Pancreas	1.395E-05	3.048E-04	2.854E+08	7.328E+04
Skin	1.395E-05	3.048E-04	6.303E+08	1.829E+05
Testes	3.559E-05	8.081E-04	4.392E+08	1.043E+05
Thyroid	1.395E-05	3.048E-04	4.310E+08	9.075E+04
EFFEC	1.850E-03	2.634E-01	3.926E+08	9.204E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.153E-07	3.589E-06	3.297E-01	7.864E-05
Stomach	5.328E-07	6.623E-06	1.410E+00	3.344E-04
Colon	3.574E-06	1.376E-05	3.122E+00	8.155E-04
Liver	4.847E-06	8.066E-05	5.382E-01	1.258E-04
LUNG	1.465E-06	1.624E-02	3.984E+00	8.703E-04
Bone	5.365E-06	9.805E-05	1.270E-01	2.586E-05
Skin	1.476E-08	2.105E-07	6.291E-02	1.829E-05
Breast	2.794E-07	3.774E-06	2.493E+00	5.079E-04
Ovary	6.919E-07	1.228E-05	3.926E-01	1.079E-04
Bladder	5.328E-07	8.695E-06	7.945E-01	2.015E-04
Kidneys	5.032E-07	8.621E-06	1.864E-01	4.345E-05
Thyroid	4.107E-08	5.624E-07	1.375E-01	2.889E-05
Leukemia	1.073E-06	1.846E-05	1.980E+00	4.695E-04
Residual	1.776E-06	2.209E-05	4.940E+00	1.235E-03
Total	2.090E-05	1.654E-02	2.050E+01	4.858E-03

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* NUCLIDE Ra-225 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.076E-06	1.183E-06	1.340E+07	7.072E+03
B Surfac	6.649E-04	4.159E-04	1.072E+08	5.499E+04
Breasts	2.076E-06	1.183E-06	4.940E+07	2.027E+04
St Wall	2.078E-06	1.196E-06	1.794E+07	9.355E+03
ULI Wall	2.873E-06	1.566E-06	1.282E+07	7.188E+03
Kidneys	6.834E-06	2.075E-05	2.202E+07	1.109E+04
Lungs	2.076E-06	9.561E-03	2.283E+07	1.095E+04
Ovaries	2.471E-06	2.892E-06	8.528E+06	4.858E+03
R Marrow	6.420E-05	3.700E-05	1.654E+07	7.852E+03
Spleen	2.090E-06	1.190E-06	1.759E+07	9.367E+03
Thymus	2.076E-06	1.183E-06	2.353E+07	1.065E+04
Uterus	2.076E-06	1.183E-06	9.425E+06	5.813E+03
Bld Wall	2.084E-06	1.204E-06	1.678E+07	9.273E+03
Brain	2.076E-06	1.183E-06	1.911E+07	6.978E+03
Esophagu	2.076E-06	5.754E-04	8.376E+06	4.078E+03
SI Wall	2.090E-06	1.201E-06	1.058E+07	6.151E+03
LLI Wall	7.282E-06	2.968E-06	1.067E+07	6.431E+03
Liver	3.582E-05	1.474E-05	1.817E+07	9.320E+03
Muscle	2.076E-06	1.183E-06	2.936E+07	1.561E+04
Pancreas	2.076E-06	1.183E-06	8.924E+06	5.219E+03
Skin	2.076E-06	1.183E-06	3.507E+08	3.786E+04
Testes	2.478E-06	2.922E-06	3.775E+07	1.899E+04
Thyroid	2.076E-06	1.183E-06	3.227E+07	1.340E+04
EFFEC	3.680E-04	2.317E-02	2.808E+07	1.247E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	6.808E-08	2.993E-08	9.635E-03	4.695E-06
Stomach	2.786E-07	1.066E-07	7.246E-02	3.775E-05
Colon	2.102E-06	6.734E-07	1.223E-01	7.083E-05
Liver	1.543E-06	4.773E-07	2.749E-02	1.410E-05
LUNG	7.178E-07	1.991E-03	2.237E-01	1.071E-04
Bone	3.611E-06	1.162E-06	1.018E-02	5.219E-06
Skin	7.104E-09	2.653E-09	3.495E-02	3.775E-06
Breast	1.754E-07	6.475E-08	2.388E-01	9.798E-05
Ovary	9.694E-08	8.695E-08	1.212E-02	6.908E-06
Bladder	1.487E-07	6.549E-08	4.054E-02	2.237E-05
Kidneys	1.088E-07	2.216E-07	1.145E-02	5.767E-06
Thyroid	2.431E-08	8.584E-09	1.028E-02	4.264E-06
Leukemia	8.473E-07	3.112E-07	9.285E-02	4.404E-05
Residual	1.099E-06	3.959E-07	2.563E-01	1.386E-04
Total	1.084E-05	1.994E-03	1.163E+00	5.639E-04

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* NUCLIDE Ac-225 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	1.616E-06	1.361E-06	5.907E+07	1.410E+04
B Surfac	7.929E-06	4.007E-04	2.412E+08	4.753E+04
Breasts	1.616E-06	1.361E-06	9.646E+07	1.946E+04
St Wall	2.524E-06	1.567E-06	6.640E+07	1.549E+04
ULI Wall	1.820E-05	4.784E-06	5.953E+07	1.491E+04
Kidneys	4.444E-05	3.811E-05	6.815E+07	1.561E+04
Lungs	1.616E-06	1.122E-02	7.736E+07	1.654E+04
Ovaries	1.716E-06	7.748E-06	5.336E+07	1.445E+04
R Marrow	2.012E-06	3.297E-05	6.792E+07	1.584E+04
Spleen	1.625E-06	1.389E-06	6.780E+07	1.573E+04
Thymus	1.616E-06	1.361E-06	7.316E+07	1.526E+04
Uterus	1.616E-06	1.361E-06	5.452E+07	1.445E+04
Bld Wall	1.964E-06	1.451E-06	6.268E+07	1.561E+04
Brain	1.616E-06	1.361E-06	7.712E+07	1.468E+04
Esophagu	1.616E-06	1.000E-03	5.557E+07	1.305E+04
SI Wall	2.855E-06	1.622E-06	5.592E+07	1.433E+04
LLI Wall	4.795E-05	1.091E-05	5.662E+07	1.491E+04
Liver	5.306E-06	1.771E-04	6.780E+07	1.549E+04
Muscle	1.616E-06	1.361E-06	7.619E+07	1.864E+04
Pancreas	1.616E-06	1.361E-06	5.510E+07	1.386E+04
Skin	1.616E-06	1.361E-06	1.095E+08	3.588E+04
Testes	1.715E-06	7.689E-06	8.248E+07	1.934E+04
Thyroid	1.616E-06	1.361E-06	8.143E+07	1.689E+04
EFFEC	1.425E-04	2.734E-02	7.433E+07	1.713E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.921E-08	3.885E-08	6.396E-02	1.503E-05
Stomach	3.112E-07	1.702E-07	2.679E-01	6.256E-05
Colon	1.273E-05	2.768E-06	6.011E-01	1.538E-04
Liver	1.987E-07	5.328E-06	1.028E-01	2.353E-05
LUNG	4.958E-07	2.327E-03	7.561E-01	1.619E-04
Bone	2.494E-08	1.073E-06	2.295E-02	4.509E-06
Skin	4.958E-09	3.630E-09	1.093E-02	3.577E-06
Breast	1.199E-07	9.213E-08	4.660E-01	9.402E-05
Ovary	6.142E-08	2.394E-07	7.596E-02	2.050E-05
Bladder	1.354E-07	8.880E-08	1.515E-01	3.775E-05
Kidneys	6.068E-07	4.662E-07	3.542E-02	8.120E-06
Thyroid	1.665E-08	1.217E-08	2.598E-02	5.382E-06
Leukemia	2.120E-08	3.448E-07	3.810E-01	8.889E-05
Residual	7.696E-07	5.550E-07	9.448E-01	2.307E-04
Total	1.554E-05	2.338E-03	3.903E+00	9.110E-04

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* NUCLIDE Fr-221 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	1.281E+08	2.912E+04
B Surfac	0.000E+00	0.000E+00	4.054E+08	6.827E+04
Breasts	0.000E+00	0.000E+00	1.911E+08	3.518E+04
St Wall	0.000E+00	0.000E+00	1.398E+08	3.111E+04
ULI Wall	0.000E+00	0.000E+00	1.281E+08	3.017E+04
Kidneys	0.000E+00	0.000E+00	1.421E+08	3.087E+04
Lungs	0.000E+00	0.000E+00	1.608E+08	3.274E+04
Ovaries	0.000E+00	0.000E+00	1.188E+08	2.994E+04
R Marrow	0.000E+00	0.000E+00	1.480E+08	3.250E+04
Spleen	0.000E+00	0.000E+00	1.433E+08	3.134E+04
Thymus	0.000E+00	0.000E+00	1.514E+08	2.994E+04
Uterus	0.000E+00	0.000E+00	1.200E+08	2.947E+04
Bld Wall	0.000E+00	0.000E+00	1.328E+08	3.076E+04
Brain	0.000E+00	0.000E+00	1.654E+08	3.017E+04
Esophagu	0.000E+00	0.000E+00	1.247E+08	2.680E+04
SI Wall	0.000E+00	0.000E+00	1.223E+08	2.924E+04
LLI Wall	0.000E+00	0.000E+00	1.235E+08	3.029E+04
Liver	0.000E+00	0.000E+00	1.433E+08	3.111E+04
Muscle	0.000E+00	0.000E+00	1.573E+08	3.530E+04
Pancreas	0.000E+00	0.000E+00	1.212E+08	2.831E+04
Skin	0.000E+00	0.000E+00	2.353E+08	4.276E+04
Testes	0.000E+00	0.000E+00	1.666E+08	3.588E+04
Thyroid	0.000E+00	0.000E+00	1.678E+08	3.285E+04
EFFEC	0.000E+00	0.000E+00	1.549E+08	3.309E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	1.433E-01	3.087E-05
Stomach	0.000E+00	0.000E+00	5.639E-01	1.258E-04
Colon	0.000E+00	0.000E+00	1.305E+00	3.122E-04
Liver	0.000E+00	0.000E+00	2.167E-01	4.718E-05
LUNG	0.000E+00	0.000E+00	1.573E+00	3.204E-04
Bone	0.000E+00	0.000E+00	3.844E-02	6.477E-06
Skin	0.000E+00	0.000E+00	2.353E-02	4.264E-06
Breast	0.000E+00	0.000E+00	9.227E-01	1.701E-04
Ovary	0.000E+00	0.000E+00	1.689E-01	4.264E-05
Bladder	0.000E+00	0.000E+00	3.215E-01	7.433E-05
Kidneys	0.000E+00	0.000E+00	7.398E-02	1.608E-05
Thyroid	0.000E+00	0.000E+00	5.347E-02	1.046E-05
Leukemia	0.000E+00	0.000E+00	8.306E-01	1.829E-04
Residual	0.000E+00	0.000E+00	2.015E+00	4.602E-04
Total	0.000E+00	0.000E+00	8.248E+00	1.806E-03

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* NUCLIDE At-217 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	1.375E+06	2.982E+02
B Surfac	0.000E+00	0.000E+00	3.111E+06	5.475E+02
Breasts	0.000E+00	0.000E+00	1.922E+06	3.553E+02
St Wall	0.000E+00	0.000E+00	1.480E+06	3.169E+02
ULI Wall	0.000E+00	0.000E+00	1.363E+06	3.145E+02
Kidneys	0.000E+00	0.000E+00	1.480E+06	3.192E+02
Lungs	0.000E+00	0.000E+00	1.666E+06	3.367E+02
Ovaries	0.000E+00	0.000E+00	1.258E+06	3.262E+02
R Marrow	0.000E+00	0.000E+00	1.596E+06	3.390E+02
Spleen	0.000E+00	0.000E+00	1.503E+06	3.192E+02
Thymus	0.000E+00	0.000E+00	1.549E+06	3.192E+02
Uterus	0.000E+00	0.000E+00	1.282E+06	3.076E+02
Bld Wall	0.000E+00	0.000E+00	1.375E+06	3.215E+02
Brain	0.000E+00	0.000E+00	1.759E+06	3.157E+02
Esophagu	0.000E+00	0.000E+00	1.363E+06	2.843E+02
SI Wall	0.000E+00	0.000E+00	1.305E+06	3.076E+02
LLI Wall	0.000E+00	0.000E+00	1.340E+06	3.192E+02
Liver	0.000E+00	0.000E+00	1.491E+06	3.180E+02
Muscle	0.000E+00	0.000E+00	1.631E+06	3.635E+02
Pancreas	0.000E+00	0.000E+00	1.293E+06	2.913E+02
Skin	0.000E+00	0.000E+00	2.167E+06	4.788E+02
Testes	0.000E+00	0.000E+00	1.689E+06	3.693E+02
Thyroid	0.000E+00	0.000E+00	1.713E+06	3.495E+02
EFFEC	0.000E+00	0.000E+00	1.596E+06	3.402E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	1.573E-03	3.274E-07
Stomach	0.000E+00	0.000E+00	5.976E-03	1.281E-06
Colon	0.000E+00	0.000E+00	1.398E-02	3.274E-06
Liver	0.000E+00	0.000E+00	2.260E-03	4.823E-07
LUNG	0.000E+00	0.000E+00	1.631E-02	3.297E-06
Bone	0.000E+00	0.000E+00	2.959E-04	5.196E-08
Skin	0.000E+00	0.000E+00	2.167E-04	4.776E-08
Breast	0.000E+00	0.000E+00	9.285E-03	1.713E-06
Ovary	0.000E+00	0.000E+00	1.794E-03	4.637E-07
Bladder	0.000E+00	0.000E+00	3.320E-03	7.771E-07
Kidneys	0.000E+00	0.000E+00	7.701E-04	1.666E-07
Thyroid	0.000E+00	0.000E+00	5.452E-04	1.113E-07
Leukemia	0.000E+00	0.000E+00	8.959E-03	1.899E-06
Residual	0.000E+00	0.000E+00	2.132E-02	4.730E-06
Total	0.000E+00	0.000E+00	8.656E-02	1.864E-05

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* NUCLIDE Bi-213 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	7.837E-10	2.876E-09	5.976E+08	1.293E+05
B Surfac	7.837E-10	2.876E-09	1.363E+09	2.400E+05
Breasts	7.837E-10	2.876E-09	8.341E+08	1.561E+05
St Wall	1.866E-07	3.082E-08	6.373E+08	1.375E+05
ULI Wall	4.666E-08	1.081E-08	5.895E+08	1.375E+05
Kidneys	1.109E-07	4.070E-07	6.419E+08	1.386E+05
Lungs	7.837E-10	3.185E-05	7.188E+08	1.468E+05
Ovaries	7.837E-10	2.876E-09	5.347E+08	1.456E+05
R Marrow	7.837E-10	2.876E-09	6.885E+08	1.480E+05
Spleen	7.837E-10	2.876E-09	6.489E+08	1.386E+05
Thymus	7.837E-10	2.876E-09	6.687E+08	1.410E+05
Uterus	7.837E-10	2.876E-09	5.499E+08	1.340E+05
Bld Wall	1.161E-09	4.259E-09	5.988E+08	1.410E+05
Brain	7.837E-10	2.876E-09	7.619E+08	1.375E+05
Esophagu	7.837E-10	6.745E-05	5.848E+08	1.235E+05
SI Wall	9.968E-08	1.775E-08	5.639E+08	1.340E+05
LLI Wall	6.671E-09	3.892E-09	5.743E+08	1.386E+05
Liver	7.837E-10	2.876E-09	6.454E+08	1.386E+05
Muscle	7.837E-10	2.876E-09	7.037E+08	1.596E+05
Pancreas	7.837E-10	2.876E-09	5.604E+08	1.270E+05
Skin	7.837E-10	2.876E-09	3.949E+09	4.928E+06
Testes	7.837E-10	2.876E-09	7.281E+08	1.619E+05
Thyroid	7.837E-10	2.876E-09	7.398E+08	1.526E+05
EFFEC	7.326E-07	1.104E-04	7.188E+08	1.957E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.483E-11	8.362E-11	6.734E-01	1.421E-04
Stomach	2.849E-08	4.440E-09	2.575E+00	5.545E-04
Colon	1.998E-08	4.181E-09	6.023E+00	1.421E-03
Liver	3.922E-11	1.114E-10	9.786E-01	2.097E-04
LUNG	2.620E-10	6.475E-06	7.025E+00	1.433E-03
Bone	2.202E-12	6.882E-12	1.293E-01	2.283E-05
Skin	2.553E-12	7.733E-12	3.938E-01	4.916E-04
Breast	6.549E-11	1.987E-10	4.031E+00	7.538E-04
Ovary	4.218E-11	1.014E-10	7.607E-01	2.074E-04
Bladder	9.620E-11	2.779E-10	1.445E+00	3.413E-04
Kidneys	1.521E-09	4.995E-09	3.344E-01	7.211E-05
Thyroid	8.288E-12	2.601E-11	2.353E-01	4.858E-05
Leukemia	2.309E-11	2.808E-11	3.868E+00	8.306E-04
Residual	4.884E-10	1.199E-09	9.238E+00	2.062E-03
Total	5.106E-08	6.475E-06	3.775E+01	8.598E-03

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* NUCLIDE Pu-238 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.386E-06	4.484E-04	7.106E+04	5.650E+01
B Surfac	1.369E-03	2.576E-01	1.083E+06	1.421E+03
Breasts	2.386E-06	4.484E-04	1.480E+06	2.248E+03
St Wall	2.620E-06	4.484E-04	1.069E+05	8.912E+01
ULI Wall	5.935E-06	4.495E-04	6.687E+04	3.355E+01
Kidneys	5.920E-06	1.116E-03	1.538E+05	1.782E+02
Lungs	2.386E-06	6.775E-03	1.235E+05	9.169E+01
Ovaries	1.796E-05	3.383E-03	5.056E+04	1.068E+02
R Marrow	6.767E-05	1.275E-02	1.957E+05	2.260E+02
Spleen	2.386E-06	4.484E-04	8.947E+04	5.242E+01
Thymus	2.386E-06	4.484E-04	1.689E+05	1.538E+02
Uterus	2.386E-06	4.484E-04	5.475E+04	2.516E+01
Bld Wall	2.386E-06	4.484E-04	1.059E+05	1.012E+02
Brain	2.386E-06	4.484E-04	8.912E+04	2.610E+01
Esophagu	2.386E-06	1.645E-03	5.242E+04	1.584E+01
SI Wall	2.971E-06	4.488E-04	5.825E+04	2.749E+01
LLI Wall	1.279E-05	4.510E-04	5.848E+04	3.262E+01
Liver	2.885E-04	5.432E-02	1.019E+05	7.759E+01
Muscle	2.386E-06	4.484E-04	6.209E+05	1.340E+03
Pancreas	2.386E-06	4.484E-04	5.173E+04	1.946E+01
Skin	2.386E-06	4.484E-04	4.765E+06	1.123E+04
Testes	1.829E-05	3.443E-03	7.642E+05	1.736E+03
Thyroid	2.386E-06	4.484E-04	4.672E+05	3.961E+02
EFFEC	8.436E-04	1.709E-01	4.089E+05	7.293E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.477E-08	6.919E-06	6.035E-05	1.817E-08
Stomach	1.606E-07	1.806E-05	4.322E-04	3.600E-07
Colon	2.742E-06	3.996E-05	6.536E-04	3.425E-07
Liver	6.549E-06	1.036E-03	1.549E-04	1.177E-07
LUNG	3.533E-07	1.380E-03	1.212E-03	8.970E-07
Bone	1.676E-06	2.816E-04	1.029E-04	1.351E-07
Skin	3.552E-09	4.921E-07	4.753E-04	1.121E-06
Breast	7.622E-08	1.029E-05	7.153E-03	1.086E-05
Ovary	3.448E-07	5.957E-05	7.188E-05	1.514E-07
Bladder	1.054E-07	1.598E-05	2.563E-04	2.446E-07
Kidneys	6.364E-08	9.620E-06	8.004E-05	9.273E-08
Thyroid	1.073E-08	1.428E-06	1.491E-04	1.258E-07
Leukemia	3.389E-07	5.365E-05	1.099E-03	1.270E-06
Residual	4.847E-07	6.327E-05	3.693E-03	7.025E-06
Total	1.295E-05	2.975E-03	1.561E-02	2.272E-05

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* NUCLIDE U-234 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	5.106E-06	2.526E-05	3.577E+05	1.235E+02
B Surfac	1.453E-04	7.211E-04	2.318E+06	1.421E+03
Breasts	5.106E-06	2.526E-05	1.678E+06	1.911E+03
St Wall	5.310E-06	2.531E-05	4.310E+05	1.526E+02
ULI Wall	8.125E-06	2.600E-05	3.565E+05	1.117E+02
Kidneys	5.306E-05	2.638E-04	4.765E+05	2.085E+02
Lungs	5.106E-06	5.036E-03	5.103E+05	1.631E+02
Ovaries	5.106E-06	2.526E-05	3.076E+05	1.666E+02
R Marrow	1.500E-05	7.448E-05	4.893E+05	2.575E+02
Spleen	5.106E-06	2.526E-05	4.264E+05	1.316E+02
Thymus	5.106E-06	2.526E-05	5.184E+05	1.934E+02
Uterus	5.106E-06	2.526E-05	3.157E+05	1.029E+02
Bld Wall	5.125E-06	2.534E-05	4.078E+05	1.596E+02
Brain	5.106E-06	2.526E-05	4.742E+05	1.069E+02
Esophagu	5.106E-06	1.117E-03	3.122E+05	8.574E+01
SI Wall	5.606E-06	2.539E-05	3.274E+05	1.033E+02
LLI Wall	1.395E-05	2.741E-05	3.320E+05	1.114E+02
Liver	1.989E-05	9.879E-05	4.357E+05	1.456E+02
Muscle	5.106E-06	2.526E-05	8.889E+05	1.200E+03
Pancreas	5.106E-06	2.526E-05	3.146E+05	9.541E+01
Skin	5.106E-06	2.526E-05	4.951E+06	1.059E+04
Testes	5.106E-06	2.526E-05	1.024E+06	1.456E+03
Thyroid	5.106E-06	2.526E-05	7.794E+05	3.740E+02
EFFEC	1.832E-04	1.287E-02	7.141E+05	6.827E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	7.955E-08	3.504E-07	3.588E-04	9.868E-08
Stomach	2.268E-07	8.214E-07	1.736E-03	6.163E-07
Colon	2.505E-06	2.135E-06	3.577E-03	1.152E-06
Liver	5.550E-07	2.379E-06	6.606E-04	2.202E-07
LUNG	5.624E-07	1.058E-03	4.986E-03	1.596E-06
Bone	3.456E-07	1.513E-06	2.202E-04	1.351E-07
Skin	5.735E-09	2.349E-08	4.940E-04	1.057E-06
Breast	1.106E-07	4.625E-07	8.108E-03	9.227E-06
Ovary	9.065E-08	4.181E-07	4.380E-04	2.365E-07
Bladder	1.950E-07	8.288E-07	9.856E-04	3.856E-07
Kidneys	6.364E-07	2.738E-06	2.481E-04	1.085E-07
Thyroid	1.617E-08	6.586E-08	2.481E-04	1.188E-07
Leukemia	8.917E-08	3.885E-07	2.749E-03	1.445E-06
Residual	7.215E-07	2.834E-06	7.747E-03	7.037E-06
Total	6.142E-06	1.073E-03	3.250E-02	2.342E-05

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* NUCLIDE Th-230 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.515E-06	5.602E-05	1.212E+06	3.320E+02
B Surfac	2.270E-03	5.158E-02	6.163E+06	1.922E+03
Breasts	2.515E-06	5.602E-05	2.773E+06	1.549E+03
St Wall	2.714E-06	5.609E-05	1.410E+06	3.786E+02
ULI Wall	5.535E-06	5.702E-05	1.212E+06	3.437E+02
Kidneys	3.424E-05	8.055E-04	1.480E+06	4.054E+02
Lungs	2.515E-06	1.417E-02	1.666E+06	4.101E+02
Ovaries	1.831E-05	4.203E-04	1.057E+06	3.751E+02
R Marrow	7.822E-05	1.856E-03	1.421E+06	4.357E+02
Spleen	2.515E-06	5.602E-05	1.433E+06	3.740E+02
Thymus	2.515E-06	5.602E-05	1.596E+06	4.101E+02
Uterus	2.515E-06	5.602E-05	1.089E+06	3.250E+02
Bld Wall	2.515E-06	5.602E-05	1.328E+06	3.798E+02
Brain	2.515E-06	5.602E-05	1.608E+06	3.355E+02
Esophagu	2.515E-06	6.564E-03	1.090E+06	2.808E+02
SI Wall	3.013E-06	5.620E-05	1.128E+06	3.262E+02
LLI Wall	1.137E-05	5.890E-05	1.142E+06	3.402E+02
Liver	2.943E-05	6.808E-04	1.433E+06	3.786E+02
Muscle	2.515E-06	5.602E-05	1.876E+06	1.096E+03
Pancreas	2.515E-06	5.602E-05	1.094E+06	3.134E+02
Skin	2.515E-06	5.602E-05	5.254E+06	8.353E+03
Testes	1.864E-05	4.277E-04	2.097E+06	1.223E+03
Thyroid	2.515E-06	5.602E-05	1.899E+06	5.196E+02
EFFEC	7.911E-04	5.173E-02	1.736E+06	7.421E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.292E-08	7.067E-07	1.258E-03	3.227E-07
Stomach	1.399E-07	1.473E-06	5.697E-03	1.526E-06
Colon	2.335E-06	3.334E-06	1.223E-02	3.530E-06
Liver	7.326E-07	1.206E-05	2.167E-03	5.743E-07
LUNG	3.163E-07	2.579E-03	1.631E-02	4.008E-06
Bone	2.745E-06	5.180E-05	5.848E-04	1.829E-07
Skin	3.201E-09	4.403E-08	5.242E-04	8.330E-07
Breast	6.512E-08	8.140E-07	1.340E-02	7.491E-06
Ovary	3.774E-07	6.697E-06	1.503E-03	5.336E-07
Bladder	1.036E-07	1.698E-06	3.215E-03	9.180E-07
Kidneys	3.041E-07	5.069E-06	7.701E-04	2.109E-07
Thyroid	9.324E-09	1.199E-07	6.046E-04	1.654E-07
Leukemia	4.181E-07	7.178E-06	7.980E-03	2.446E-06
Residual	4.144E-07	4.958E-06	2.074E-02	8.644E-06
Total	7.992E-06	2.675E-03	8.691E-02	3.134E-05

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* NUCLIDE Ra-226 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	7.267E-06	4.314E-06	2.714E+07	6.244E+03
B Surfac	2.302E-03	1.366E-03	9.262E+07	1.584E+04
Breasts	7.267E-06	4.314E-06	4.124E+07	7.596E+03
St Wall	7.474E-06	4.366E-06	2.982E+07	6.687E+03
ULI Wall	1.178E-05	5.809E-06	2.726E+07	6.477E+03
Kidneys	1.083E-05	6.394E-06	3.041E+07	6.652E+03
Lungs	7.267E-06	5.087E-03	3.437E+07	7.060E+03
Ovaries	7.267E-06	4.314E-06	2.516E+07	6.303E+03
R Marrow	1.601E-04	9.513E-05	3.146E+07	6.932E+03
Spleen	9.846E-06	5.831E-06	3.052E+07	6.745E+03
Thymus	7.267E-06	4.314E-06	3.262E+07	6.408E+03
Uterus	7.267E-06	4.314E-06	2.540E+07	6.314E+03
Bld Wall	7.274E-06	4.322E-06	2.819E+07	6.617E+03
Brain	7.267E-06	4.314E-06	3.507E+07	6.454E+03
Esophagu	7.267E-06	1.150E-03	2.621E+07	5.732E+03
SI Wall	7.729E-06	4.444E-06	2.586E+07	6.268E+03
LLI Wall	2.539E-05	1.035E-05	2.610E+07	6.477E+03
Liver	3.299E-05	1.959E-05	3.052E+07	6.675E+03
Muscle	7.267E-06	4.314E-06	3.367E+07	7.584E+03
Pancreas	7.267E-06	4.314E-06	2.575E+07	6.058E+03
Skin	7.267E-06	4.314E-06	5.580E+07	9.460E+03
Testes	7.267E-06	4.314E-06	3.588E+07	7.736E+03
Thyroid	7.267E-06	4.314E-06	3.600E+07	7.060E+03
EFFEC	1.035E-03	1.281E-02	3.309E+07	7.118E+03

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.135E-07	9.509E-08	3.017E-02	6.594E-06
Stomach	8.473E-07	3.101E-07	1.200E-01	2.703E-05
Colon	6.438E-06	1.935E-06	2.761E-01	6.687E-05
Liver	1.654E-06	6.956E-07	4.625E-02	1.011E-05
LUNG	1.954E-06	1.073E-03	3.355E-01	6.908E-05
Bone	8.917E-06	3.511E-06	8.796E-03	1.503E-06
Skin	1.998E-08	7.696E-09	5.569E-03	9.436E-07
Breast	4.736E-07	1.765E-07	1.992E-01	3.670E-05
Ovary	2.523E-07	1.158E-07	3.577E-02	8.970E-06
Bladder	4.736E-07	2.087E-07	6.815E-02	1.596E-05
Kidneys	1.832E-07	7.252E-08	1.584E-02	3.460E-06
Thyroid	6.401E-08	2.327E-08	1.146E-02	2.248E-06
Leukemia	1.820E-06	7.696E-07	1.771E-01	3.891E-05
Residual	1.206E-05	4.625E-06	4.299E-01	9.868E-05
Total	3.537E-05	1.084E-03	1.759E+00	3.868E-04

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* NUCLIDE Rn-222 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	1.806E+06	3.879E+02
B Surfac	0.000E+00	0.000E+00	3.856E+06	6.745E+02
Breasts	0.000E+00	0.000E+00	2.493E+06	4.637E+02
St Wall	0.000E+00	0.000E+00	1.922E+06	4.124E+02
ULI Wall	0.000E+00	0.000E+00	1.782E+06	4.101E+02
Kidneys	0.000E+00	0.000E+00	1.934E+06	4.159E+02
Lungs	0.000E+00	0.000E+00	2.167E+06	4.404E+02
Ovaries	0.000E+00	0.000E+00	1.619E+06	4.392E+02
R Marrow	0.000E+00	0.000E+00	2.085E+06	4.439E+02
Spleen	0.000E+00	0.000E+00	1.957E+06	4.147E+02
Thymus	0.000E+00	0.000E+00	2.004E+06	4.229E+02
Uterus	0.000E+00	0.000E+00	1.666E+06	4.019E+02
Bld Wall	0.000E+00	0.000E+00	1.806E+06	4.229E+02
Brain	0.000E+00	0.000E+00	2.307E+06	4.136E+02
Esophagu	0.000E+00	0.000E+00	1.771E+06	3.740E+02
SI Wall	0.000E+00	0.000E+00	1.713E+06	4.019E+02
LLI Wall	0.000E+00	0.000E+00	1.736E+06	4.171E+02
Liver	0.000E+00	0.000E+00	1.946E+06	4.147E+02
Muscle	0.000E+00	0.000E+00	2.109E+06	4.753E+02
Pancreas	0.000E+00	0.000E+00	1.689E+06	3.798E+02
Skin	0.000E+00	0.000E+00	2.656E+06	6.058E+02
Testes	0.000E+00	0.000E+00	2.179E+06	4.835E+02
Thyroid	0.000E+00	0.000E+00	2.214E+06	4.602E+02
EFFEC	0.000E+00	0.000E+00	2.074E+06	4.450E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	2.039E-03	4.299E-07
Stomach	0.000E+00	0.000E+00	7.759E-03	1.666E-06
Colon	0.000E+00	0.000E+00	1.817E-02	4.264E-06
Liver	0.000E+00	0.000E+00	2.947E-03	6.291E-07
LUNG	0.000E+00	0.000E+00	2.120E-02	4.310E-06
Bone	0.000E+00	0.000E+00	3.658E-04	6.407E-08
Skin	0.000E+00	0.000E+00	2.645E-04	6.046E-08
Breast	0.000E+00	0.000E+00	1.200E-02	2.237E-06
Ovary	0.000E+00	0.000E+00	2.307E-03	6.244E-07
Bladder	0.000E+00	0.000E+00	4.369E-03	1.023E-06
Kidneys	0.000E+00	0.000E+00	1.007E-03	2.167E-07
Thyroid	0.000E+00	0.000E+00	7.048E-04	1.468E-07
Leukemia	0.000E+00	0.000E+00	1.165E-02	2.493E-06
Residual	0.000E+00	0.000E+00	2.784E-02	6.163E-06
Total	0.000E+00	0.000E+00	1.127E-01	2.435E-05

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* NUCLIDE Pu-239 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.684E-06	5.051E-04	2.330E+05	6.978E+01
B Surfac	1.523E-03	2.870E-01	1.103E+06	6.769E+02
Breasts	2.684E-06	5.051E-04	8.796E+05	9.052E+02
St Wall	2.904E-06	5.051E-04	2.680E+05	8.679E+01
ULI Wall	6.013E-06	5.062E-04	2.307E+05	6.396E+01
Kidneys	6.253E-06	1.181E-03	2.901E+05	1.212E+02
Lungs	2.684E-06	6.168E-03	3.087E+05	9.169E+01
Ovaries	1.995E-05	3.763E-03	2.039E+05	9.134E+01
R Marrow	7.241E-05	1.367E-02	3.111E+05	1.398E+02
Spleen	2.684E-06	5.051E-04	2.656E+05	7.351E+01
Thymus	2.684E-06	5.051E-04	3.111E+05	1.115E+02
Uterus	2.684E-06	5.051E-04	2.097E+05	5.907E+01
Bld Wall	2.684E-06	5.051E-04	2.540E+05	9.180E+01
Brain	2.684E-06	5.051E-04	3.006E+05	6.093E+01
Esophagu	2.684E-06	1.654E-03	2.155E+05	5.091E+01
SI Wall	3.233E-06	5.054E-04	2.167E+05	5.976E+01
LLI Wall	1.244E-05	5.076E-04	2.190E+05	6.361E+01
Liver	3.194E-04	6.024E-02	2.703E+05	8.260E+01
Muscle	2.684E-06	5.051E-04	4.916E+05	5.650E+02
Pancreas	2.684E-06	5.051E-04	2.109E+05	5.452E+01
Skin	2.684E-06	5.051E-04	2.167E+06	4.276E+03
Testes	2.031E-05	3.829E-03	5.639E+05	7.153E+02
Thyroid	2.684E-06	5.051E-04	4.520E+05	2.074E+02
EFFEC	9.276E-04	1.855E-01	4.066E+05	3.309E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.810E-08	7.437E-06	2.481E-04	5.860E-08
Stomach	1.613E-07	1.850E-05	1.082E-03	3.507E-07
Colon	2.586E-06	4.033E-05	2.330E-03	6.594E-07
Liver	6.956E-06	1.103E-03	4.101E-04	1.247E-07
LUNG	3.693E-07	1.243E-03	3.017E-03	8.970E-07
Bone	1.798E-06	3.019E-04	1.047E-04	6.431E-08
Skin	3.689E-09	5.143E-07	2.167E-04	4.264E-07
Breast	7.733E-08	1.051E-05	4.252E-03	4.369E-06
Ovary	3.681E-07	6.364E-05	2.901E-04	1.305E-07
Bladder	1.147E-07	1.735E-05	6.140E-04	2.225E-07
Kidneys	6.401E-08	9.731E-06	1.514E-04	6.303E-08
Thyroid	1.103E-08	1.480E-06	1.445E-04	6.606E-08
Leukemia	3.500E-07	5.550E-05	1.747E-03	7.852E-07
Residual	4.884E-07	6.438E-05	4.637E-03	3.425E-06
Total	1.343E-05	2.938E-03	1.922E-02	1.164E-05

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* NUCLIDE U-235 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	4.717E-06	2.334E-05	6.198E+08	1.421E+05
B Surfac	1.366E-04	6.778E-04	2.144E+09	3.658E+05
Breasts	4.717E-06	2.334E-05	9.448E+08	1.759E+05
St Wall	4.906E-06	2.339E-05	6.815E+08	1.526E+05
ULI Wall	7.507E-06	2.402E-05	6.221E+08	1.480E+05
Kidneys	4.899E-05	2.437E-04	6.943E+08	1.514E+05
Lungs	4.717E-06	4.444E-03	7.864E+08	1.608E+05
Ovaries	4.717E-06	2.334E-05	5.743E+08	1.433E+05
R Marrow	1.386E-05	6.878E-05	7.165E+08	1.584E+05
Spleen	4.717E-06	2.334E-05	6.967E+08	1.538E+05
Thymus	4.717E-06	2.334E-05	7.444E+08	1.456E+05
Uterus	4.717E-06	2.334E-05	5.790E+08	1.445E+05
Bld Wall	4.736E-06	2.342E-05	6.454E+08	1.514E+05
Brain	4.717E-06	2.334E-05	8.004E+08	1.468E+05
Esophagu	4.717E-06	1.025E-03	5.988E+08	1.305E+05
SI Wall	5.180E-06	2.345E-05	5.907E+08	1.433E+05
LLI Wall	1.289E-05	2.533E-05	5.965E+08	1.480E+05
Liver	1.837E-05	9.128E-05	6.967E+08	1.526E+05
Muscle	4.717E-06	2.334E-05	7.689E+08	1.748E+05
Pancreas	4.717E-06	2.334E-05	5.872E+08	1.386E+05
Skin	4.717E-06	2.334E-05	1.007E+09	2.260E+05
Testes	4.717E-06	2.334E-05	8.213E+08	1.782E+05
Thyroid	4.717E-06	2.334E-05	8.213E+08	1.619E+05
EFFEC	1.728E-04	1.142E-02	7.549E+08	1.631E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	7.400E-08	3.275E-07	6.885E-01	1.503E-04
Stomach	2.124E-07	7.659E-07	2.749E+00	6.163E-04
Colon	2.608E-06	2.057E-06	6.314E+00	1.526E-03
Liver	5.143E-07	2.205E-06	1.055E+00	2.318E-04
LUNG	5.217E-07	9.398E-04	7.689E+00	1.573E-03
Bone	3.238E-07	1.417E-06	2.039E-01	3.472E-05
Skin	5.328E-09	2.183E-08	1.004E-01	2.260E-05
Breast	1.032E-07	4.366E-07	4.567E+00	8.493E-04
Ovary	8.621E-08	3.922E-07	8.167E-01	2.039E-04
Bladder	1.817E-07	7.696E-07	1.561E+00	3.658E-04
Kidneys	5.883E-07	2.535E-06	3.611E-01	7.875E-05
Thyroid	1.502E-08	6.142E-08	2.610E-01	5.161E-05
Leukemia	1.029E-07	4.514E-07	4.019E+00	8.889E-04
Residual	6.734E-07	2.657E-06	9.798E+00	2.260E-03
Total	5.994E-06	9.509E-04	4.019E+01	8.854E-03

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* NUCLIDE Th-231 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	9.176E-13	2.142E-11	3.658E+07	1.003E+04
B Surfac	4.122E-10	9.901E-09	1.899E+08	5.569E+04
Breasts	9.176E-13	2.142E-11	7.910E+07	3.204E+04
St Wall	9.180E-13	2.142E-11	4.287E+07	1.188E+04
ULI Wall	1.142E-12	2.466E-11	3.693E+07	1.051E+04
Kidneys	5.587E-12	1.405E-10	4.543E+07	1.340E+04
Lungs	9.176E-13	2.352E-09	5.068E+07	1.305E+04
Ovaries	3.529E-12	8.510E-11	3.180E+07	1.031E+04
R Marrow	1.518E-11	3.904E-10	4.310E+07	1.258E+04
Spleen	9.209E-13	2.150E-11	4.334E+07	1.177E+04
Thymus	9.176E-13	2.142E-11	4.893E+07	1.305E+04
Uterus	9.176E-13	2.142E-11	3.309E+07	9.716E+03
Bld Wall	9.187E-13	2.145E-11	4.043E+07	1.223E+04
Brain	9.176E-13	2.142E-11	4.835E+07	1.004E+04
Esophagu	9.176E-13	8.706E-10	3.297E+07	8.376E+03
SI Wall	9.231E-13	2.143E-11	3.425E+07	9.833E+03
LLI Wall	1.775E-12	3.058E-11	3.448E+07	1.019E+04
Liver	1.075E-11	2.742E-10	4.357E+07	1.188E+04
Muscle	9.176E-13	2.142E-11	5.534E+07	2.388E+04
Pancreas	9.176E-13	2.142E-11	3.297E+07	9.204E+03
Skin	9.176E-13	2.142E-11	2.936E+08	9.996E+04
Testes	3.582E-12	8.636E-11	6.279E+07	2.819E+04
Thyroid	9.176E-13	2.142E-11	5.825E+07	1.643E+04
EFFEC	1.243E-06	1.236E-06	5.347E+07	1.817E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.956E-13	4.366E-12	3.798E-02	9.635E-06
Stomach	4.255E-09	8.288E-10	1.736E-01	4.800E-05
Colon	1.750E-07	3.374E-08	3.705E-01	1.071E-04
Liver	9.250E-12	1.036E-11	6.606E-02	1.806E-05
LUNG	9.731E-12	8.473E-08	4.951E-01	1.282E-04
Bone	2.253E-12	1.040E-11	1.806E-02	5.289E-06
Skin	1.676E-13	1.025E-13	2.924E-02	9.972E-06
Breast	2.549E-12	1.513E-11	3.821E-01	1.549E-04
Ovary	1.365E-10	2.990E-11	4.520E-02	1.468E-05
Bladder	3.693E-11	7.881E-12	9.774E-02	2.959E-05
Kidneys	3.548E-12	1.928E-12	2.365E-02	6.967E-06
Thyroid	5.180E-14	4.144E-13	1.852E-02	5.231E-06
Leukemia	4.847E-11	1.965E-11	2.423E-01	7.060E-05
Residual	1.058E-10	6.290E-11	6.198E-01	2.144E-04
Total	1.798E-07	1.195E-07	2.621E+00	8.213E-04

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* NUCLIDE Pa-231 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	1.033E-05	1.951E-03	1.526E+08	3.472E+04
B Surfac	4.640E-03	8.776E-01	4.241E+08	8.341E+04
Breasts	1.033E-05	1.951E-03	2.318E+08	5.627E+04
St Wall	1.054E-05	1.951E-03	1.654E+08	3.740E+04
ULI Wall	1.493E-05	2.216E-03	1.514E+08	3.600E+04
Kidneys	6.290E-05	1.193E-02	1.678E+08	3.833E+04
Lungs	1.033E-05	7.437E-03	1.887E+08	3.973E+04
Ovaries	3.974E-05	7.518E-03	1.386E+08	3.740E+04
R Marrow	1.709E-04	3.245E-02	1.771E+08	4.008E+04
Spleen	1.036E-05	1.958E-03	1.689E+08	3.740E+04
Thymus	1.033E-05	1.951E-03	1.771E+08	3.775E+04
Uterus	1.033E-05	1.951E-03	1.410E+08	3.495E+04
Bld Wall	1.034E-05	1.954E-03	1.561E+08	3.763E+04
Brain	1.033E-05	1.951E-03	1.957E+08	3.600E+04
Esophagu	1.033E-05	3.155E-03	1.491E+08	3.180E+04
SI Wall	1.086E-05	1.951E-03	1.445E+08	3.483E+04
LLI Wall	2.365E-05	2.696E-03	1.468E+08	3.600E+04
Liver	1.210E-04	2.298E-02	1.678E+08	3.740E+04
Muscle	1.033E-05	1.951E-03	1.876E+08	5.079E+04
Pancreas	1.033E-05	1.951E-03	1.445E+08	3.320E+04
Skin	1.033E-05	1.951E-03	2.843E+08	1.247E+05
Testes	4.033E-05	7.629E-03	1.992E+08	5.417E+04
Thyroid	1.033E-05	1.951E-03	1.980E+08	4.299E+04
EFFEC	1.772E-03	3.458E-01	1.829E+08	4.404E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	1.469E-07	2.283E-05	1.713E-01	3.658E-05
Stomach	3.293E-07	4.218E-05	6.675E-01	1.514E-04
Colon	3.019E-06	9.250E-05	1.538E+00	3.716E-04
Liver	2.527E-06	3.885E-04	2.540E-01	5.662E-05
LUNG	9.509E-07	1.299E-03	1.841E+00	3.879E-04
Bone	5.254E-06	8.695E-04	4.031E-02	7.922E-06
Skin	9.287E-09	1.336E-06	2.831E-02	1.247E-05
Breast	1.661E-07	2.372E-05	1.120E+00	2.714E-04
Ovary	7.326E-07	1.221E-04	1.969E-01	5.324E-05
Bladder	3.700E-07	5.624E-05	3.775E-01	9.099E-05
Kidneys	5.069E-07	7.807E-05	8.726E-02	1.992E-05
Thyroid	2.542E-08	3.630E-06	6.303E-02	1.363E-05
Leukemia	8.140E-07	1.288E-04	9.937E-01	2.248E-04
Residual	1.029E-06	1.391E-04	2.400E+00	5.895E-04
Total	1.587E-05	3.267E-03	9.798E+00	2.283E-03

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* NUCLIDE Ac-227 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	8.725E-06	1.635E-03	4.613E+05	1.121E+02
B Surfac	1.730E-03	3.250E-01	1.957E+06	4.322E+02
Breasts	8.725E-06	1.635E-03	8.132E+05	2.470E+02
St Wall	8.728E-06	1.635E-03	5.208E+05	1.235E+02
ULI Wall	1.001E-05	1.845E-03	4.648E+05	1.177E+02
Kidneys	1.313E-05	2.511E-03	5.371E+05	1.270E+02
Lungs	8.725E-06	2.066E-02	6.081E+05	1.328E+02
Ovaries	3.455E-05	6.479E-03	4.171E+05	1.162E+02
R Marrow	9.080E-05	1.711E-02	5.347E+05	1.316E+02
Spleen	8.773E-06	1.643E-03	5.312E+05	1.247E+02
Thymus	8.725E-06	1.635E-03	5.778E+05	1.235E+02
Uterus	8.725E-06	1.635E-03	4.264E+05	1.136E+02
Bld Wall	8.739E-06	1.637E-03	4.928E+05	1.247E+02
Brain	8.725E-06	1.635E-03	6.023E+05	1.155E+02
Esophagu	8.725E-06	6.601E-03	4.334E+05	1.018E+02
SI Wall	8.739E-06	1.635E-03	4.369E+05	1.125E+02
LLI Wall	1.295E-05	2.226E-03	4.415E+05	1.165E+02
Liver	3.737E-04	7.008E-02	5.324E+05	1.235E+02
Muscle	8.725E-06	1.635E-03	6.186E+05	2.027E+02
Pancreas	8.725E-06	1.635E-03	4.299E+05	1.087E+02
Skin	8.725E-06	1.635E-03	1.282E+06	8.656E+02
Testes	3.431E-05	6.434E-03	6.734E+05	2.202E+02
Thyroid	8.725E-06	1.635E-03	6.524E+05	1.456E+02
EFFEC	1.194E-03	2.695E-01	5.976E+05	1.643E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	1.506E-07	2.394E-05	4.986E-04	1.177E-07
Stomach	4.107E-07	5.698E-05	2.097E-03	4.986E-07
Colon	1.391E-06	1.443E-04	4.695E-03	1.212E-06
Liver	1.066E-05	1.724E-03	8.073E-04	1.876E-07
LUNG	1.084E-06	4.218E-03	5.942E-03	1.293E-06
Bone	2.549E-06	4.218E-04	1.864E-04	4.101E-08
Skin	1.128E-08	1.624E-06	1.282E-04	8.633E-08
Breast	2.264E-07	3.193E-05	3.926E-03	1.188E-06
Ovary	7.067E-07	1.221E-04	5.930E-04	1.654E-07
Bladder	3.585E-07	5.550E-05	1.188E-03	3.017E-07
Kidneys	1.384E-07	2.168E-05	2.796E-04	6.606E-08
Thyroid	3.201E-08	4.477E-06	2.074E-04	4.637E-08
Leukemia	5.661E-07	8.769E-05	3.006E-03	7.386E-07
Residual	1.476E-06	1.991E-04	7.491E-03	2.097E-06
Total	1.976E-05	7.104E-03	3.111E-02	8.050E-06

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* NUCLIDE Sr-90 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.457E-06	1.273E-07	5.441E+05	1.957E+02
B Surfac	1.511E-03	6.997E-05	2.656E+06	9.681E+02
Breasts	2.457E-06	1.273E-07	1.106E+06	4.078E+02
St Wall	3.335E-06	8.447E-07	6.326E+05	2.318E+02
ULI Wall	2.165E-05	1.310E-05	5.429E+05	2.050E+02
Kidneys	2.457E-06	1.273E-07	6.745E+05	2.516E+02
Lungs	2.457E-06	4.773E-03	7.503E+05	2.551E+02
Ovaries	2.457E-06	1.273E-07	4.695E+05	1.864E+02
R Marrow	6.627E-04	3.127E-05	6.338E+05	2.248E+02
Spleen	2.457E-06	1.273E-07	6.396E+05	2.318E+02
Thymus	2.457E-06	1.273E-07	7.246E+05	2.458E+02
Uterus	2.457E-06	1.273E-07	4.835E+05	1.887E+02
Bld Wall	5.487E-06	3.260E-07	5.965E+05	2.330E+02
Brain	2.457E-06	1.273E-07	7.200E+05	2.004E+02
Esophagu	2.457E-06	1.611E-04	4.835E+05	1.608E+02
SI Wall	4.196E-06	1.986E-06	5.010E+05	1.911E+02
LLI Wall	8.103E-05	4.444E-05	5.068E+05	1.981E+02
Liver	2.457E-06	1.273E-07	6.442E+05	2.318E+02
Muscle	2.457E-06	1.274E-07	7.957E+05	3.390E+02
Pancreas	2.457E-06	1.273E-07	4.835E+05	1.782E+02
Skin	2.457E-06	1.273E-07	1.072E+09	1.631E+05
Testes	2.457E-06	1.273E-07	9.064E+05	3.879E+02
Thyroid	2.457E-06	1.273E-07	8.539E+05	2.901E+02
EFFEC	1.024E-04	5.805E-04	1.145E+07	1.911E+03

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.070E-09	1.387E-10	5.557E-04	1.852E-07
Stomach	2.190E-08	3.848E-09	2.551E-03	9.355E-07
Colon	8.251E-07	3.811E-07	5.441E-03	2.085E-06
Liver	5.624E-09	1.876E-10	9.763E-04	3.518E-07
LUNG	4.144E-08	3.959E-05	7.340E-03	2.493E-06
Bone	2.176E-07	6.697E-09	2.516E-04	9.192E-08
Skin	4.107E-10	1.151E-11	1.069E-01	1.631E-05
Breast	2.028E-08	5.291E-10	5.336E-03	1.969E-06
Ovary	4.736E-09	1.669E-10	6.675E-04	2.656E-07
Bladder	1.880E-08	7.585E-10	1.445E-03	5.639E-07
Kidneys	1.950E-09	6.438E-11	3.507E-04	1.305E-07
Thyroid	1.391E-09	3.533E-11	2.714E-04	9.238E-08
Leukemia	4.773E-06	1.606E-07	3.553E-03	1.258E-06
Residual	6.475E-08	1.665E-09	9.040E-03	3.542E-06
Total	5.994E-06	3.996E-05	1.445E-01	3.029E-05

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* NUCLIDE Y-90 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	4.769E-11	1.324E-08	1.631E+07	4.707E+03
B Surfac	1.379E-09	3.829E-07	5.173E+07	1.363E+04
Breasts	4.769E-11	1.324E-08	2.563E+07	6.664E+03
St Wall	3.948E-06	7.903E-07	1.794E+07	5.173E+03
ULI Wall	5.010E-05	1.003E-05	1.631E+07	4.940E+03
Kidneys	4.773E-11	1.324E-08	1.841E+07	5.312E+03
Lungs	4.769E-11	2.566E-05	2.062E+07	5.545E+03
Ovaries	5.280E-11	1.324E-08	1.491E+07	4.858E+03
R Marrow	1.379E-09	3.826E-07	1.887E+07	5.324E+03
Spleen	4.773E-11	1.324E-08	1.829E+07	5.208E+03
Thymus	4.769E-11	1.324E-08	1.946E+07	5.219E+03
Uterus	4.780E-11	1.324E-08	1.503E+07	4.753E+03
Bld Wall	2.242E-10	6.220E-08	1.689E+07	5.208E+03
Brain	4.769E-11	1.324E-08	2.109E+07	4.916E+03
Esophagu	4.769E-11	3.785E-06	1.561E+07	4.287E+03
SI Wall	9.457E-06	1.874E-06	1.538E+07	4.765E+03
LLI Wall	1.166E-04	2.332E-05	1.561E+07	4.940E+03
Liver	1.353E-09	3.756E-07	1.829E+07	5.184E+03
Muscle	4.788E-11	1.324E-08	2.050E+07	6.326E+03
Pancreas	4.777E-11	1.324E-08	1.514E+07	4.520E+03
Skin	4.773E-11	1.324E-08	7.270E+09	1.223E+07
Testes	4.769E-11	1.324E-08	2.202E+07	6.699E+03
Thyroid	4.769E-11	1.324E-08	2.179E+07	5.848E+03
EFFEC	9.942E-06	5.147E-06	9.238E+07	1.282E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	7.918E-14	1.846E-11	1.794E-02	4.928E-06
Stomach	2.316E-08	4.403E-09	7.246E-02	2.085E-05
Colon	1.443E-06	2.731E-07	1.654E-01	5.103E-05
Liver	2.986E-12	6.882E-10	2.773E-02	7.852E-06
LUNG	8.436E-13	2.675E-07	2.015E-01	5.417E-05
Bone	1.735E-13	4.181E-11	4.916E-03	1.293E-06
Skin	8.399E-15	1.732E-12	7.258E-01	1.223E-03
Breast	4.144E-13	8.658E-11	1.235E-01	3.215E-05
Ovary	1.058E-13	2.239E-11	2.120E-02	6.908E-06
Bladder	6.882E-13	1.695E-10	4.089E-02	1.258E-05
Kidneys	3.811E-14	8.547E-12	9.576E-03	2.761E-06
Thyroid	2.901E-14	5.772E-12	6.932E-03	1.864E-06
Leukemia	1.399E-11	2.942E-09	1.059E-01	2.994E-05
Residual	1.295E-12	2.631E-10	2.575E-01	7.712E-05
Total	1.465E-06	5.476E-07	1.782E+00	1.526E-03

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* NUCLIDE Cs-137 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	5.195E-05	1.763E-05	5.697E+05	2.004E+02
B Surfac	5.091E-05	1.729E-05	2.668E+06	9.495E+02
Breasts	4.148E-05	1.407E-05	1.127E+06	4.043E+02
St Wall	4.958E-05	1.652E-05	6.582E+05	2.353E+02
ULI Wall	5.343E-05	1.807E-05	5.697E+05	2.097E+02
Kidneys	4.991E-05	1.693E-05	6.990E+05	2.540E+02
Lungs	4.692E-05	1.602E-05	7.782E+05	2.586E+02
Ovaries	5.298E-05	1.797E-05	4.940E+05	1.934E+02
R Marrow	4.854E-05	1.649E-05	6.640E+05	2.295E+02
Spleen	4.995E-05	1.694E-05	6.664E+05	2.353E+02
Thymus	4.847E-05	1.648E-05	7.491E+05	2.481E+02
Uterus	5.347E-05	1.814E-05	5.091E+05	1.946E+02
Bld Wall	5.354E-05	1.816E-05	6.209E+05	2.365E+02
Brain	4.359E-05	1.482E-05	7.526E+05	2.050E+02
Esophagu	4.836E-05	2.747E-05	5.114E+05	1.666E+02
SI Wall	5.187E-05	1.759E-05	5.266E+05	1.957E+02
LLI Wall	6.186E-05	2.086E-05	5.336E+05	2.039E+02
Liver	5.025E-05	1.705E-05	6.710E+05	2.353E+02
Muscle	4.640E-05	1.577E-05	8.202E+05	3.390E+02
Pancreas	5.332E-05	1.808E-05	5.103E+05	1.829E+02
Skin	3.966E-05	1.346E-05	1.005E+09	3.204E+05
Testes	4.651E-05	1.578E-05	9.273E+05	3.856E+02
Thyroid	4.836E-05	1.644E-05	8.796E+05	2.924E+02
EFFEC	5.017E-05	1.729E-05	1.081E+07	3.483E+03

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	5.180E-08	1.746E-08	5.883E-04	1.922E-07
Stomach	1.850E-07	5.698E-08	2.656E-03	9.506E-07
Colon	5.143E-07	1.576E-07	5.720E-03	2.144E-06
Liver	7.659E-08	2.457E-08	1.017E-03	3.565E-07
LUNG	3.811E-07	1.254E-07	7.607E-03	2.528E-06
Bone	4.662E-09	1.536E-09	2.528E-04	9.017E-08
Skin	3.589E-09	1.140E-09	1.003E-01	3.192E-05
Breast	1.528E-07	5.143E-08	5.441E-03	1.957E-06
Ovary	6.327E-08	2.257E-08	7.025E-04	2.749E-07
Bladder	1.325E-07	4.292E-08	1.503E-03	5.720E-07
Kidneys	2.612E-08	8.362E-09	3.635E-04	1.316E-07
Thyroid	1.258E-08	4.070E-09	2.796E-04	9.308E-08
Leukemia	2.649E-07	8.658E-08	3.728E-03	1.293E-06
Residual	6.771E-07	2.098E-07	9.425E-03	3.588E-06
Total	2.546E-06	8.103E-07	1.398E-01	4.613E-05

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* NUCLIDE Ba-137m *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	2.738E+09	5.837E+05
B Surfac	0.000E+00	0.000E+00	5.394E+09	9.635E+05
Breasts	0.000E+00	0.000E+00	3.751E+09	6.874E+05
St Wall	0.000E+00	0.000E+00	2.912E+09	6.186E+05
ULI Wall	0.000E+00	0.000E+00	2.714E+09	6.140E+05
Kidneys	0.000E+00	0.000E+00	2.924E+09	6.244E+05
Lungs	0.000E+00	0.000E+00	3.262E+09	6.536E+05
Ovaries	0.000E+00	0.000E+00	2.563E+09	6.291E+05
R Marrow	0.000E+00	0.000E+00	3.180E+09	6.641E+05
Spleen	0.000E+00	0.000E+00	2.959E+09	6.233E+05
Thymus	0.000E+00	0.000E+00	3.029E+09	6.163E+05
Uterus	0.000E+00	0.000E+00	2.540E+09	6.023E+05
Bld Wall	0.000E+00	0.000E+00	2.703E+09	6.233E+05
Brain	0.000E+00	0.000E+00	3.507E+09	6.163E+05
Esophagu	0.000E+00	0.000E+00	2.726E+09	5.592E+05
SI Wall	0.000E+00	0.000E+00	2.610E+09	6.046E+05
LLI Wall	0.000E+00	0.000E+00	2.668E+09	6.291E+05
Liver	0.000E+00	0.000E+00	2.947E+09	6.198E+05
Muscle	0.000E+00	0.000E+00	3.192E+09	7.083E+05
Pancreas	0.000E+00	0.000E+00	2.586E+09	5.697E+05
Skin	0.000E+00	0.000E+00	4.345E+09	1.922E+06
Testes	0.000E+00	0.000E+00	3.285E+09	7.188E+05
Thyroid	0.000E+00	0.000E+00	3.355E+09	6.839E+05
EFFEC	0.000E+00	0.000E+00	3.134E+09	6.734E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	3.134E+00	6.431E-04
Stomach	0.000E+00	0.000E+00	1.177E+01	2.493E-03
Colon	0.000E+00	0.000E+00	2.784E+01	6.407E-03
Liver	0.000E+00	0.000E+00	4.462E+00	9.390E-04
LUNG	0.000E+00	0.000E+00	3.192E+01	6.396E-03
Bone	0.000E+00	0.000E+00	5.126E-01	9.145E-05
Skin	0.000E+00	0.000E+00	4.334E-01	1.922E-04
Breast	0.000E+00	0.000E+00	1.817E+01	3.320E-03
Ovary	0.000E+00	0.000E+00	3.646E+00	8.947E-04
Bladder	0.000E+00	0.000E+00	6.536E+00	1.503E-03
Kidneys	0.000E+00	0.000E+00	1.526E+00	3.250E-04
Thyroid	0.000E+00	0.000E+00	1.068E+00	2.179E-04
Leukemia	0.000E+00	0.000E+00	1.782E+01	3.728E-03
Residual	0.000E+00	0.000E+00	4.229E+01	9.238E-03
Total	0.000E+00	0.000E+00	1.713E+02	3.635E-02

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* NUCLIDE U-233 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	5.254E-06	3.237E-06	1.212E+06	3.087E+02
B Surfac	1.551E-04	1.477E-04	4.800E+06	1.549E+03
Breasts	5.254E-06	3.237E-06	2.586E+06	1.491E+03
St Wall	5.461E-06	3.303E-06	1.351E+06	3.483E+02
ULI Wall	8.306E-06	4.244E-06	1.200E+06	3.122E+02
Kidneys	5.383E-05	3.673E-05	1.410E+06	3.891E+02
Lungs	5.254E-06	1.473E-02	1.573E+06	3.728E+02
Ovaries	5.280E-06	3.570E-06	1.078E+06	3.390E+02
R Marrow	1.553E-05	1.261E-05	1.445E+06	4.206E+02
Spleen	5.254E-06	3.238E-06	1.375E+06	3.379E+02
Thymus	5.254E-06	3.237E-06	1.503E+06	3.728E+02
Uterus	5.254E-06	3.237E-06	1.103E+06	2.982E+02
Bld Wall	5.272E-06	3.249E-06	1.282E+06	3.542E+02
Brain	5.254E-06	3.237E-06	1.561E+06	3.076E+02
Esophagu	5.254E-06	6.712E-03	1.132E+06	2.633E+02
SI Wall	5.757E-06	3.403E-06	1.132E+06	2.971E+02
LLI Wall	1.421E-05	6.198E-06	1.146E+06	3.099E+02
Liver	2.049E-05	1.564E-05	1.375E+06	3.448E+02
Muscle	5.254E-06	3.237E-06	1.794E+06	1.038E+03
Pancreas	5.254E-06	3.237E-06	1.115E+06	2.819E+02
Skin	5.254E-06	3.237E-06	5.324E+06	6.920E+03
Testes	5.280E-06	3.575E-06	1.969E+06	1.212E+03
Thyroid	5.254E-06	3.237E-06	1.806E+06	5.149E+02
EFFEC	1.897E-04	3.549E-02	1.654E+06	6.990E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	8.177E-08	3.996E-08	1.305E-03	3.029E-07
Stomach	2.309E-07	8.843E-08	5.452E-03	1.410E-06
Colon	2.523E-06	7.289E-07	1.212E-02	3.215E-06
Liver	5.698E-07	3.060E-07	2.085E-03	5.231E-07
LUNG	5.735E-07	2.686E-03	1.538E-02	3.646E-06
Bone	3.622E-07	2.168E-07	4.555E-04	1.468E-07
Skin	5.883E-09	2.497E-09	5.312E-04	6.908E-07
Breast	1.128E-07	4.588E-08	1.247E-02	7.200E-06
Ovary	9.435E-08	5.217E-08	1.538E-03	4.823E-07
Bladder	2.002E-07	9.694E-08	3.099E-03	8.563E-07
Kidneys	6.438E-07	3.127E-07	7.328E-04	2.027E-07
Thyroid	1.650E-08	6.771E-09	5.755E-04	1.643E-07
Leukemia	9.176E-08	5.365E-08	8.108E-03	2.365E-06
Residual	7.363E-07	2.775E-07	2.039E-02	8.085E-06
Total	6.253E-06	2.690E-03	8.435E-02	2.924E-05

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* NUCLIDE U-238 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	4.492E-06	2.648E-06	6.850E+04	4.520E+01
B Surfac	1.301E-04	8.321E-05	8.621E+05	9.425E+02
Breasts	4.492E-06	2.648E-06	9.949E+05	1.503E+03
St Wall	4.669E-06	2.706E-06	9.623E+04	6.151E+01
ULI Wall	7.145E-06	3.522E-06	6.559E+04	3.134E+01
Kidneys	4.666E-05	3.119E-05	1.247E+05	1.075E+02
Lungs	4.492E-06	1.214E-02	1.160E+05	6.512E+01
Ovaries	4.492E-06	2.649E-06	5.079E+04	8.050E+01
R Marrow	1.320E-05	8.469E-06	1.445E+05	1.491E+02
Spleen	4.492E-06	2.648E-06	8.738E+04	4.310E+01
Thymus	4.492E-06	2.648E-06	1.375E+05	9.600E+01
Uterus	4.492E-06	2.648E-06	5.324E+04	2.645E+01
Bld Wall	4.507E-06	2.658E-06	9.227E+04	6.687E+01
Brain	4.492E-06	2.648E-06	9.262E+04	2.843E+01
Esophagu	4.492E-06	5.705E-03	4.905E+04	1.876E+01
SI Wall	4.928E-06	2.792E-06	5.685E+04	2.738E+01
LLI Wall	1.228E-05	5.213E-06	5.790E+04	3.146E+01
Liver	1.749E-05	1.127E-05	9.436E+04	5.557E+01
Muscle	4.492E-06	2.648E-06	4.299E+05	9.134E+02
Pancreas	4.492E-06	2.648E-06	5.091E+04	2.283E+01
Skin	4.492E-06	2.648E-06	3.390E+06	8.644E+03
Testes	4.492E-06	2.648E-06	5.114E+05	1.124E+03
Thyroid	4.492E-06	2.648E-06	3.169E+05	2.377E+02
EFFEC	1.648E-04	2.973E-02	2.924E+05	4.940E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	7.067E-08	3.574E-08	5.639E-05	2.155E-08
Stomach	2.013E-07	7.992E-08	3.879E-04	2.481E-07
Colon	2.283E-06	7.622E-07	6.431E-04	3.239E-07
Liver	4.921E-07	2.368E-07	1.433E-04	8.423E-08
LUNG	4.995E-07	2.246E-03	1.135E-03	6.373E-07
Bone	3.104E-07	1.480E-07	8.190E-05	8.947E-08
Skin	5.106E-09	2.135E-09	3.378E-04	8.621E-07
Breast	9.953E-08	4.588E-08	4.811E-03	7.258E-06
Ovary	8.103E-08	4.033E-08	7.223E-05	1.145E-07
Bladder	1.732E-07	8.103E-08	2.237E-04	1.619E-07
Kidneys	5.624E-07	2.708E-07	6.489E-05	5.592E-08
Thyroid	1.436E-08	5.883E-09	1.009E-04	7.572E-08
Leukemia	1.502E-07	9.139E-08	8.108E-04	8.365E-07
Residual	6.401E-07	2.512E-07	2.726E-03	4.870E-06
Total	5.587E-06	2.246E-03	1.159E-02	1.561E-05

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* NUCLIDE Th-234 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.006E-13	1.020E-12	2.540E+07	6.652E+03
B Surfac	4.684E-12	2.988E-11	1.305E+08	3.064E+04
Breasts	2.006E-13	1.020E-12	4.695E+07	1.066E+04
St Wall	2.007E-13	1.025E-12	2.959E+07	7.607E+03
ULI Wall	2.184E-13	1.101E-12	2.563E+07	7.153E+03
Kidneys	3.101E-12	1.321E-11	3.087E+07	7.747E+03
Lungs	2.006E-13	3.132E-09	3.507E+07	8.283E+03
Ovaries	1.803E-12	3.357E-12	2.225E+07	6.792E+03
R Marrow	4.939E-13	3.067E-12	2.901E+07	7.456E+03
Spleen	2.006E-13	1.020E-12	3.017E+07	7.736E+03
Thymus	2.006E-13	1.020E-12	3.344E+07	7.794E+03
Uterus	2.006E-13	1.020E-12	2.307E+07	6.792E+03
Bld Wall	2.007E-13	1.023E-12	2.784E+07	7.666E+03
Brain	2.006E-13	1.020E-12	3.378E+07	6.967E+03
Esophagu	2.006E-13	1.722E-09	2.283E+07	5.965E+03
SI Wall	2.014E-13	1.033E-12	2.377E+07	6.780E+03
LLI Wall	3.193E-13	1.275E-12	2.412E+07	7.060E+03
Liver	5.946E-13	3.992E-12	3.017E+07	7.666E+03
Muscle	2.006E-13	1.020E-12	3.530E+07	9.670E+03
Pancreas	2.006E-13	1.020E-12	2.307E+07	6.524E+03
Skin	2.006E-13	1.020E-12	8.737E+07	2.004E+04
Testes	1.831E-12	3.398E-12	3.938E+07	1.037E+04
Thyroid	2.006E-13	1.020E-12	3.786E+07	8.551E+03
EFFEC	1.259E-05	2.847E-05	3.437E+07	8.738E+03

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.514E-12	8.806E-11	2.633E-02	6.862E-06
Stomach	2.187E-08	4.958E-09	1.200E-01	3.076E-05
Colon	1.854E-06	3.959E-07	2.575E-01	7.340E-05
Liver	5.809E-11	1.332E-10	4.578E-02	1.162E-05
LUNG	6.179E-11	2.227E-06	3.425E-01	8.097E-05
Bone	2.338E-11	3.101E-11	1.235E-02	2.912E-06
Skin	8.917E-13	1.728E-12	8.714E-03	2.004E-06
Breast	2.535E-11	3.252E-10	2.272E-01	5.149E-05
Ovary	2.035E-10	6.623E-11	3.169E-02	9.658E-06
Bladder	1.169E-10	3.774E-11	6.734E-02	1.852E-05
Kidneys	4.403E-11	5.661E-11	1.608E-02	4.031E-06
Thyroid	1.284E-12	9.805E-12	1.200E-02	2.726E-06
Leukemia	1.110E-09	1.262E-09	1.631E-01	4.182E-05
Residual	2.756E-10	7.992E-10	4.159E-01	1.134E-04
Total	1.876E-06	2.631E-06	1.748E+00	4.497E-04

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* NUCLIDE Pa-234m *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	6.652E+07	1.480E+04
B Surfac	0.000E+00	0.000E+00	1.445E+08	2.936E+04
Breasts	0.000E+00	0.000E+00	9.378E+07	1.817E+04
St Wall	0.000E+00	0.000E+00	7.176E+07	1.584E+04
ULI Wall	0.000E+00	0.000E+00	6.699E+07	1.561E+04
Kidneys	0.000E+00	0.000E+00	7.258E+07	1.608E+04
Lungs	0.000E+00	0.000E+00	8.085E+07	1.666E+04
Ovaries	0.000E+00	0.000E+00	6.571E+07	1.503E+04
R Marrow	0.000E+00	0.000E+00	7.806E+07	1.678E+04
Spleen	0.000E+00	0.000E+00	7.305E+07	1.596E+04
Thymus	0.000E+00	0.000E+00	7.584E+07	1.549E+04
Uterus	0.000E+00	0.000E+00	6.291E+07	1.515E+04
Bld Wall	0.000E+00	0.000E+00	6.664E+07	1.596E+04
Brain	0.000E+00	0.000E+00	8.586E+07	1.549E+04
Esophagu	0.000E+00	0.000E+00	6.710E+07	1.398E+04
SI Wall	0.000E+00	0.000E+00	6.466E+07	1.538E+04
LLI Wall	0.000E+00	0.000E+00	6.594E+07	1.596E+04
Liver	0.000E+00	0.000E+00	7.281E+07	1.584E+04
Muscle	0.000E+00	0.000E+00	7.922E+07	1.841E+04
Pancreas	0.000E+00	0.000E+00	6.373E+07	1.445E+04
Skin	0.000E+00	0.000E+00	6.384E+09	1.094E+07
Testes	0.000E+00	0.000E+00	8.213E+07	1.876E+04
Thyroid	0.000E+00	0.000E+00	8.365E+07	1.713E+04
EFFEC	0.000E+00	0.000E+00	1.410E+08	1.258E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	7.724E-02	1.608E-05
Stomach	0.000E+00	0.000E+00	2.901E-01	6.396E-05
Colon	0.000E+00	0.000E+00	6.874E-01	1.631E-04
Liver	0.000E+00	0.000E+00	1.103E-01	2.400E-05
LUNG	0.000E+00	0.000E+00	7.910E-01	1.631E-04
Bone	0.000E+00	0.000E+00	1.375E-02	2.784E-06
Skin	0.000E+00	0.000E+00	6.373E-01	1.092E-03
Breast	0.000E+00	0.000E+00	4.532E-01	8.784E-05
Ovary	0.000E+00	0.000E+00	9.343E-02	2.144E-05
Bladder	0.000E+00	0.000E+00	1.608E-01	3.856E-05
Kidneys	0.000E+00	0.000E+00	3.775E-02	8.365E-06
Thyroid	0.000E+00	0.000E+00	2.668E-02	5.452E-06
Leukemia	0.000E+00	0.000E+00	4.380E-01	9.413E-05
Residual	0.000E+00	0.000E+00	1.039E+00	2.365E-04
Total	0.000E+00	0.000E+00	4.858E+00	2.015E-03

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* NUCLIDE Pa-234 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	6.449E-15	1.119E-13	8.796E+09	1.841E+06
B Surfac	1.833E-13	2.994E-12	1.747E+10	3.122E+06
Breasts	6.449E-15	1.119E-13	1.212E+10	2.155E+06
St Wall	6.512E-15	1.120E-13	9.425E+09	1.957E+06
ULI Wall	1.341E-14	1.138E-13	8.842E+09	1.934E+06
Kidneys	7.012E-14	1.401E-12	9.506E+09	1.969E+06
Lungs	6.449E-15	1.553E-11	1.059E+10	2.050E+06
Ovaries	1.117E-14	4.651E-13	8.691E+09	1.887E+06
R Marrow	1.863E-14	3.053E-13	1.032E+10	2.085E+06
Spleen	6.449E-15	1.119E-13	9.611E+09	1.969E+06
Thymus	6.449E-15	1.119E-13	9.891E+09	1.899E+06
Uterus	6.449E-15	1.119E-13	8.318E+09	1.899E+06
Bld Wall	6.471E-15	1.122E-13	8.749E+09	1.957E+06
Brain	6.449E-15	1.119E-13	1.132E+10	1.934E+06
Esophagu	6.449E-15	3.517E-12	8.924E+09	1.759E+06
SI Wall	7.008E-15	1.121E-13	8.563E+09	1.911E+06
LLI Wall	3.227E-14	1.183E-13	8.726E+09	1.992E+06
Liver	2.422E-14	3.700E-13	9.565E+09	1.957E+06
Muscle	6.449E-15	1.119E-13	1.035E+10	2.225E+06
Pancreas	6.449E-15	1.119E-13	8.435E+09	1.806E+06
Skin	6.449E-15	1.119E-13	1.445E+10	4.532E+06
Testes	1.125E-14	4.714E-13	1.065E+10	2.248E+06
Thyroid	6.449E-15	1.119E-13	1.089E+10	2.097E+06
EFFEC	1.937E-06	1.444E-06	1.017E+10	2.097E+06

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	3.563E-11	1.528E-10	1.026E+01	2.027E-03
Stomach	1.650E-08	3.060E-09	3.810E+01	7.899E-03
Colon	1.850E-07	3.271E-08	9.075E+01	2.027E-02
Liver	4.551E-10	1.735E-10	1.445E+01	2.971E-03
LUNG	7.992E-10	6.364E-08	1.036E+02	2.004E-02
Bone	1.495E-11	1.839E-11	1.654E+00	2.959E-04
Skin	9.398E-12	4.810E-12	1.445E+00	4.520E-04
Breast	2.716E-10	4.440E-10	5.848E+01	1.042E-02
Ovary	2.087E-09	4.218E-10	1.235E+01	2.680E-03
Bladder	1.099E-09	2.290E-10	2.120E+01	4.730E-03
Kidneys	1.972E-10	5.920E-11	4.951E+00	1.024E-03
Thyroid	4.366E-12	2.068E-11	3.472E+00	6.675E-04
Leukemia	1.702E-09	7.030E-10	5.790E+01	1.165E-02
Residual	4.995E-09	1.850E-09	1.363E+02	2.912E-02
Total	2.135E-07	1.036E-07	5.557E+02	1.143E-01

C A P 8 8 - P C
Version 3.0

Clean Air Act Assessment Package - 1988

C H I / Q T A B L E S
Non-Radon Individual Assessment
May 6, 2014 12:05 pmm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2012

Comments: CY 2012 WIPP Compliance Report bias corr
40 CFR part 191, Subpart A

Dataset Name: 2012-191SubpartA
Dataset Date: 5/6/2014 9:17:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\2012VET.WND

May 6, 2014 12:05 pmm CHIQ
Page 1

GROUND-LEVEL CHI/Q VALUES FOR Am-241
SOLUBILITY: M
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	350
N	3.069E-06
NNW	4.638E-06
NW	5.885E-06
WNW	3.927E-06
W	2.454E-06
WSW	1.760E-06
SW	1.804E-06
SSW	1.653E-06
S	1.485E-06
SSE	1.489E-06
SE	1.436E-06
ESE	1.607E-06
E	2.132E-06
ENE	2.090E-06
NE	1.947E-06
NNE	2.274E-06

GROUND-LEVEL CHI/Q VALUES FOR Pu-238
SOLUBILITY: M
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	350
N	3.053E-06
NNW	4.601E-06
NW	5.827E-06
WNW	3.886E-06
W	2.431E-06
WSW	1.745E-06
SW	1.789E-06
SSW	1.641E-06
S	1.480E-06
SSE	1.481E-06
SE	1.428E-06
ESE	1.596E-06
E	2.115E-06
ENE	2.079E-06
NE	1.938E-06
NNE	2.265E-06

GROUND-LEVEL CHI/Q VALUES FOR Pu-239
SOLUBILITY: M
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	350
N	3.116E-06
NNW	4.803E-06
NW	6.137E-06
WNW	4.073E-06
W	2.557E-06
WSW	1.832E-06
SW	1.869E-06
SSW	1.702E-06
S	1.502E-06
SSE	1.522E-06
SE	1.458E-06
ESE	1.658E-06
E	2.240E-06
ENE	2.162E-06
NE	1.989E-06
NNE	2.306E-06

GROUND-LEVEL CHI/Q VALUES FOR Sr-90
SOLUBILITY: S
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	350
N	3.049E-06
NNW	4.576E-06
NW	5.791E-06
WNW	3.869E-06
W	2.416E-06
WSW	1.734E-06
SW	1.780E-06
SSW	1.635E-06
S	1.478E-06
SSE	1.476E-06
SE	1.427E-06
ESE	1.588E-06
E	2.094E-06
ENE	2.066E-06
NE	1.932E-06
NNE	2.261E-06

GROUND-LEVEL CHI/Q VALUES FOR Cs-137
SOLUBILITY: F
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	350
N	3.072E-06
NNW	4.639E-06
NW	5.887E-06
WNW	3.932E-06
W	2.454E-06
WSW	1.760E-06
SW	1.805E-06
SSW	1.654E-06
S	1.485E-06
SSE	1.489E-06
SE	1.437E-06
ESE	1.606E-06
E	2.128E-06
ENE	2.088E-06
NE	1.947E-06
NNE	2.276E-06

GROUND-LEVEL CHI/Q VALUES FOR U-233
SOLUBILITY: S
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	350
N	3.244E-06
NNW	4.990E-06
NW	6.447E-06
WNW	4.360E-06
W	2.671E-06
WSW	1.904E-06
SW	1.952E-06
SSW	1.776E-06
S	1.536E-06
SSE	1.559E-06
SE	1.515E-06
ESE	1.700E-06
E	2.260E-06
ENE	2.184E-06
NE	2.030E-06
NNE	2.381E-06

GROUND-LEVEL CHI/Q VALUES FOR U-238
SOLUBILITY: S
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	350
N	3.253E-06
NNW	4.999E-06
NW	6.464E-06
WNW	4.380E-06
W	2.677E-06
WSW	1.907E-06
SW	1.956E-06
SSW	1.781E-06
S	1.538E-06
SSE	1.560E-06
SE	1.519E-06
ESE	1.701E-06
E	2.257E-06
ENE	2.183E-06
NE	2.031E-06
NNE	2.386E-06

CY 2012 CAP88-PC Output Data for the Maximum Exposed Individual Near the DOE Land Withdrawal Area (7,500 meters)

C A P 8 8 - P C

Version 3.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
May 7, 2014 02:11 pmm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2012

Comments: CY 2012 WIPP Compliance Report bias corr
40 CFR part 191, Subpart A at MEOSI

Effective Dose Equivalent (mrem/year)
1.06E-05

At This Location: 7500 Meters West Northwest

Dataset Name: 2012_191SubpartA
Dataset Date: 5/7/2014 1:24:00 PM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\2012VET

May 7, 2014 02:11 pmm SYNOPSIS
Page 1

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 7500 Meters West Northwest
Lifetime Fatal Cancer Risk: 4.71E-12

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
Adrenals	7.42E-06
B Surfac	2.50E-05
Breasts	5.96E-06
St Wall	7.10E-06
ULI Wall	7.81E-06
Kidneys	7.15E-06
Lungs	7.22E-06
Ovaries	7.61E-06
R Marrow	1.33E-05
Spleen	7.14E-06
Thymus	6.94E-06
Uterus	7.64E-06
Bld Wall	7.68E-06
Brain	6.25E-06
Esophagu	6.98E-06
SI Wall	7.43E-06
LLI Wall	9.56E-06
Liver	7.89E-06
Muscle	6.66E-06
Pancreas	7.61E-06
Skin	6.11E-06
Testes	6.72E-06
Thyroid	6.93E-06
EFFEC	1.06E-05

RADIONUCLIDE EMISSIONS DURING THE YEAR 2012

Nuclide	Type	Size	Source #1 Ci/y	Source #2 Ci/y	Source #3 Ci/y	TOTAL Ci/y
Am-241	M	1	4.3E-08	1.7E-09	1.2E-08	5.7E-08
Pu-238	M	1	4.2E-08	1.3E-09	1.3E-08	5.6E-08
Pu-239	M	1	4.8E-07	1.1E-09	6.9E-09	4.9E-07
Sr-90	S	1	2.6E-06	1.3E-07	1.1E-06	3.8E-06
Cs-137	F	1	3.2E-05	1.5E-06	9.9E-06	4.4E-05
U-233	S	1	1.0E-07	1.9E-08	1.5E-08	1.4E-07
U-238	S	1	8.3E-08	1.7E-08	1.4E-08	1.1E-07

SITE INFORMATION

Temperature:	19 degrees C
Precipitation:	17 cm/y
Humidity:	8 g/cu m
Mixing Height:	1000 m

User specified location of max exposed individual.
(ILOC, JLOC): 4, 1

SOURCE INFORMATION

Source Number:	1	2	3
Stack Height (m):	7.70	6.70	20.00
Diameter (m):	5.20	1.80	2.60
Plume Rise Momentum (m/s): (Exit Velocity)	6.70	10.80	3.30

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	1.000	1.000	1.000
Fraction From Assessment Area:	0.000	0.000	0.000
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

7500

C A P 8 8 - P C
Version 3.0

Clean Air Act Assessment Package - 1988

G E N E R A L D A T A
Non-Radon Individual Assessment
May 7, 2014 02:11 pmm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2012

Comments: CY 2012 WIPP Compliance Report bias corr
40 CFR part 191, Subpart A at MEOSI

Dataset Name: 2012_191SubpartA
Dataset Date: 5/7/2014 1:24:00 PM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\2012VET.WND

May 7, 2014 02:11 pmm GENERAL
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VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

Nuclide	Clearance Type	Particle Size (microns)	Scavenging Coefficient (per second)	Dry Deposition Velocity (m/s)
Am-241	M	1	1.70E-06	1.80E-03
Np-237	M	1	1.70E-06	1.80E-03
Pa-233	M	1	1.70E-06	1.80E-03
U-233	M	1	1.70E-06	1.80E-03
Th-229	S	1	1.70E-06	1.80E-03
Ra-225	M	1	1.70E-06	1.80E-03
Ac-225	M	1	1.70E-06	1.80E-03
Fr-221	M	1	1.70E-06	1.80E-03
At-217	M	1	1.70E-06	1.80E-03
Bi-213	M	1	1.70E-06	1.80E-03
Pu-238	M	1	1.70E-06	1.80E-03
U-234	M	1	1.70E-06	1.80E-03
Th-230	S	1	1.70E-06	1.80E-03
Ra-226	M	1	1.70E-06	1.80E-03
Rn-222	G	0	0.00E+00	0.00E+00
Pu-239	M	1	1.70E-06	1.80E-03
U-235	M	1	1.70E-06	1.80E-03
Th-231	S	1	1.70E-06	1.80E-03
Pa-231	M	1	1.70E-06	1.80E-03
Ac-227	M	1	1.70E-06	1.80E-03
Sr-90	S	1	1.70E-06	1.80E-03
Y-90	M	1	1.70E-06	1.80E-03
Cs-137	F	1	1.70E-06	1.80E-03
Ba-137m	M	1	1.70E-06	1.80E-03
U-233	S	1	1.70E-06	1.80E-03
U-238	S	1	1.70E-06	1.80E-03
Th-234	S	1	1.70E-06	1.80E-03
Pa-234m	M	1	1.70E-06	1.80E-03
Pa-234	M	1	1.70E-06	1.80E-03

VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

	DECAY CONSTANT (PER DAY)			TRANSFER COEFFICIENT	
Nuclide	Radio-active (1)	Surface	Water	Milk (2)	Meat (3)
Am-241	4.39E-06	5.48E-05	0.00E+00	2.00E-06	5.00E-05
Np-237	8.87E-10	5.48E-05	0.00E+00	1.00E-05	1.00E-03
Pa-233	2.57E-02	5.48E-05	0.00E+00	5.00E-06	5.00E-06
U-233	1.20E-08	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-229	2.58E-07	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Ra-225	4.68E-02	5.48E-05	0.00E+00	1.00E-03	2.00E-03
Ac-225	6.93E-02	5.48E-05	0.00E+00	2.00E-06	2.00E-05
Fr-221	2.08E+02	5.48E-05	0.00E+00	8.00E-03	3.00E-02
At-217	1.85E+06	5.48E-05	0.00E+00	1.00E-02	1.00E-02
Bi-213	2.19E+01	5.48E-05	0.00E+00	1.00E-03	2.00E-03
Pu-238	2.16E-05	5.48E-05	0.00E+00	1.00E-06	1.00E-04
U-234	7.76E-09	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-230	2.46E-08	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Ra-226	1.19E-06	5.48E-05	0.00E+00	1.00E-03	2.00E-03
Rn-222	1.81E-01	5.48E-05	0.00E+00	0.00E+00	0.00E+00
Pu-239	7.88E-08	5.48E-05	0.00E+00	1.00E-06	1.00E-04
U-235	2.70E-12	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-231	6.52E-01	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Pa-231	5.79E-08	5.48E-05	0.00E+00	5.00E-06	5.00E-06
Ac-227	8.71E-05	5.48E-05	0.00E+00	2.00E-06	2.00E-05
Sr-90	6.52E-05	5.48E-05	0.00E+00	2.00E-03	1.00E-02
Y-90	2.60E-01	5.48E-05	0.00E+00	6.00E-05	2.00E-03
Cs-137	6.32E-05	5.48E-05	0.00E+00	1.00E-02	5.00E-02
Ba-137m	3.91E+02	5.48E-05	0.00E+00	5.00E-04	2.00E-04
U-233	1.20E-08	5.48E-05	0.00E+00	4.00E-04	8.00E-04
U-238	4.25E-13	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-234	2.88E-02	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Pa-234m	8.53E+02	5.48E-05	0.00E+00	5.00E-06	5.00E-06
Pa-234	2.48E+00	5.48E-05	0.00E+00	5.00E-06	5.00E-06

FOOTNOTES:

(1) Fraction of animal's daily intake of nuclide which appears in each L of milk (days/L)

(2) Fraction of animal's daily intake of nuclide which appears in each kg of meat (days/kg)

VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

	CONCENTRATION UPTAKE FACTOR		GI UPTAKE FRACTION	
Nuclide	Forage (1)	Edible (2)	Inhalation	Ingestion
Am-241	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Np-237	1.00E-01	2.00E-02	5.00E-04	5.00E-04
Pa-233	1.00E-01	1.00E-02	5.00E-04	5.00E-04
U-233	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-229	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Ra-225	2.00E-01	4.00E-02	2.00E-01	2.00E-01
Ac-225	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Fr-221	1.00E-01	3.00E-02	1.00E+00	1.00E+00
At-217	9.00E-01	2.00E-01	1.00E+00	1.00E+00
Bi-213	5.00E-01	1.00E-01	5.00E-02	5.00E-02
Pu-238	1.00E-01	1.00E-03	5.00E-04	5.00E-04
U-234	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-230	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Ra-226	2.00E-01	4.00E-02	2.00E-01	2.00E-01
Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pu-239	1.00E-01	1.00E-03	5.00E-04	5.00E-04
U-235	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-231	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Pa-231	1.00E-01	1.00E-02	5.00E-04	5.00E-04
Ac-227	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Sr-90	4.00E+00	3.00E-01	3.00E-01	3.00E-01
Y-90	1.00E-01	2.00E-03	1.00E-04	1.00E-04
Cs-137	1.00E+00	2.00E-01	1.00E+00	1.00E+00
Ba-137m	1.00E-01	1.00E-02	2.00E-01	2.00E-01
U-233	1.00E-01	2.00E-03	2.00E-02	2.00E-02
U-238	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-234	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Pa-234m	1.00E-01	1.00E-02	5.00E-04	5.00E-04
Pa-234	1.00E-01	1.00E-02	5.00E-04	5.00E-04

FOOTNOTES: (1) Concentration factor for uptake of nuclide from soil for pasture and forage (in pCi/kg dry weight per pCi/kg dry soil)
(2) Concentration factor for uptake of nuclide from soil by edible parts of crops (in pCi/kg wet weight per pCi/kg dry soil)

DECAY CHAIN ACTIVITIES

Nuclide	Stack	Activity at 500. seconds	Activity at 100.00 years
Am-241	1	4.2900E-08	0.0000E+00
Am-241	2	1.6600E-09	0.0000E+00
Am-241	3	1.2200E-08	0.0000E+00
Np-237	1	0.0000E+00	0.0000E+00
Np-237	2	0.0000E+00	0.0000E+00
Np-237	3	0.0000E+00	0.0000E+00
Pa-233	1	0.0000E+00	0.0000E+00
Pa-233	2	0.0000E+00	0.0000E+00
Pa-233	3	0.0000E+00	0.0000E+00
U-233	1	0.0000E+00	0.0000E+00
U-233	2	0.0000E+00	0.0000E+00
U-233	3	0.0000E+00	0.0000E+00
Th-229	1	0.0000E+00	0.0000E+00
Th-229	2	0.0000E+00	0.0000E+00
Th-229	3	0.0000E+00	0.0000E+00
Ra-225	1	0.0000E+00	0.0000E+00
Ra-225	2	0.0000E+00	0.0000E+00
Ra-225	3	0.0000E+00	0.0000E+00
Ac-225	1	0.0000E+00	0.0000E+00
Ac-225	2	0.0000E+00	0.0000E+00
Ac-225	3	0.0000E+00	0.0000E+00
Fr-221	1	0.0000E+00	0.0000E+00
Fr-221	2	0.0000E+00	0.0000E+00
Fr-221	3	0.0000E+00	0.0000E+00
At-217	1	0.0000E+00	0.0000E+00
At-217	2	0.0000E+00	0.0000E+00
At-217	3	0.0000E+00	0.0000E+00
Bi-213	1	0.0000E+00	0.0000E+00
Bi-213	2	0.0000E+00	0.0000E+00
Bi-213	3	0.0000E+00	0.0000E+00
Pu-238	1	4.1600E-08	0.0000E+00
Pu-238	2	1.3200E-09	0.0000E+00
Pu-238	3	1.3300E-08	0.0000E+00
U-234	1	0.0000E+00	0.0000E+00
U-234	2	0.0000E+00	0.0000E+00
U-234	3	0.0000E+00	0.0000E+00
Th-230	1	0.0000E+00	0.0000E+00
Th-230	2	0.0000E+00	0.0000E+00
Th-230	3	0.0000E+00	0.0000E+00
Ra-226	1	0.0000E+00	0.0000E+00
Ra-226	2	0.0000E+00	0.0000E+00
Ra-226	3	0.0000E+00	0.0000E+00
Rn-222	1	0.0000E+00	0.0000E+00
Rn-222	2	0.0000E+00	0.0000E+00
Rn-222	3	0.0000E+00	0.0000E+00
Pu-239	1	4.8500E-07	2.2360E-07
Pu-239	2	1.1000E-09	0.0000E+00
Pu-239	3	6.9100E-09	0.0000E+00
U-235	1	0.0000E+00	0.0000E+00
U-235	2	0.0000E+00	0.0000E+00
U-235	3	0.0000E+00	0.0000E+00

Th-231	1	0.0000E+00	0.0000E+00
Th-231	2	0.0000E+00	0.0000E+00
Th-231	3	0.0000E+00	0.0000E+00
Pa-231	1	0.0000E+00	0.0000E+00
Pa-231	2	0.0000E+00	0.0000E+00
Pa-231	3	0.0000E+00	0.0000E+00
Ac-227	1	0.0000E+00	0.0000E+00
Ac-227	2	0.0000E+00	0.0000E+00
Ac-227	3	0.0000E+00	0.0000E+00
Sr-90	1	2.6000E-06	1.1900E-06
Sr-90	2	1.3000E-07	0.0000E+00
Sr-90	3	1.0600E-06	4.8520E-07
Y-90	1	3.9070E-09	1.1660E-06
Y-90	2	0.0000E+00	0.0000E+00
Y-90	3	1.5930E-09	4.7490E-07
Cs-137	1	3.2400E-05	1.4830E-05
Cs-137	2	1.5400E-06	7.0510E-07
Cs-137	3	9.8800E-06	4.5230E-06

Ba-137m	1	2.7460E-05	1.4030E-05
Ba-137m	2	1.3050E-06	6.6700E-07
Ba-137m	3	8.3740E-06	4.2790E-06
U-233	1	1.0400E-07	0.0000E+00
U-233	2	1.8700E-08	0.0000E+00
U-233	3	1.4500E-08	0.0000E+00
U-238	1	8.2900E-08	0.0000E+00
U-238	2	1.7100E-08	0.0000E+00
U-238	3	1.4100E-08	0.0000E+00
Th-234	1	0.0000E+00	0.0000E+00
Th-234	2	0.0000E+00	0.0000E+00
Th-234	3	0.0000E+00	0.0000E+00
Pa-234m	1	0.0000E+00	0.0000E+00
Pa-234m	2	0.0000E+00	0.0000E+00
Pa-234m	3	0.0000E+00	0.0000E+00
Pa-234	1	0.0000E+00	0.0000E+00
Pa-234	2	0.0000E+00	0.0000E+00
Pa-234	3	0.0000E+00	0.0000E+00

VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS

HUMAN INHALATION RATE	
Cubic centimeters/hr	9.17E+05
SOIL PARAMETERS	
Effective surface density (kg/sq m, dry weight) (Assumes 15 cm plow layer)	2.15E+02
BUILDUP TIMES	
For activity in soil (years)	1.00E+02
For radionuclides deposited on ground/water (days)	3.65E+04
DELAY TIMES	
Ingestion of pasture grass by animals (hr)	0.00E+00
Ingestion of stored feed by animals (hr)	2.16E+03
Ingestion of leafy vegetables by man (hr)	3.36E+02
Ingestion of produce by man (hr)	3.36E+02
Transport time from animal feed-milk-man (day)	2.00E+00
Time from slaughter to consumption (day)	2.00E+01
WEATHERING	
Removal rate constant for physical loss (per hr)	2.90E-03
CROP EXPOSURE DURATION	
Pasture grass (hr)	7.20E+02
Crops/leafy vegetables (hr)	1.44E+03
AGRICULTURAL PRODUCTIVITY	
Grass-cow-milk-man pathway (kg/sq m)	2.80E-01
Produce/leafy veg for human consumption (kg/sq m)	7.16E-01
FALLOUT INTERCEPTION FRACTIONS	
Vegetables	2.00E-01
Pasture	5.70E-01
GRAZING PARAMETERS	
Fraction of year animals graze on pasture	4.00E-01
Fraction of daily feed that is pasture grass when animal grazes on pasture	4.30E-01

VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS

ANIMAL FEED CONSUMPTION FACTORS	
Contaminated feed/forage (kg/day, dry weight)	1.56E+01
DAIRY PRODUCTIVITY	
Milk production of cow (L/day)	1.10E+01
MEAT ANIMAL SLAUGHTER PARAMETERS	
Muscle mass of animal at slaughter (kg)	2.00E+02
Fraction of herd slaughtered (per day)	3.81E-03
DECONTAMINATION	
Fraction of radioactivity retained after washing for leafy vegetables and produce	5.00E-01
FRACTIONS GROWN IN GARDEN OF INTEREST	
Produce ingested	1.00E+00
Leafy vegetables ingested	1.00E+00
INGESTION RATIOS:	
IMMEDIATE SURROUNDING AREA/TOTAL WITHIN AREA	
Vegetables	1.00E+00
Meat	1.00E+00
Milk	1.00E+00
MINIMUM INGESTION FRACTIONS FROM OUTSIDE AREA (Minimum fractions of food types from outside area listed below are actual fixed values.)	
Vegetables	0.00E+00
Meat	0.00E+00
Milk	0.00E+00
HUMAN FOOD UTILIZATION FACTORS	
Produce ingestion (kg/y)	1.76E+02
Milk ingestion (L/y)	1.12E+02
Meat ingestion (kg/y)	8.50E+01
Leafy vegetable ingestion (kg/y)	1.80E+01
SWIMMING PARAMETERS	
Fraction of time spent swimming	0.00E+00
Dilution factor for water (cm)	1.00E+00

C A P 8 8 - P C
Version 3.0

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S
Non-Radon Individual Assessment
May 7, 2014 02:11 pmm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2012

Comments: CY 2012 WIPP Compliance Report bias corr
40 CFR part 191, Subpart A at MEOSI

Dataset Name: 2012_191SubpartA
Dataset Date: 5/7/2014 1:24:00 PM
Wind File: . C:\Program Files\CAP88-PC30\WndFiles\2012VET.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
Adrenals	7.42E-06
B Surfac	2.50E-05
Breasts	5.96E-06
St Wall	7.10E-06
ULI Wall	7.81E-06
Kidneys	7.15E-06
Lungs	7.22E-06
Ovaries	7.61E-06
R Marrow	1.33E-05
Spleen	7.14E-06
Thymus	6.94E-06
Uterus	7.64E-06
Bld Wall	7.68E-06
Brain	6.25E-06
Esophagu	6.98E-06
SI Wall	7.43E-06
LLI Wall	9.56E-06
Liver	7.89E-06
Muscle	6.66E-06
Pancreas	7.61E-06
Skin	6.11E-06
Testes	6.72E-06
Thyroid	6.93E-06
EFFEC	1.06E-05

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	8.07E-06
INHALATION	2.43E-06
AIR IMMERSION	2.92E-10
GROUND SURFACE	1.04E-07
INTERNAL	1.05E-05
EXTERNAL	1.04E-07
TOTAL	1.06E-05

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
Am-241	1.76E-07
Np-237	0.00E+00
Pa-233	0.00E+00
U-233	0.00E+00
Th-229	0.00E+00
Ra-225	0.00E+00
Ac-225	0.00E+00
Fr-221	0.00E+00
At-217	0.00E+00
Bi-213	0.00E+00
Pu-238	1.93E-07
U-234	0.00E+00
Th-230	0.00E+00
Ra-226	0.00E+00
Rn-222	0.00E+00
Pu-239	1.92E-06
U-235	0.00E+00
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Sr-90	9.99E-07
Y-90	1.67E-09
Cs-137	7.05E-06
Ba-137m	1.02E-07
U-233	9.79E-08
U-238	6.82E-08
Th-234	0.00E+00
Pa-234m	0.00E+00
Pa-234	0.00E+00
TOTAL	1.06E-05

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
Esophagu	7.51E-14
Stomach	2.68E-13
Colon	8.17E-13
Liver	2.41E-13
LUNG	8.59E-13
Bone	6.55E-14
Skin	5.65E-15
Breast	2.23E-13
Ovary	9.92E-14
Bladder	1.92E-13
Kidneys	3.87E-14
Thyroid	1.83E-14
Leukemia	8.30E-13
Residual	9.80E-13
Total	4.71E-12
TOTAL	9.43E-12

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	4.14E-12
INHALATION	5.15E-13
AIR IMMERSION	1.59E-16
GROUND SURFACE	5.53E-14
INTERNAL	4.66E-12
EXTERNAL	5.54E-14
TOTAL	4.71E-12

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
Am-241	2.78E-14
Np-237	0.00E+00
Pa-233	0.00E+00
U-233	0.00E+00
Th-229	0.00E+00
Ra-225	0.00E+00
Ac-225	0.00E+00
Fr-221	0.00E+00
At-217	0.00E+00
Bi-213	0.00E+00
Pu-238	3.35E-14
U-234	0.00E+00
Th-230	0.00E+00
Ra-226	0.00E+00
Rn-222	0.00E+00
Pu-239	3.03E-13
U-235	0.00E+00
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Sr-90	5.90E-13
Y-90	2.00E-16
Cs-137	3.58E-12
Ba-137m	5.51E-14
U-233	7.42E-14
U-238	5.15E-14
Th-234	0.00E+00
Pa-234m	0.00E+00
Pa-234	0.00E+00
TOTAL	4.71E-12

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INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)
Direction	7500
N	4.9E-06
NNW	8.4E-06
NW	1.3E-05
WNW	1.1E-05
W	5.1E-06
WSW	3.8E-06
SW	4.1E-06
SSW	3.4E-06
S	1.6E-06
SSE	1.9E-06
SE	2.3E-06
ESE	2.2E-06
E	2.7E-06
ENE	2.3E-06
NE	2.3E-06
NNE	3.1E-06

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INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 7500
N	2.2E-12
NNW	3.7E-12
NW	5.9E-12
WNW	4.7E-12
W	2.3E-12
WSW	1.7E-12
SW	1.8E-12
SSW	1.5E-12
S	7.4E-13
SSE	8.8E-13
SE	1.0E-12
ESE	1.0E-12
E	1.2E-12
ENE	1.1E-12
NE	1.0E-12
NNE	1.4E-12

C A P 8 8 - P C
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Clean Air Act Assessment Package - 1988

W E A T H E R D A T A
Non-Radon Individual Assessment
May 7, 2014 02:11 pmm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2012

Comments: CY 2012 WIPP Compliance Report bias corr
40 CFR part 191, Subpart A at MEOSI

Dataset Name: 2012_191SubpartA
Dataset Date: 5/7/2014 1:24:00 PM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\2012VET.WND

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HARMONIC AVERAGE WIND SPEEDS (WIND TOWARDS)

	Pasquill Stability Class							
Dir	A	B	C	D	E	F	G	Wind Freq
N	2.081	2.979	3.339	3.273	2.655	2.826	0.000	0.076
NNW	2.147	3.054	3.342	4.212	3.207	3.178	0.000	0.123
NW	2.126	2.864	3.139	4.325	3.463	3.019	0.000	0.168
WNW	1.665	2.231	2.334	3.828	3.708	3.187	0.000	0.113
W	1.541	1.986	2.217	3.993	3.810	3.011	0.000	0.060
WSW	1.497	2.154	2.352	4.067	3.314	3.039	0.000	0.043
SW	1.589	1.865	2.258	3.798	2.827	3.276	0.000	0.043
SSW	1.620	2.453	2.771	3.566	2.908	3.286	0.000	0.040
S	1.870	3.853	3.273	2.842	2.655	2.969	0.000	0.036
SSE	1.783	3.067	3.577	3.582	2.852	2.992	0.000	0.035
SE	1.635	2.345	2.803	3.196	2.660	2.343	0.000	0.031
ESE	1.532	2.089	2.520	3.776	3.524	1.210	0.000	0.033
E	1.646	2.665	3.563	5.270	4.774	2.572	0.000	0.052
ENE	1.784	2.986	3.841	4.757	3.158	0.897	0.000	0.050
NE	1.813	2.713	3.390	3.554	2.819	2.120	0.000	0.044
NNE	2.021	2.732	3.102	3.140	2.511	2.385	0.000	0.053

ARITHMETIC AVERAGE WIND SPEEDS (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	3.072	4.080	4.589	4.446	3.223	3.172	0.000
NNW	3.205	4.322	4.724	5.286	3.706	3.452	0.000
NW	3.204	4.283	4.699	5.320	3.932	3.349	0.000
WNW	2.650	3.560	3.770	4.913	4.229	3.606	0.000
W	2.446	3.252	3.641	5.509	4.577	3.592	0.000
WSW	2.385	3.437	3.847	5.916	4.364	3.514	0.000
SW	2.497	3.232	3.936	5.793	3.832	3.610	0.000
SSW	2.629	3.820	4.429	5.286	3.608	3.643	0.000
S	3.187	5.142	4.650	3.989	3.482	3.588	0.000
SSE	2.751	4.611	5.166	4.942	3.582	3.372	0.000
SE	2.477	3.376	4.040	4.679	3.600	2.998	0.000
ESE	2.351	3.119	3.728	5.871	5.021	1.852	0.000
E	2.564	4.048	5.472	7.463	5.913	2.572	0.000
ENE	2.723	4.178	5.407	6.256	3.772	1.132	0.000
NE	2.732	3.863	4.966	5.167	3.329	2.572	0.000
NNE	2.924	3.786	4.370	4.522	3.146	2.829	0.000

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FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	0.2193	0.1405	0.2339	0.2783	0.1174	0.0106	0.0000
NNW	0.1316	0.0811	0.1559	0.4555	0.1613	0.0146	0.0000
NW	0.0804	0.0475	0.0886	0.5101	0.2426	0.0309	0.0000
WNW	0.0743	0.0345	0.0699	0.3933	0.3805	0.0476	0.0000
W	0.1129	0.0500	0.0957	0.4121	0.2959	0.0334	0.0000
WSW	0.1379	0.0543	0.1031	0.4058	0.2333	0.0656	0.0000
SW	0.1272	0.0550	0.1109	0.4118	0.2113	0.0839	0.0000
SSW	0.1561	0.0701	0.1468	0.3856	0.1855	0.0559	0.0000
S	0.2003	0.3233	0.2972	0.1358	0.0327	0.0107	0.0000
SSE	0.2103	0.1719	0.2762	0.2575	0.0713	0.0128	0.0000
SE	0.2549	0.1207	0.1978	0.2832	0.1239	0.0194	0.0000
ESE	0.2439	0.1039	0.1665	0.3275	0.1552	0.0030	0.0000
E	0.1875	0.0879	0.1696	0.3937	0.1607	0.0006	0.0000
ENE	0.2314	0.1318	0.2328	0.3693	0.0337	0.0010	0.0000
NE	0.2914	0.1557	0.2336	0.2647	0.0525	0.0021	0.0000
NNE	0.2679	0.1666	0.2424	0.2403	0.0774	0.0053	0.0000
TOTAL	0.1581	0.0948	0.1563	0.3792	0.1858	0.0258	0.0000

ADDITIONAL WEATHER INFORMATION

Average Air Temperature: 19.2 degrees C
292.32 K
Precipitation: 17.0 cm/y
Humidity: 8.0 g/cu m
Lid Height: 1000 meters
Surface Roughness Length: 0.010 meters
Height Of Wind Measurements: 10.0 meters
Average Wind Speed: 4.442 m/s
Vertical Temperature Gradients:
STABILITY E 0.073 k/m
STABILITY F 0.109 k/m
STABILITY G 0.146 k/m

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Clean Air Act Assessment Package - 1988

C O N C E N T R A T I O N T A B L E S
Non-Radon Individual Assessment
May 7, 2014 02:11 pmm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2012

Comments: CY 2012 WIPP Compliance Report bias corr
40 CFR part 191, Subpart A at MEOSI

Dataset Name: 2012_191SubpartA
Dataset Date: 5/7/2014 1:24:00 PM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\2012VET.WND

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
N	7500	Am-241	6.13E-11	1.10E-17	2.69E-18	1.37E-17
N	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Pu-238	6.07E-11	1.09E-17	2.67E-18	1.36E-17
N	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Pu-239	5.32E-10	9.58E-17	2.34E-17	1.19E-16
N	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Sr-90	4.09E-09	7.36E-16	1.80E-16	9.16E-16
N	7500	Y-90	5.93E-12	1.07E-18	2.61E-19	1.33E-18
N	7500	Cs-137	4.73E-08	8.51E-15	2.08E-15	1.06E-14
N	7500	Ba-137m	4.01E-08	7.21E-15	1.76E-15	8.98E-15
N	7500	U-233	1.48E-10	2.67E-17	6.50E-18	3.32E-17
N	7500	U-238	1.23E-10	2.22E-17	5.41E-18	2.76E-17
N	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Am-241	1.09E-10	1.95E-17	3.63E-18	2.32E-17
NNW	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Pu-238	1.07E-10	1.93E-17	3.59E-18	2.29E-17
NNW	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Pu-239	9.43E-10	1.70E-16	3.15E-17	2.01E-16
NNW	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
NNW	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Sr-90	7.24E-09	1.30E-15	2.42E-16	1.55E-15
NNW	7500	Y-90	1.05E-11	1.89E-18	3.51E-19	2.24E-18
NNW	7500	Cs-137	8.38E-08	1.51E-14	2.80E-15	1.79E-14
NNW	7500	Ba-137m	7.10E-08	1.28E-14	2.37E-15	1.52E-14
NNW	7500	U-233	2.63E-10	4.73E-17	8.76E-18	5.61E-17
NNW	7500	U-238	2.19E-10	3.93E-17	7.28E-18	4.66E-17
NNW	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Am-241	1.77E-10	3.19E-17	4.64E-18	3.66E-17
NW	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Pu-238	1.76E-10	3.16E-17	4.60E-18	3.62E-17
NW	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Pu-239	1.54E-09	2.77E-16	4.03E-17	3.18E-16
NW	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Sr-90	1.18E-08	2.13E-15	3.10E-16	2.44E-15
NW	7500	Y-90	1.72E-11	3.09E-18	4.50E-19	3.54E-18
NW	7500	Cs-137	1.37E-07	2.46E-14	3.58E-15	2.82E-14
NW	7500	Ba-137m	1.16E-07	2.09E-14	3.04E-15	2.39E-14
NW	7500	U-233	4.30E-10	7.73E-17	1.12E-17	8.85E-17
NW	7500	U-238	3.57E-10	6.43E-17	9.32E-18	7.36E-17
NW	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Am-241	1.42E-10	2.55E-17	3.44E-18	2.90E-17
WNW	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
WNW	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Pu-238	1.40E-10	2.53E-17	3.41E-18	2.87E-17
WNW	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Pu-239	1.23E-09	2.22E-16	2.99E-17	2.52E-16
WNW	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Sr-90	9.46E-09	1.70E-15	2.30E-16	1.93E-15
WNW	7500	Y-90	1.37E-11	2.47E-18	3.34E-19	2.80E-18
WNW	7500	Cs-137	1.09E-07	1.97E-14	2.66E-15	2.24E-14
WNW	7500	Ba-137m	9.28E-08	1.67E-14	2.25E-15	1.89E-14
WNW	7500	U-233	3.44E-10	6.19E-17	8.32E-18	7.02E-17
WNW	7500	U-238	2.86E-10	5.14E-17	6.92E-18	5.84E-17
WNW	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Am-241	6.66E-11	1.20E-17	1.98E-18	1.40E-17
W	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Pu-238	6.60E-11	1.19E-17	1.97E-18	1.38E-17
W	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Pu-239	5.80E-10	1.04E-16	1.72E-17	1.22E-16
W	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Sr-90	4.45E-09	8.01E-16	1.33E-16	9.33E-16
W	7500	Y-90	6.45E-12	1.16E-18	1.92E-19	1.35E-18
W	7500	Cs-137	5.14E-08	9.26E-15	1.53E-15	1.08E-14
W	7500	Ba-137m	4.36E-08	7.85E-15	1.30E-15	9.15E-15
W	7500	U-233	1.61E-10	2.91E-17	4.79E-18	3.39E-17

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
W	7500	U-238	1.34E-10	2.42E-17	3.99E-18	2.82E-17
W	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Am-241	4.94E-11	8.89E-18	1.48E-18	1.04E-17
WSW	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Pu-238	4.89E-11	8.80E-18	1.47E-18	1.03E-17
WSW	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Pu-239	4.30E-10	7.73E-17	1.28E-17	9.02E-17
WSW	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Sr-90	3.30E-09	5.93E-16	9.88E-17	6.92E-16
WSW	7500	Y-90	4.78E-12	8.61E-19	1.43E-19	1.00E-18
WSW	7500	Cs-137	3.81E-08	6.86E-15	1.14E-15	8.01E-15
WSW	7500	Ba-137m	3.23E-08	5.82E-15	9.68E-16	6.79E-15
WSW	7500	U-233	1.20E-10	2.16E-17	3.57E-18	2.51E-17
WSW	7500	U-238	9.96E-11	1.79E-17	2.97E-18	2.09E-17
WSW	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Am-241	5.39E-11	9.71E-18	1.55E-18	1.13E-17
SW	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Pu-238	5.34E-11	9.61E-18	1.53E-18	1.11E-17
SW	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
SW	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Pu-239	4.69E-10	8.44E-17	1.34E-17	9.78E-17
SW	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Sr-90	3.60E-09	6.48E-16	1.03E-16	7.51E-16
SW	7500	Y-90	5.22E-12	9.40E-19	1.50E-19	1.09E-18
SW	7500	Cs-137	4.16E-08	7.50E-15	1.19E-15	8.69E-15
SW	7500	Ba-137m	3.53E-08	6.35E-15	1.01E-15	7.36E-15
SW	7500	U-233	1.31E-10	2.35E-17	3.73E-18	2.73E-17
SW	7500	U-238	1.09E-10	1.96E-17	3.10E-18	2.27E-17
SW	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Am-241	4.40E-11	7.93E-18	1.43E-18	9.35E-18
SSW	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Pu-238	4.36E-11	7.85E-18	1.41E-18	9.26E-18
SSW	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Pu-239	3.83E-10	6.89E-17	1.24E-17	8.13E-17
SSW	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Sr-90	2.94E-09	5.29E-16	9.52E-17	6.24E-16
SSW	7500	Y-90	4.26E-12	7.67E-19	1.38E-19	9.06E-19
SSW	7500	Cs-137	3.40E-08	6.12E-15	1.10E-15	7.22E-15
SSW	7500	Ba-137m	2.88E-08	5.19E-15	9.33E-16	6.12E-15
SSW	7500	U-233	1.07E-10	1.92E-17	3.45E-18	2.27E-17
SSW	7500	U-238	8.88E-11	1.60E-17	2.87E-18	1.88E-17
SSW	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Am-241	1.86E-11	3.35E-18	1.25E-18	4.61E-18
S	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
S	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Pu-238	1.84E-11	3.32E-18	1.24E-18	4.56E-18
S	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Pu-239	1.62E-10	2.91E-17	1.09E-17	4.00E-17
S	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Sr-90	1.24E-09	2.24E-16	8.37E-17	3.08E-16
S	7500	Y-90	1.80E-12	3.25E-19	1.22E-19	4.46E-19
S	7500	Cs-137	1.44E-08	2.59E-15	9.68E-16	3.56E-15
S	7500	Ba-137m	1.22E-08	2.19E-15	8.21E-16	3.01E-15
S	7500	U-233	4.51E-11	8.11E-18	3.03E-18	1.11E-17
S	7500	U-238	3.75E-11	6.75E-18	2.52E-18	9.27E-18
S	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Am-241	2.34E-11	4.22E-18	1.23E-18	5.45E-18
SSE	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Pu-238	2.32E-11	4.18E-18	1.22E-18	5.40E-18
SSE	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Pu-239	2.04E-10	3.67E-17	1.07E-17	4.74E-17
SSE	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Sr-90	1.56E-09	2.82E-16	8.24E-17	3.64E-16

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
SSE	7500	Y-90	2.27E-12	4.09E-19	1.20E-19	5.28E-19
SSE	7500	Cs-137	1.81E-08	3.26E-15	9.52E-16	4.21E-15
SSE	7500	Ba-137m	1.53E-08	2.76E-15	8.07E-16	3.57E-15
SSE	7500	U-233	5.67E-11	1.02E-17	2.98E-18	1.32E-17
SSE	7500	U-238	4.72E-11	8.49E-18	2.48E-18	1.10E-17
SSE	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Am-241	2.84E-11	5.11E-18	1.31E-18	6.42E-18
SE	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Pu-238	2.81E-11	5.06E-18	1.29E-18	6.36E-18
SE	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Pu-239	2.47E-10	4.44E-17	1.14E-17	5.58E-17
SE	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Sr-90	1.90E-09	3.41E-16	8.73E-17	4.29E-16
SE	7500	Y-90	2.75E-12	4.95E-19	1.27E-19	6.22E-19
SE	7500	Cs-137	2.19E-08	3.95E-15	1.01E-15	4.96E-15
SE	7500	Ba-137m	1.86E-08	3.35E-15	8.55E-16	4.20E-15
SE	7500	U-233	6.88E-11	1.24E-17	3.16E-18	1.55E-17
SE	7500	U-238	5.72E-11	1.03E-17	2.63E-18	1.29E-17
SE	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Am-241	2.72E-11	4.90E-18	1.33E-18	6.23E-18
ESE	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
ESE	7500	Pu-238	2.70E-11	4.85E-18	1.32E-18	6.17E-18
ESE	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Pu-239	2.36E-10	4.26E-17	1.16E-17	5.41E-17
ESE	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Sr-90	1.82E-09	3.27E-16	8.88E-17	4.16E-16
ESE	7500	Y-90	2.64E-12	4.74E-19	1.29E-19	6.03E-19
ESE	7500	Cs-137	2.10E-08	3.78E-15	1.03E-15	4.81E-15
ESE	7500	Ba-137m	1.78E-08	3.21E-15	8.70E-16	4.08E-15
ESE	7500	U-233	6.59E-11	1.19E-17	3.21E-18	1.51E-17
ESE	7500	U-238	5.48E-11	9.86E-18	2.67E-18	1.25E-17
ESE	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Am-241	3.38E-11	6.08E-18	1.57E-18	7.65E-18
E	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Pu-238	3.35E-11	6.02E-18	1.55E-18	7.58E-18
E	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Pu-239	2.94E-10	5.29E-17	1.36E-17	6.65E-17
E	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Sr-90	2.26E-09	4.06E-16	1.05E-16	5.11E-16
E	7500	Y-90	3.27E-12	5.89E-19	1.52E-19	7.41E-19
E	7500	Cs-137	2.61E-08	4.70E-15	1.21E-15	5.91E-15
E	7500	Ba-137m	2.21E-08	3.98E-15	1.03E-15	5.01E-15
E	7500	U-233	8.18E-11	1.47E-17	3.79E-18	1.85E-17
E	7500	U-238	6.80E-11	1.22E-17	3.15E-18	1.54E-17
E	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
E	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Am-241	2.77E-11	4.99E-18	1.63E-18	6.62E-18
ENE	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Pu-238	2.74E-11	4.94E-18	1.62E-18	6.55E-18
ENE	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Pu-239	2.40E-10	4.33E-17	1.42E-17	5.74E-17
ENE	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Sr-90	1.85E-09	3.33E-16	1.09E-16	4.42E-16
ENE	7500	Y-90	2.68E-12	4.83E-19	1.58E-19	6.41E-19
ENE	7500	Cs-137	2.14E-08	3.85E-15	1.26E-15	5.11E-15
ENE	7500	Ba-137m	1.81E-08	3.26E-15	1.07E-15	4.33E-15
ENE	7500	U-233	6.70E-11	1.21E-17	3.94E-18	1.60E-17
ENE	7500	U-238	5.57E-11	1.00E-17	3.28E-18	1.33E-17
ENE	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Am-241	2.71E-11	4.88E-18	1.66E-18	6.54E-18
NE	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Pu-238	2.68E-11	4.83E-18	1.65E-18	6.48E-18
NE	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Pu-239	2.35E-10	4.24E-17	1.44E-17	5.68E-17
NE	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
NE	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Sr-90	1.81E-09	3.26E-16	1.11E-16	4.37E-16
NE	7500	Y-90	2.63E-12	4.73E-19	1.61E-19	6.34E-19
NE	7500	Cs-137	2.09E-08	3.77E-15	1.28E-15	5.05E-15
NE	7500	Ba-137m	1.77E-08	3.19E-15	1.09E-15	4.28E-15
NE	7500	U-233	6.56E-11	1.18E-17	4.02E-18	1.58E-17
NE	7500	U-238	5.45E-11	9.82E-18	3.34E-18	1.32E-17
NE	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Am-241	3.71E-11	6.67E-18	1.99E-18	8.66E-18
NNE	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Pu-238	3.67E-11	6.61E-18	1.97E-18	8.58E-18
NNE	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Pu-239	3.22E-10	5.79E-17	1.73E-17	7.52E-17
NNE	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Sr-90	2.47E-09	4.45E-16	1.33E-16	5.78E-16
NNE	7500	Y-90	3.59E-12	6.46E-19	1.93E-19	8.39E-19
NNE	7500	Cs-137	2.86E-08	5.15E-15	1.54E-15	6.69E-15
NNE	7500	Ba-137m	2.42E-08	4.36E-15	1.30E-15	5.67E-15
NNE	7500	U-233	8.97E-11	1.61E-17	4.81E-18	2.09E-17
NNE	7500	U-238	7.46E-11	1.34E-17	4.00E-18	1.74E-17
NNE	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00

C A P 8 8 - P C
Version 3.0

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K C O N V E R S I O N F A C T O R S
Non-Radon Individual Assessment
May 7, 2014 02:11 pmm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2012

Comments: CY 2012 WIPP Compliance Report bias corr
40 CFR part 191, Subpart A at MEOSI

Dataset Name: 2012_191SubpartA
Dataset Date: 5/7/2014 1:24:00 PM
Wind File: . C:\Program Files\CAP88-PC30\WndFiles\2012VET.WND

DOSE AND RISK FACTOR UNITS

The units for each type of dose rate conversion factor are shown below, by pathway:

Pathway	Units
Ingestion	millirem/picoCurie
Inhalation	millirem/picoCurie
Immersion	millirem-cubic cm/microCurie-year
Surface	millirem-square cm/microCurie-year

Risks for internal exposures (inhalation and ingestion) are the lifetime risk of premature death in a birth cohort of 100,000 people for a 1 picoCurie/year intake rate, where the average lifetime is 70.7565 years.
This is simplified to lifetime risk per 100,000 picoCuries.

The units for each type of risk conversion factor are shown below, by pathway:

Pathway	Units
Ingestion	lifetime risk/100,000 picoCuries
Inhalation	lifetime risk/100,000 picoCuries
Immersion	lifetime risk-cubic cm/100,000 picoCurie-years
Surface	lifetime risk-square cm/100,000 picoCurie-years

****
* NUCLIDE Am-241 *
****

DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.831E-06	5.321E-04	5.289E+07	1.713E+04
B Surfac	1.670E-03	3.149E-01	3.344E+08	1.083E+05
Breasts	2.831E-06	5.321E-04	1.247E+08	4.101E+04
St Wall	3.065E-06	5.321E-04	6.466E+07	2.097E+04
ULI Wall	6.371E-06	5.332E-04	5.277E+07	1.841E+04
Kidneys	8.540E-06	1.613E-03	7.002E+07	2.225E+04
Lungs	2.831E-06	6.849E-03	7.852E+07	2.342E+04
Ovaries	3.237E-05	6.109E-03	4.380E+07	1.724E+04
R Marrow	5.676E-05	1.072E-02	6.070E+07	1.957E+04
Spleen	2.831E-06	5.321E-04	6.524E+07	2.109E+04
Thymus	2.831E-06	5.321E-04	7.596E+07	2.283E+04
Uterus	2.831E-06	5.321E-04	4.520E+07	1.666E+04
Bld Wall	2.831E-06	5.321E-04	6.023E+07	2.062E+04
Brain	2.831E-06	5.321E-04	7.258E+07	1.806E+04
Esophagu	2.831E-06	1.731E-03	4.357E+07	1.386E+04
SI Wall	3.415E-06	5.324E-04	4.765E+07	1.713E+04
LLI Wall	1.322E-05	5.346E-04	4.835E+07	1.782E+04
Liver	1.023E-04	1.932E-02	6.571E+07	2.109E+04
Muscle	2.831E-06	5.321E-04	8.516E+07	3.285E+04
Pancreas	2.831E-06	5.321E-04	4.485E+07	1.608E+04
Skin	2.831E-06	5.321E-04	1.491E+08	9.693E+04
Testes	3.209E-05	6.053E-03	9.996E+07	3.786E+04
Thyroid	2.831E-06	5.321E-04	9.122E+07	2.575E+04
EFFEC	7.548E-04	1.543E-01	7.887E+07	2.714E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.366E-08	6.808E-06	5.009E-02	1.596E-05
Stomach	1.310E-07	1.399E-05	2.610E-01	8.470E-05
Colon	2.727E-06	2.727E-05	5.254E-01	1.876E-04
Liver	2.701E-06	4.366E-04	9.961E-02	3.192E-05
LUNG	2.941E-07	1.373E-03	7.677E-01	2.295E-04
Bone	2.031E-06	3.415E-04	3.180E-02	1.029E-05
Skin	2.960E-09	4.218E-07	1.491E-02	9.669E-06
Breast	5.587E-08	7.844E-06	6.023E-01	1.980E-04
Ovary	5.920E-07	1.032E-04	6.233E-02	2.458E-05
Bladder	1.073E-07	1.628E-05	1.456E-01	4.986E-05
Kidneys	8.843E-08	1.365E-05	3.646E-02	1.158E-05
Thyroid	8.214E-09	1.154E-06	2.901E-02	8.202E-06
Leukemia	3.226E-07	4.958E-05	3.402E-01	1.099E-04
Residual	3.545E-07	4.736E-05	9.075E-01	3.274E-04
Total	9.472E-06	2.438E-03	3.879E+00	1.293E-03

****
* NUCLIDE Np-237 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	1.313E-06	2.471E-04	7.724E+07	2.027E+04
B Surfac	1.005E-03	1.898E-01	3.728E+08	9.273E+04
Breasts	1.313E-06	2.471E-04	1.468E+08	4.206E+04
St Wall	1.517E-06	2.472E-04	8.912E+07	2.318E+04
ULI Wall	4.396E-06	2.479E-04	7.794E+07	2.132E+04
Kidneys	3.564E-06	6.741E-04	9.343E+07	2.470E+04
Lungs	1.313E-06	5.273E-03	1.051E+08	2.540E+04
Ovaries	1.335E-05	2.522E-03	6.792E+07	2.015E+04
R Marrow	3.833E-05	7.248E-03	8.959E+07	2.353E+04
Spleen	1.313E-06	2.471E-04	9.052E+07	2.330E+04
Thymus	1.313E-06	2.471E-04	1.005E+08	2.423E+04
Uterus	1.313E-06	2.471E-04	7.025E+07	2.015E+04
Bld Wall	1.313E-06	2.472E-04	8.423E+07	2.365E+04
Brain	1.313E-06	2.471E-04	1.017E+08	2.062E+04
Esophagu	1.313E-06	1.341E-03	7.048E+07	1.759E+04
SI Wall	1.822E-06	2.472E-04	7.246E+07	2.004E+04
LLI Wall	1.035E-05	2.493E-04	7.316E+07	2.085E+04
Liver	1.595E-05	3.018E-03	9.087E+07	2.330E+04
Muscle	1.313E-06	2.471E-04	1.085E+08	3.495E+04
Pancreas	1.313E-06	2.471E-04	7.037E+07	1.911E+04
Skin	1.313E-06	2.471E-04	1.794E+08	9.739E+04
Testes	1.358E-05	2.566E-03	1.212E+08	3.938E+04
Thyroid	1.313E-06	2.471E-04	1.158E+08	2.854E+04
EFFEC	3.959E-04	8.399E-02	1.037E+08	2.936E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.401E-08	3.667E-06	8.108E-02	2.027E-05
Stomach	8.917E-08	8.510E-06	3.600E-01	9.355E-05
Colon	2.405E-06	1.783E-05	7.829E-01	2.179E-04
Liver	4.588E-07	7.400E-05	1.375E-01	3.530E-05
LUNG	1.739E-07	1.088E-03	1.028E+00	2.481E-04
Bone	1.288E-06	2.183E-04	3.542E-02	8.807E-06
Skin	1.757E-09	2.431E-07	1.794E-02	9.716E-06
Breast	3.567E-08	4.810E-06	7.095E-01	2.027E-04
Ovary	2.849E-07	4.921E-05	9.658E-02	2.866E-05
Bladder	5.772E-08	8.584E-06	2.039E-01	5.720E-05
Kidneys	4.514E-08	6.771E-06	4.858E-02	1.281E-05
Thyroid	5.069E-09	6.808E-07	3.681E-02	9.087E-06
Leukemia	2.331E-07	3.678E-05	5.033E-01	1.316E-04
Residual	2.264E-07	2.941E-05	1.270E+00	3.693E-04
Total	5.328E-06	1.547E-03	5.312E+00	1.445E-03

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* NUCLIDE Pa-233 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	3.552E-13	3.425E-11	8.365E+08	1.876E+05
B Surfac	8.443E-12	8.547E-10	2.423E+09	4.264E+05
Breasts	3.552E-13	3.425E-11	1.223E+09	2.342E+05
St Wall	3.553E-13	3.425E-11	9.064E+08	2.004E+05
ULI Wall	3.829E-13	3.430E-11	8.318E+08	1.957E+05
Kidneys	5.439E-12	4.965E-10	9.180E+08	2.015E+05
Lungs	3.552E-13	1.238E-09	1.035E+09	2.132E+05
Ovaries	3.175E-12	2.614E-10	7.549E+08	2.015E+05
R Marrow	8.795E-13	8.791E-11	9.635E+08	2.120E+05
Spleen	3.552E-13	3.425E-11	9.250E+08	2.015E+05
Thymus	3.552E-13	3.425E-11	9.704E+08	1.992E+05
Uterus	3.552E-13	3.425E-11	7.736E+08	1.922E+05
Bld Wall	3.554E-13	3.429E-11	8.563E+08	2.027E+05
Brain	3.552E-13	3.425E-11	1.073E+09	1.969E+05
Esophagu	3.552E-13	4.521E-10	8.097E+08	1.759E+05
SI Wall	3.564E-13	3.426E-11	7.910E+08	1.911E+05
LLI Wall	5.417E-13	3.441E-11	8.015E+08	1.969E+05
Liver	1.078E-12	1.093E-10	9.215E+08	2.004E+05
Muscle	3.552E-13	3.425E-11	1.012E+09	2.330E+05
Pancreas	3.552E-13	3.425E-11	7.864E+08	1.829E+05
Skin	3.552E-13	3.425E-11	1.934E+09	3.146E+05
Testes	3.224E-12	2.654E-10	1.067E+09	2.388E+05
Thyroid	3.552E-13	3.425E-11	1.073E+09	2.190E+05
EFFEC	3.247E-06	1.232E-05	9.984E+08	2.167E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	1.069E-11	6.845E-10	9.320E-01	2.027E-04
Stomach	6.290E-09	2.601E-09	3.658E+00	8.085E-04
Colon	4.366E-07	8.991E-08	8.458E+00	2.027E-03
Liver	1.720E-10	1.424E-09	1.398E+00	3.041E-04
LUNG	2.494E-10	9.546E-07	1.011E+01	2.085E-03
Bone	4.181E-11	2.102E-09	2.307E-01	4.054E-05
Skin	4.440E-12	1.820E-11	1.934E-01	3.134E-05
Breast	8.214E-11	2.420E-09	5.907E+00	1.131E-03
Ovary	1.454E-09	7.289E-10	1.074E+00	2.866E-04
Bladder	8.880E-10	4.921E-10	2.074E+00	4.905E-04
Kidneys	8.621E-11	7.733E-10	4.777E-01	1.048E-04
Thyroid	1.761E-12	9.398E-11	3.413E-01	6.978E-05
Leukemia	1.273E-09	1.698E-08	5.406E+00	1.188E-03
Residual	1.913E-09	7.326E-09	1.305E+01	2.994E-03
Total	4.514E-07	1.080E-06	5.336E+01	1.177E-02

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* NUCLIDE U-233 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	5.254E-06	2.607E-05	1.212E+06	3.087E+02
B Surfac	1.551E-04	7.929E-04	4.800E+06	1.549E+03
Breasts	5.254E-06	2.607E-05	2.586E+06	1.491E+03
St Wall	5.461E-06	2.611E-05	1.351E+06	3.483E+02
ULI Wall	8.306E-06	2.681E-05	1.200E+06	3.122E+02
Kidneys	5.383E-05	2.680E-04	1.410E+06	3.891E+02
Lungs	5.254E-06	5.132E-03	1.573E+06	3.728E+02
Ovaries	5.280E-06	2.635E-05	1.078E+06	3.390E+02
R Marrow	1.553E-05	7.826E-05	1.445E+06	4.206E+02
Spleen	5.254E-06	2.607E-05	1.375E+06	3.379E+02
Thymus	5.254E-06	2.607E-05	1.503E+06	3.728E+02
Uterus	5.254E-06	2.607E-05	1.103E+06	2.982E+02
Bld Wall	5.272E-06	2.615E-05	1.282E+06	3.542E+02
Brain	5.254E-06	2.607E-05	1.561E+06	3.076E+02
Esophagu	5.254E-06	1.131E-03	1.132E+06	2.633E+02
SI Wall	5.757E-06	2.619E-05	1.132E+06	2.971E+02
LLI Wall	1.421E-05	2.825E-05	1.146E+06	3.099E+02
Liver	2.049E-05	1.029E-04	1.375E+06	3.448E+02
Muscle	5.254E-06	2.607E-05	1.794E+06	1.038E+03
Pancreas	5.254E-06	2.607E-05	1.115E+06	2.819E+02
Skin	5.254E-06	2.607E-05	5.324E+06	6.920E+03
Testes	5.280E-06	2.635E-05	1.969E+06	1.212E+03
Thyroid	5.254E-06	2.607E-05	1.806E+06	5.149E+02
EFFEC	1.897E-04	1.314E-02	1.654E+06	6.990E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	8.177E-08	3.604E-07	1.305E-03	3.029E-07
Stomach	2.309E-07	8.399E-07	5.452E-03	1.410E-06
Colon	2.523E-06	2.176E-06	1.212E-02	3.215E-06
Liver	5.698E-07	2.464E-06	2.085E-03	5.231E-07
LUNG	5.735E-07	1.080E-03	1.538E-02	3.646E-06
Bone	3.622E-07	1.613E-06	4.555E-04	1.468E-07
Skin	5.883E-09	2.409E-08	5.312E-04	6.908E-07
Breast	1.128E-07	4.736E-07	1.247E-02	7.200E-06
Ovary	9.435E-08	4.366E-07	1.538E-03	4.823E-07
Bladder	2.002E-07	8.510E-07	3.099E-03	8.563E-07
Kidneys	6.438E-07	2.779E-06	7.328E-04	2.027E-07
Thyroid	1.650E-08	6.734E-08	5.755E-04	1.643E-07
Leukemia	9.176E-08	4.033E-07	8.108E-03	2.365E-06
Residual	7.363E-07	2.897E-06	2.039E-02	8.085E-06
Total	6.253E-06	1.095E-03	8.435E-02	2.924E-05

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* NUCLIDE Th-229 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	1.395E-05	3.048E-04	3.076E+08	7.468E+04
B Surfac	4.170E-03	9.487E-02	1.340E+09	2.726E+05
Breasts	1.395E-05	3.048E-04	5.149E+08	1.052E+05
St Wall	1.415E-05	3.050E-04	3.483E+08	8.283E+04
ULI Wall	1.722E-05	3.097E-04	3.099E+08	7.922E+04
Kidneys	5.839E-05	1.389E-03	3.588E+08	8.353E+04
Lungs	1.395E-05	9.235E-02	4.078E+08	8.901E+04
Ovaries	3.512E-05	7.977E-04	2.761E+08	7.584E+04
R Marrow	1.994E-04	4.677E-03	3.530E+08	8.365E+04
Spleen	1.395E-05	3.049E-04	3.553E+08	8.411E+04
Thymus	1.395E-05	3.048E-04	3.868E+08	8.225E+04
Uterus	1.395E-05	3.048E-04	2.831E+08	7.642E+04
Bld Wall	1.396E-05	3.051E-04	3.285E+08	8.341E+04
Brain	1.395E-05	3.048E-04	4.019E+08	7.771E+04
Esophagu	1.395E-05	3.677E-02	2.866E+08	6.839E+04
SI Wall	1.447E-05	3.051E-04	2.912E+08	7.584E+04
LLI Wall	2.426E-05	3.298E-04	2.936E+08	7.864E+04
Liver	2.018E-04	4.651E-03	3.553E+08	8.318E+04
Muscle	1.395E-05	3.048E-04	4.031E+08	9.996E+04
Pancreas	1.395E-05	3.048E-04	2.854E+08	7.328E+04
Skin	1.395E-05	3.048E-04	6.303E+08	1.829E+05
Testes	3.559E-05	8.081E-04	4.392E+08	1.043E+05
Thyroid	1.395E-05	3.048E-04	4.310E+08	9.075E+04
EFFEC	1.850E-03	2.634E-01	3.926E+08	9.204E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.153E-07	3.589E-06	3.297E-01	7.864E-05
Stomach	5.328E-07	6.623E-06	1.410E+00	3.344E-04
Colon	3.574E-06	1.376E-05	3.122E+00	8.155E-04
Liver	4.847E-06	8.066E-05	5.382E-01	1.258E-04
LUNG	1.465E-06	1.624E-02	3.984E+00	8.703E-04
Bone	5.365E-06	9.805E-05	1.270E-01	2.586E-05
Skin	1.476E-08	2.105E-07	6.291E-02	1.829E-05
Breast	2.794E-07	3.774E-06	2.493E+00	5.079E-04
Ovary	6.919E-07	1.228E-05	3.926E-01	1.079E-04
Bladder	5.328E-07	8.695E-06	7.945E-01	2.015E-04
Kidneys	5.032E-07	8.621E-06	1.864E-01	4.345E-05
Thyroid	4.107E-08	5.624E-07	1.375E-01	2.889E-05
Leukemia	1.073E-06	1.846E-05	1.980E+00	4.695E-04
Residual	1.776E-06	2.209E-05	4.940E+00	1.235E-03
Total	2.090E-05	1.654E-02	2.050E+01	4.858E-03

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* NUCLIDE Ra-225 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.076E-06	1.183E-06	1.340E+07	7.072E+03
B Surfac	6.649E-04	4.159E-04	1.072E+08	5.499E+04
Breasts	2.076E-06	1.183E-06	4.940E+07	2.027E+04
St Wall	2.078E-06	1.196E-06	1.794E+07	9.355E+03
ULI Wall	2.873E-06	1.566E-06	1.282E+07	7.188E+03
Kidneys	6.834E-06	2.075E-05	2.202E+07	1.109E+04
Lungs	2.076E-06	9.561E-03	2.283E+07	1.095E+04
Ovaries	2.471E-06	2.892E-06	8.528E+06	4.858E+03
R Marrow	6.420E-05	3.700E-05	1.654E+07	7.852E+03
Spleen	2.090E-06	1.190E-06	1.759E+07	9.367E+03
Thymus	2.076E-06	1.183E-06	2.353E+07	1.065E+04
Uterus	2.076E-06	1.183E-06	9.425E+06	5.813E+03
Bld Wall	2.084E-06	1.204E-06	1.678E+07	9.273E+03
Brain	2.076E-06	1.183E-06	1.911E+07	6.978E+03
Esophagu	2.076E-06	5.754E-04	8.376E+06	4.078E+03
SI Wall	2.090E-06	1.201E-06	1.058E+07	6.151E+03
LLI Wall	7.282E-06	2.968E-06	1.067E+07	6.431E+03
Liver	3.582E-05	1.474E-05	1.817E+07	9.320E+03
Muscle	2.076E-06	1.183E-06	2.936E+07	1.561E+04
Pancreas	2.076E-06	1.183E-06	8.924E+06	5.219E+03
Skin	2.076E-06	1.183E-06	3.507E+08	3.786E+04
Testes	2.478E-06	2.922E-06	3.775E+07	1.899E+04
Thyroid	2.076E-06	1.183E-06	3.227E+07	1.340E+04
EFFEC	3.680E-04	2.317E-02	2.808E+07	1.247E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	6.808E-08	2.993E-08	9.635E-03	4.695E-06
Stomach	2.786E-07	1.066E-07	7.246E-02	3.775E-05
Colon	2.102E-06	6.734E-07	1.223E-01	7.083E-05
Liver	1.543E-06	4.773E-07	2.749E-02	1.410E-05
LUNG	7.178E-07	1.991E-03	2.237E-01	1.071E-04
Bone	3.611E-06	1.162E-06	1.018E-02	5.219E-06
Skin	7.104E-09	2.653E-09	3.495E-02	3.775E-06
Breast	1.754E-07	6.475E-08	2.388E-01	9.798E-05
Ovary	9.694E-08	8.695E-08	1.212E-02	6.908E-06
Bladder	1.487E-07	6.549E-08	4.054E-02	2.237E-05
Kidneys	1.088E-07	2.216E-07	1.145E-02	5.767E-06
Thyroid	2.431E-08	8.584E-09	1.028E-02	4.264E-06
Leukemia	8.473E-07	3.112E-07	9.285E-02	4.404E-05
Residual	1.099E-06	3.959E-07	2.563E-01	1.386E-04
Total	1.084E-05	1.994E-03	1.163E+00	5.639E-04

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* NUCLIDE Ac-225 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	1.616E-06	1.361E-06	5.907E+07	1.410E+04
B Surfac	7.929E-06	4.007E-04	2.412E+08	4.753E+04
Breasts	1.616E-06	1.361E-06	9.646E+07	1.946E+04
St Wall	2.524E-06	1.567E-06	6.640E+07	1.549E+04
ULI Wall	1.820E-05	4.784E-06	5.953E+07	1.491E+04
Kidneys	4.444E-05	3.811E-05	6.815E+07	1.561E+04
Lungs	1.616E-06	1.122E-02	7.736E+07	1.654E+04
Ovaries	1.716E-06	7.748E-06	5.336E+07	1.445E+04
R Marrow	2.012E-06	3.297E-05	6.792E+07	1.584E+04
Spleen	1.625E-06	1.389E-06	6.780E+07	1.573E+04
Thymus	1.616E-06	1.361E-06	7.316E+07	1.526E+04
Uterus	1.616E-06	1.361E-06	5.452E+07	1.445E+04
Bld Wall	1.964E-06	1.451E-06	6.268E+07	1.561E+04
Brain	1.616E-06	1.361E-06	7.712E+07	1.468E+04
Esophagu	1.616E-06	1.000E-03	5.557E+07	1.305E+04
SI Wall	2.855E-06	1.622E-06	5.592E+07	1.433E+04
LLI Wall	4.795E-05	1.091E-05	5.662E+07	1.491E+04
Liver	5.306E-06	1.771E-04	6.780E+07	1.549E+04
Muscle	1.616E-06	1.361E-06	7.619E+07	1.864E+04
Pancreas	1.616E-06	1.361E-06	5.510E+07	1.386E+04
Skin	1.616E-06	1.361E-06	1.095E+08	3.588E+04
Testes	1.715E-06	7.689E-06	8.248E+07	1.934E+04
Thyroid	1.616E-06	1.361E-06	8.143E+07	1.689E+04
EFFEC	1.425E-04	2.734E-02	7.433E+07	1.713E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.921E-08	3.885E-08	6.396E-02	1.503E-05
Stomach	3.112E-07	1.702E-07	2.679E-01	6.256E-05
Colon	1.273E-05	2.768E-06	6.011E-01	1.538E-04
Liver	1.987E-07	5.328E-06	1.028E-01	2.353E-05
LUNG	4.958E-07	2.327E-03	7.561E-01	1.619E-04
Bone	2.494E-08	1.073E-06	2.295E-02	4.509E-06
Skin	4.958E-09	3.630E-09	1.093E-02	3.577E-06
Breast	1.199E-07	9.213E-08	4.660E-01	9.402E-05
Ovary	6.142E-08	2.394E-07	7.596E-02	2.050E-05
Bladder	1.354E-07	8.880E-08	1.515E-01	3.775E-05
Kidneys	6.068E-07	4.662E-07	3.542E-02	8.120E-06
Thyroid	1.665E-08	1.217E-08	2.598E-02	5.382E-06
Leukemia	2.120E-08	3.448E-07	3.810E-01	8.889E-05
Residual	7.696E-07	5.550E-07	9.448E-01	2.307E-04
Total	1.554E-05	2.338E-03	3.903E+00	9.110E-04

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* NUCLIDE Fr-221 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	1.281E+08	2.912E+04
B Surfac	0.000E+00	0.000E+00	4.054E+08	6.827E+04
Breasts	0.000E+00	0.000E+00	1.911E+08	3.518E+04
St Wall	0.000E+00	0.000E+00	1.398E+08	3.111E+04
ULI Wall	0.000E+00	0.000E+00	1.281E+08	3.017E+04
Kidneys	0.000E+00	0.000E+00	1.421E+08	3.087E+04
Lungs	0.000E+00	0.000E+00	1.608E+08	3.274E+04
Ovaries	0.000E+00	0.000E+00	1.188E+08	2.994E+04
R Marrow	0.000E+00	0.000E+00	1.480E+08	3.250E+04
Spleen	0.000E+00	0.000E+00	1.433E+08	3.134E+04
Thymus	0.000E+00	0.000E+00	1.514E+08	2.994E+04
Uterus	0.000E+00	0.000E+00	1.200E+08	2.947E+04
Bld Wall	0.000E+00	0.000E+00	1.328E+08	3.076E+04
Brain	0.000E+00	0.000E+00	1.654E+08	3.017E+04
Esophagu	0.000E+00	0.000E+00	1.247E+08	2.680E+04
SI Wall	0.000E+00	0.000E+00	1.223E+08	2.924E+04
LLI Wall	0.000E+00	0.000E+00	1.235E+08	3.029E+04
Liver	0.000E+00	0.000E+00	1.433E+08	3.111E+04
Muscle	0.000E+00	0.000E+00	1.573E+08	3.530E+04
Pancreas	0.000E+00	0.000E+00	1.212E+08	2.831E+04
Skin	0.000E+00	0.000E+00	2.353E+08	4.276E+04
Testes	0.000E+00	0.000E+00	1.666E+08	3.588E+04
Thyroid	0.000E+00	0.000E+00	1.678E+08	3.285E+04
EFFEC	0.000E+00	0.000E+00	1.549E+08	3.309E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	1.433E-01	3.087E-05
Stomach	0.000E+00	0.000E+00	5.639E-01	1.258E-04
Colon	0.000E+00	0.000E+00	1.305E+00	3.122E-04
Liver	0.000E+00	0.000E+00	2.167E-01	4.718E-05
LUNG	0.000E+00	0.000E+00	1.573E+00	3.204E-04
Bone	0.000E+00	0.000E+00	3.844E-02	6.477E-06
Skin	0.000E+00	0.000E+00	2.353E-02	4.264E-06
Breast	0.000E+00	0.000E+00	9.227E-01	1.701E-04
Ovary	0.000E+00	0.000E+00	1.689E-01	4.264E-05
Bladder	0.000E+00	0.000E+00	3.215E-01	7.433E-05
Kidneys	0.000E+00	0.000E+00	7.398E-02	1.608E-05
Thyroid	0.000E+00	0.000E+00	5.347E-02	1.046E-05
Leukemia	0.000E+00	0.000E+00	8.306E-01	1.829E-04
Residual	0.000E+00	0.000E+00	2.015E+00	4.602E-04
Total	0.000E+00	0.000E+00	8.248E+00	1.806E-03

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* NUCLIDE At-217 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	1.375E+06	2.982E+02
B Surfac	0.000E+00	0.000E+00	3.111E+06	5.475E+02
Breasts	0.000E+00	0.000E+00	1.922E+06	3.553E+02
St Wall	0.000E+00	0.000E+00	1.480E+06	3.169E+02
ULI Wall	0.000E+00	0.000E+00	1.363E+06	3.145E+02
Kidneys	0.000E+00	0.000E+00	1.480E+06	3.192E+02
Lungs	0.000E+00	0.000E+00	1.666E+06	3.367E+02
Ovaries	0.000E+00	0.000E+00	1.258E+06	3.262E+02
R Marrow	0.000E+00	0.000E+00	1.596E+06	3.390E+02
Spleen	0.000E+00	0.000E+00	1.503E+06	3.192E+02
Thymus	0.000E+00	0.000E+00	1.549E+06	3.192E+02
Uterus	0.000E+00	0.000E+00	1.282E+06	3.076E+02
Bld Wall	0.000E+00	0.000E+00	1.375E+06	3.215E+02
Brain	0.000E+00	0.000E+00	1.759E+06	3.157E+02
Esophagu	0.000E+00	0.000E+00	1.363E+06	2.843E+02
SI Wall	0.000E+00	0.000E+00	1.305E+06	3.076E+02
LLI Wall	0.000E+00	0.000E+00	1.340E+06	3.192E+02
Liver	0.000E+00	0.000E+00	1.491E+06	3.180E+02
Muscle	0.000E+00	0.000E+00	1.631E+06	3.635E+02
Pancreas	0.000E+00	0.000E+00	1.293E+06	2.913E+02
Skin	0.000E+00	0.000E+00	2.167E+06	4.788E+02
Testes	0.000E+00	0.000E+00	1.689E+06	3.693E+02
Thyroid	0.000E+00	0.000E+00	1.713E+06	3.495E+02
EFFEC	0.000E+00	0.000E+00	1.596E+06	3.402E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	1.573E-03	3.274E-07
Stomach	0.000E+00	0.000E+00	5.976E-03	1.281E-06
Colon	0.000E+00	0.000E+00	1.398E-02	3.274E-06
Liver	0.000E+00	0.000E+00	2.260E-03	4.823E-07
LUNG	0.000E+00	0.000E+00	1.631E-02	3.297E-06
Bone	0.000E+00	0.000E+00	2.959E-04	5.196E-08
Skin	0.000E+00	0.000E+00	2.167E-04	4.776E-08
Breast	0.000E+00	0.000E+00	9.285E-03	1.713E-06
Ovary	0.000E+00	0.000E+00	1.794E-03	4.637E-07
Bladder	0.000E+00	0.000E+00	3.320E-03	7.771E-07
Kidneys	0.000E+00	0.000E+00	7.701E-04	1.666E-07
Thyroid	0.000E+00	0.000E+00	5.452E-04	1.113E-07
Leukemia	0.000E+00	0.000E+00	8.959E-03	1.899E-06
Residual	0.000E+00	0.000E+00	2.132E-02	4.730E-06
Total	0.000E+00	0.000E+00	8.656E-02	1.864E-05

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* NUCLIDE Bi-213 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	7.837E-10	2.876E-09	5.976E+08	1.293E+05
B Surfac	7.837E-10	2.876E-09	1.363E+09	2.400E+05
Breasts	7.837E-10	2.876E-09	8.341E+08	1.561E+05
St Wall	1.866E-07	3.082E-08	6.373E+08	1.375E+05
ULI Wall	4.666E-08	1.081E-08	5.895E+08	1.375E+05
Kidneys	1.109E-07	4.070E-07	6.419E+08	1.386E+05
Lungs	7.837E-10	3.185E-05	7.188E+08	1.468E+05
Ovaries	7.837E-10	2.876E-09	5.347E+08	1.456E+05
R Marrow	7.837E-10	2.876E-09	6.885E+08	1.480E+05
Spleen	7.837E-10	2.876E-09	6.489E+08	1.386E+05
Thymus	7.837E-10	2.876E-09	6.687E+08	1.410E+05
Uterus	7.837E-10	2.876E-09	5.499E+08	1.340E+05
Bld Wall	1.161E-09	4.259E-09	5.988E+08	1.410E+05
Brain	7.837E-10	2.876E-09	7.619E+08	1.375E+05
Esophagu	7.837E-10	6.745E-05	5.848E+08	1.235E+05
SI Wall	9.968E-08	1.775E-08	5.639E+08	1.340E+05
LLI Wall	6.671E-09	3.892E-09	5.743E+08	1.386E+05
Liver	7.837E-10	2.876E-09	6.454E+08	1.386E+05
Muscle	7.837E-10	2.876E-09	7.037E+08	1.596E+05
Pancreas	7.837E-10	2.876E-09	5.604E+08	1.270E+05
Skin	7.837E-10	2.876E-09	3.949E+09	4.928E+06
Testes	7.837E-10	2.876E-09	7.281E+08	1.619E+05
Thyroid	7.837E-10	2.876E-09	7.398E+08	1.526E+05
EFFEC	7.326E-07	1.104E-04	7.188E+08	1.957E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.483E-11	8.362E-11	6.734E-01	1.421E-04
Stomach	2.849E-08	4.440E-09	2.575E+00	5.545E-04
Colon	1.998E-08	4.181E-09	6.023E+00	1.421E-03
Liver	3.922E-11	1.114E-10	9.786E-01	2.097E-04
LUNG	2.620E-10	6.475E-06	7.025E+00	1.433E-03
Bone	2.202E-12	6.882E-12	1.293E-01	2.283E-05
Skin	2.553E-12	7.733E-12	3.938E-01	4.916E-04
Breast	6.549E-11	1.987E-10	4.031E+00	7.538E-04
Ovary	4.218E-11	1.014E-10	7.607E-01	2.074E-04
Bladder	9.620E-11	2.779E-10	1.445E+00	3.413E-04
Kidneys	1.521E-09	4.995E-09	3.344E-01	7.211E-05
Thyroid	8.288E-12	2.601E-11	2.353E-01	4.858E-05
Leukemia	2.309E-11	2.808E-11	3.868E+00	8.306E-04
Residual	4.884E-10	1.199E-09	9.238E+00	2.062E-03
Total	5.106E-08	6.475E-06	3.775E+01	8.598E-03

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* NUCLIDE Pu-238 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.386E-06	4.484E-04	7.106E+04	5.650E+01
B Surfac	1.369E-03	2.576E-01	1.083E+06	1.421E+03
Breasts	2.386E-06	4.484E-04	1.480E+06	2.248E+03
St Wall	2.620E-06	4.484E-04	1.069E+05	8.912E+01
ULI Wall	5.935E-06	4.495E-04	6.687E+04	3.355E+01
Kidneys	5.920E-06	1.116E-03	1.538E+05	1.782E+02
Lungs	2.386E-06	6.775E-03	1.235E+05	9.169E+01
Ovaries	1.796E-05	3.383E-03	5.056E+04	1.068E+02
R Marrow	6.767E-05	1.275E-02	1.957E+05	2.260E+02
Spleen	2.386E-06	4.484E-04	8.947E+04	5.242E+01
Thymus	2.386E-06	4.484E-04	1.689E+05	1.538E+02
Uterus	2.386E-06	4.484E-04	5.475E+04	2.516E+01
Bld Wall	2.386E-06	4.484E-04	1.059E+05	1.012E+02
Brain	2.386E-06	4.484E-04	8.912E+04	2.610E+01
Esophagu	2.386E-06	1.645E-03	5.242E+04	1.584E+01
SI Wall	2.971E-06	4.488E-04	5.825E+04	2.749E+01
LLI Wall	1.279E-05	4.510E-04	5.848E+04	3.262E+01
Liver	2.885E-04	5.432E-02	1.019E+05	7.759E+01
Muscle	2.386E-06	4.484E-04	6.209E+05	1.340E+03
Pancreas	2.386E-06	4.484E-04	5.173E+04	1.946E+01
Skin	2.386E-06	4.484E-04	4.765E+06	1.123E+04
Testes	1.829E-05	3.443E-03	7.642E+05	1.736E+03
Thyroid	2.386E-06	4.484E-04	4.672E+05	3.961E+02
EFFEC	8.436E-04	1.709E-01	4.089E+05	7.293E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.477E-08	6.919E-06	6.035E-05	1.817E-08
Stomach	1.606E-07	1.806E-05	4.322E-04	3.600E-07
Colon	2.742E-06	3.996E-05	6.536E-04	3.425E-07
Liver	6.549E-06	1.036E-03	1.549E-04	1.177E-07
LUNG	3.533E-07	1.380E-03	1.212E-03	8.970E-07
Bone	1.676E-06	2.816E-04	1.029E-04	1.351E-07
Skin	3.552E-09	4.921E-07	4.753E-04	1.121E-06
Breast	7.622E-08	1.029E-05	7.153E-03	1.086E-05
Ovary	3.448E-07	5.957E-05	7.188E-05	1.514E-07
Bladder	1.054E-07	1.598E-05	2.563E-04	2.446E-07
Kidneys	6.364E-08	9.620E-06	8.004E-05	9.273E-08
Thyroid	1.073E-08	1.428E-06	1.491E-04	1.258E-07
Leukemia	3.389E-07	5.365E-05	1.099E-03	1.270E-06
Residual	4.847E-07	6.327E-05	3.693E-03	7.025E-06
Total	1.295E-05	2.975E-03	1.561E-02	2.272E-05

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* NUCLIDE U-234 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	5.106E-06	2.526E-05	3.577E+05	1.235E+02
B Surfac	1.453E-04	7.211E-04	2.318E+06	1.421E+03
Breasts	5.106E-06	2.526E-05	1.678E+06	1.911E+03
St Wall	5.310E-06	2.531E-05	4.310E+05	1.526E+02
ULI Wall	8.125E-06	2.600E-05	3.565E+05	1.117E+02
Kidneys	5.306E-05	2.638E-04	4.765E+05	2.085E+02
Lungs	5.106E-06	5.036E-03	5.103E+05	1.631E+02
Ovaries	5.106E-06	2.526E-05	3.076E+05	1.666E+02
R Marrow	1.500E-05	7.448E-05	4.893E+05	2.575E+02
Spleen	5.106E-06	2.526E-05	4.264E+05	1.316E+02
Thymus	5.106E-06	2.526E-05	5.184E+05	1.934E+02
Uterus	5.106E-06	2.526E-05	3.157E+05	1.029E+02
Bld Wall	5.125E-06	2.534E-05	4.078E+05	1.596E+02
Brain	5.106E-06	2.526E-05	4.742E+05	1.069E+02
Esophagu	5.106E-06	1.117E-03	3.122E+05	8.574E+01
SI Wall	5.606E-06	2.539E-05	3.274E+05	1.033E+02
LLI Wall	1.395E-05	2.741E-05	3.320E+05	1.114E+02
Liver	1.989E-05	9.879E-05	4.357E+05	1.456E+02
Muscle	5.106E-06	2.526E-05	8.889E+05	1.200E+03
Pancreas	5.106E-06	2.526E-05	3.146E+05	9.541E+01
Skin	5.106E-06	2.526E-05	4.951E+06	1.059E+04
Testes	5.106E-06	2.526E-05	1.024E+06	1.456E+03
Thyroid	5.106E-06	2.526E-05	7.794E+05	3.740E+02
EFFEC	1.832E-04	1.287E-02	7.141E+05	6.827E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	7.955E-08	3.504E-07	3.588E-04	9.868E-08
Stomach	2.268E-07	8.214E-07	1.736E-03	6.163E-07
Colon	2.505E-06	2.135E-06	3.577E-03	1.152E-06
Liver	5.550E-07	2.379E-06	6.606E-04	2.202E-07
LUNG	5.624E-07	1.058E-03	4.986E-03	1.596E-06
Bone	3.456E-07	1.513E-06	2.202E-04	1.351E-07
Skin	5.735E-09	2.349E-08	4.940E-04	1.057E-06
Breast	1.106E-07	4.625E-07	8.108E-03	9.227E-06
Ovary	9.065E-08	4.181E-07	4.380E-04	2.365E-07
Bladder	1.950E-07	8.288E-07	9.856E-04	3.856E-07
Kidneys	6.364E-07	2.738E-06	2.481E-04	1.085E-07
Thyroid	1.617E-08	6.586E-08	2.481E-04	1.188E-07
Leukemia	8.917E-08	3.885E-07	2.749E-03	1.445E-06
Residual	7.215E-07	2.834E-06	7.747E-03	7.037E-06
Total	6.142E-06	1.073E-03	3.250E-02	2.342E-05

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* NUCLIDE Th-230 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.515E-06	5.602E-05	1.212E+06	3.320E+02
B Surfac	2.270E-03	5.158E-02	6.163E+06	1.922E+03
Breasts	2.515E-06	5.602E-05	2.773E+06	1.549E+03
St Wall	2.714E-06	5.609E-05	1.410E+06	3.786E+02
ULI Wall	5.535E-06	5.702E-05	1.212E+06	3.437E+02
Kidneys	3.424E-05	8.055E-04	1.480E+06	4.054E+02
Lungs	2.515E-06	1.417E-02	1.666E+06	4.101E+02
Ovaries	1.831E-05	4.203E-04	1.057E+06	3.751E+02
R Marrow	7.822E-05	1.856E-03	1.421E+06	4.357E+02
Spleen	2.515E-06	5.602E-05	1.433E+06	3.740E+02
Thymus	2.515E-06	5.602E-05	1.596E+06	4.101E+02
Uterus	2.515E-06	5.602E-05	1.089E+06	3.250E+02
Bld Wall	2.515E-06	5.602E-05	1.328E+06	3.798E+02
Brain	2.515E-06	5.602E-05	1.608E+06	3.355E+02
Esophagu	2.515E-06	6.564E-03	1.090E+06	2.808E+02
SI Wall	3.013E-06	5.620E-05	1.128E+06	3.262E+02
LLI Wall	1.137E-05	5.890E-05	1.142E+06	3.402E+02
Liver	2.943E-05	6.808E-04	1.433E+06	3.786E+02
Muscle	2.515E-06	5.602E-05	1.876E+06	1.096E+03
Pancreas	2.515E-06	5.602E-05	1.094E+06	3.134E+02
Skin	2.515E-06	5.602E-05	5.254E+06	8.353E+03
Testes	1.864E-05	4.277E-04	2.097E+06	1.223E+03
Thyroid	2.515E-06	5.602E-05	1.899E+06	5.196E+02
EFFEC	7.911E-04	5.173E-02	1.736E+06	7.421E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.292E-08	7.067E-07	1.258E-03	3.227E-07
Stomach	1.399E-07	1.473E-06	5.697E-03	1.526E-06
Colon	2.335E-06	3.334E-06	1.223E-02	3.530E-06
Liver	7.326E-07	1.206E-05	2.167E-03	5.743E-07
LUNG	3.163E-07	2.579E-03	1.631E-02	4.008E-06
Bone	2.745E-06	5.180E-05	5.848E-04	1.829E-07
Skin	3.201E-09	4.403E-08	5.242E-04	8.330E-07
Breast	6.512E-08	8.140E-07	1.340E-02	7.491E-06
Ovary	3.774E-07	6.697E-06	1.503E-03	5.336E-07
Bladder	1.036E-07	1.698E-06	3.215E-03	9.180E-07
Kidneys	3.041E-07	5.069E-06	7.701E-04	2.109E-07
Thyroid	9.324E-09	1.199E-07	6.046E-04	1.654E-07
Leukemia	4.181E-07	7.178E-06	7.980E-03	2.446E-06
Residual	4.144E-07	4.958E-06	2.074E-02	8.644E-06
Total	7.992E-06	2.675E-03	8.691E-02	3.134E-05

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* NUCLIDE Ra-226 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	7.267E-06	4.314E-06	2.714E+07	6.244E+03
B Surfac	2.302E-03	1.366E-03	9.262E+07	1.584E+04
Breasts	7.267E-06	4.314E-06	4.124E+07	7.596E+03
St Wall	7.474E-06	4.366E-06	2.982E+07	6.687E+03
ULI Wall	1.178E-05	5.809E-06	2.726E+07	6.477E+03
Kidneys	1.083E-05	6.394E-06	3.041E+07	6.652E+03
Lungs	7.267E-06	5.087E-03	3.437E+07	7.060E+03
Ovaries	7.267E-06	4.314E-06	2.516E+07	6.303E+03
R Marrow	1.601E-04	9.513E-05	3.146E+07	6.932E+03
Spleen	9.846E-06	5.831E-06	3.052E+07	6.745E+03
Thymus	7.267E-06	4.314E-06	3.262E+07	6.408E+03
Uterus	7.267E-06	4.314E-06	2.540E+07	6.314E+03
Bld Wall	7.274E-06	4.322E-06	2.819E+07	6.617E+03
Brain	7.267E-06	4.314E-06	3.507E+07	6.454E+03
Esophagu	7.267E-06	1.150E-03	2.621E+07	5.732E+03
SI Wall	7.729E-06	4.444E-06	2.586E+07	6.268E+03
LLI Wall	2.539E-05	1.035E-05	2.610E+07	6.477E+03
Liver	3.299E-05	1.959E-05	3.052E+07	6.675E+03
Muscle	7.267E-06	4.314E-06	3.367E+07	7.584E+03
Pancreas	7.267E-06	4.314E-06	2.575E+07	6.058E+03
Skin	7.267E-06	4.314E-06	5.580E+07	9.460E+03
Testes	7.267E-06	4.314E-06	3.588E+07	7.736E+03
Thyroid	7.267E-06	4.314E-06	3.600E+07	7.060E+03
EFFEC	1.035E-03	1.281E-02	3.309E+07	7.118E+03

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.135E-07	9.509E-08	3.017E-02	6.594E-06
Stomach	8.473E-07	3.101E-07	1.200E-01	2.703E-05
Colon	6.438E-06	1.935E-06	2.761E-01	6.687E-05
Liver	1.654E-06	6.956E-07	4.625E-02	1.011E-05
LUNG	1.954E-06	1.073E-03	3.355E-01	6.908E-05
Bone	8.917E-06	3.511E-06	8.796E-03	1.503E-06
Skin	1.998E-08	7.696E-09	5.569E-03	9.436E-07
Breast	4.736E-07	1.765E-07	1.992E-01	3.670E-05
Ovary	2.523E-07	1.158E-07	3.577E-02	8.970E-06
Bladder	4.736E-07	2.087E-07	6.815E-02	1.596E-05
Kidneys	1.832E-07	7.252E-08	1.584E-02	3.460E-06
Thyroid	6.401E-08	2.327E-08	1.146E-02	2.248E-06
Leukemia	1.820E-06	7.696E-07	1.771E-01	3.891E-05
Residual	1.206E-05	4.625E-06	4.299E-01	9.868E-05
Total	3.537E-05	1.084E-03	1.759E+00	3.868E-04

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* NUCLIDE Rn-222 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	1.806E+06	3.879E+02
B Surfac	0.000E+00	0.000E+00	3.856E+06	6.745E+02
Breasts	0.000E+00	0.000E+00	2.493E+06	4.637E+02
St Wall	0.000E+00	0.000E+00	1.922E+06	4.124E+02
ULI Wall	0.000E+00	0.000E+00	1.782E+06	4.101E+02
Kidneys	0.000E+00	0.000E+00	1.934E+06	4.159E+02
Lungs	0.000E+00	0.000E+00	2.167E+06	4.404E+02
Ovaries	0.000E+00	0.000E+00	1.619E+06	4.392E+02
R Marrow	0.000E+00	0.000E+00	2.085E+06	4.439E+02
Spleen	0.000E+00	0.000E+00	1.957E+06	4.147E+02
Thymus	0.000E+00	0.000E+00	2.004E+06	4.229E+02
Uterus	0.000E+00	0.000E+00	1.666E+06	4.019E+02
Bld Wall	0.000E+00	0.000E+00	1.806E+06	4.229E+02
Brain	0.000E+00	0.000E+00	2.307E+06	4.136E+02
Esophagu	0.000E+00	0.000E+00	1.771E+06	3.740E+02
SI Wall	0.000E+00	0.000E+00	1.713E+06	4.019E+02
LLI Wall	0.000E+00	0.000E+00	1.736E+06	4.171E+02
Liver	0.000E+00	0.000E+00	1.946E+06	4.147E+02
Muscle	0.000E+00	0.000E+00	2.109E+06	4.753E+02
Pancreas	0.000E+00	0.000E+00	1.689E+06	3.798E+02
Skin	0.000E+00	0.000E+00	2.656E+06	6.058E+02
Testes	0.000E+00	0.000E+00	2.179E+06	4.835E+02
Thyroid	0.000E+00	0.000E+00	2.214E+06	4.602E+02
EFFEC	0.000E+00	0.000E+00	2.074E+06	4.450E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	2.039E-03	4.299E-07
Stomach	0.000E+00	0.000E+00	7.759E-03	1.666E-06
Colon	0.000E+00	0.000E+00	1.817E-02	4.264E-06
Liver	0.000E+00	0.000E+00	2.947E-03	6.291E-07
LUNG	0.000E+00	0.000E+00	2.120E-02	4.310E-06
Bone	0.000E+00	0.000E+00	3.658E-04	6.407E-08
Skin	0.000E+00	0.000E+00	2.645E-04	6.046E-08
Breast	0.000E+00	0.000E+00	1.200E-02	2.237E-06
Ovary	0.000E+00	0.000E+00	2.307E-03	6.244E-07
Bladder	0.000E+00	0.000E+00	4.369E-03	1.023E-06
Kidneys	0.000E+00	0.000E+00	1.007E-03	2.167E-07
Thyroid	0.000E+00	0.000E+00	7.048E-04	1.468E-07
Leukemia	0.000E+00	0.000E+00	1.165E-02	2.493E-06
Residual	0.000E+00	0.000E+00	2.784E-02	6.163E-06
Total	0.000E+00	0.000E+00	1.127E-01	2.435E-05

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* NUCLIDE Pu-239 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.684E-06	5.051E-04	2.330E+05	6.978E+01
B Surfac	1.523E-03	2.870E-01	1.103E+06	6.769E+02
Breasts	2.684E-06	5.051E-04	8.796E+05	9.052E+02
St Wall	2.904E-06	5.051E-04	2.680E+05	8.679E+01
ULI Wall	6.013E-06	5.062E-04	2.307E+05	6.396E+01
Kidneys	6.253E-06	1.181E-03	2.901E+05	1.212E+02
Lungs	2.684E-06	6.168E-03	3.087E+05	9.169E+01
Ovaries	1.995E-05	3.763E-03	2.039E+05	9.134E+01
R Marrow	7.241E-05	1.367E-02	3.111E+05	1.398E+02
Spleen	2.684E-06	5.051E-04	2.656E+05	7.351E+01
Thymus	2.684E-06	5.051E-04	3.111E+05	1.115E+02
Uterus	2.684E-06	5.051E-04	2.097E+05	5.907E+01
Bld Wall	2.684E-06	5.051E-04	2.540E+05	9.180E+01
Brain	2.684E-06	5.051E-04	3.006E+05	6.093E+01
Esophagu	2.684E-06	1.654E-03	2.155E+05	5.091E+01
SI Wall	3.233E-06	5.054E-04	2.167E+05	5.976E+01
LLI Wall	1.244E-05	5.076E-04	2.190E+05	6.361E+01
Liver	3.194E-04	6.024E-02	2.703E+05	8.260E+01
Muscle	2.684E-06	5.051E-04	4.916E+05	5.650E+02
Pancreas	2.684E-06	5.051E-04	2.109E+05	5.452E+01
Skin	2.684E-06	5.051E-04	2.167E+06	4.276E+03
Testes	2.031E-05	3.829E-03	5.639E+05	7.153E+02
Thyroid	2.684E-06	5.051E-04	4.520E+05	2.074E+02
EFFEC	9.276E-04	1.855E-01	4.066E+05	3.309E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.810E-08	7.437E-06	2.481E-04	5.860E-08
Stomach	1.613E-07	1.850E-05	1.082E-03	3.507E-07
Colon	2.586E-06	4.033E-05	2.330E-03	6.594E-07
Liver	6.956E-06	1.103E-03	4.101E-04	1.247E-07
LUNG	3.693E-07	1.243E-03	3.017E-03	8.970E-07
Bone	1.798E-06	3.019E-04	1.047E-04	6.431E-08
Skin	3.689E-09	5.143E-07	2.167E-04	4.264E-07
Breast	7.733E-08	1.051E-05	4.252E-03	4.369E-06
Ovary	3.681E-07	6.364E-05	2.901E-04	1.305E-07
Bladder	1.147E-07	1.735E-05	6.140E-04	2.225E-07
Kidneys	6.401E-08	9.731E-06	1.514E-04	6.303E-08
Thyroid	1.103E-08	1.480E-06	1.445E-04	6.606E-08
Leukemia	3.500E-07	5.550E-05	1.747E-03	7.852E-07
Residual	4.884E-07	6.438E-05	4.637E-03	3.425E-06
Total	1.343E-05	2.938E-03	1.922E-02	1.164E-05

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* NUCLIDE U-235 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	4.717E-06	2.334E-05	6.198E+08	1.421E+05
B Surfac	1.366E-04	6.778E-04	2.144E+09	3.658E+05
Breasts	4.717E-06	2.334E-05	9.448E+08	1.759E+05
St Wall	4.906E-06	2.339E-05	6.815E+08	1.526E+05
ULI Wall	7.507E-06	2.402E-05	6.221E+08	1.480E+05
Kidneys	4.899E-05	2.437E-04	6.943E+08	1.514E+05
Lungs	4.717E-06	4.444E-03	7.864E+08	1.608E+05
Ovaries	4.717E-06	2.334E-05	5.743E+08	1.433E+05
R Marrow	1.386E-05	6.878E-05	7.165E+08	1.584E+05
Spleen	4.717E-06	2.334E-05	6.967E+08	1.538E+05
Thymus	4.717E-06	2.334E-05	7.444E+08	1.456E+05
Uterus	4.717E-06	2.334E-05	5.790E+08	1.445E+05
Bld Wall	4.736E-06	2.342E-05	6.454E+08	1.514E+05
Brain	4.717E-06	2.334E-05	8.004E+08	1.468E+05
Esophagu	4.717E-06	1.025E-03	5.988E+08	1.305E+05
SI Wall	5.180E-06	2.345E-05	5.907E+08	1.433E+05
LLI Wall	1.289E-05	2.533E-05	5.965E+08	1.480E+05
Liver	1.837E-05	9.128E-05	6.967E+08	1.526E+05
Muscle	4.717E-06	2.334E-05	7.689E+08	1.748E+05
Pancreas	4.717E-06	2.334E-05	5.872E+08	1.386E+05
Skin	4.717E-06	2.334E-05	1.007E+09	2.260E+05
Testes	4.717E-06	2.334E-05	8.213E+08	1.782E+05
Thyroid	4.717E-06	2.334E-05	8.213E+08	1.619E+05
EFFEC	1.728E-04	1.142E-02	7.549E+08	1.631E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	7.400E-08	3.275E-07	6.885E-01	1.503E-04
Stomach	2.124E-07	7.659E-07	2.749E+00	6.163E-04
Colon	2.608E-06	2.057E-06	6.314E+00	1.526E-03
Liver	5.143E-07	2.205E-06	1.055E+00	2.318E-04
LUNG	5.217E-07	9.398E-04	7.689E+00	1.573E-03
Bone	3.238E-07	1.417E-06	2.039E-01	3.472E-05
Skin	5.328E-09	2.183E-08	1.004E-01	2.260E-05
Breast	1.032E-07	4.366E-07	4.567E+00	8.493E-04
Ovary	8.621E-08	3.922E-07	8.167E-01	2.039E-04
Bladder	1.817E-07	7.696E-07	1.561E+00	3.658E-04
Kidneys	5.883E-07	2.535E-06	3.611E-01	7.875E-05
Thyroid	1.502E-08	6.142E-08	2.610E-01	5.161E-05
Leukemia	1.029E-07	4.514E-07	4.019E+00	8.889E-04
Residual	6.734E-07	2.657E-06	9.798E+00	2.260E-03
Total	5.994E-06	9.509E-04	4.019E+01	8.854E-03

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* NUCLIDE Th-231 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	9.176E-13	2.142E-11	3.658E+07	1.003E+04
B Surfac	4.122E-10	9.901E-09	1.899E+08	5.569E+04
Breasts	9.176E-13	2.142E-11	7.910E+07	3.204E+04
St Wall	9.180E-13	2.142E-11	4.287E+07	1.188E+04
ULI Wall	1.142E-12	2.466E-11	3.693E+07	1.051E+04
Kidneys	5.587E-12	1.405E-10	4.543E+07	1.340E+04
Lungs	9.176E-13	2.352E-09	5.068E+07	1.305E+04
Ovaries	3.529E-12	8.510E-11	3.180E+07	1.031E+04
R Marrow	1.518E-11	3.904E-10	4.310E+07	1.258E+04
Spleen	9.209E-13	2.150E-11	4.334E+07	1.177E+04
Thymus	9.176E-13	2.142E-11	4.893E+07	1.305E+04
Uterus	9.176E-13	2.142E-11	3.309E+07	9.716E+03
Bld Wall	9.187E-13	2.145E-11	4.043E+07	1.223E+04
Brain	9.176E-13	2.142E-11	4.835E+07	1.004E+04
Esophagu	9.176E-13	8.706E-10	3.297E+07	8.376E+03
SI Wall	9.231E-13	2.143E-11	3.425E+07	9.833E+03
LLI Wall	1.775E-12	3.058E-11	3.448E+07	1.019E+04
Liver	1.075E-11	2.742E-10	4.357E+07	1.188E+04
Muscle	9.176E-13	2.142E-11	5.534E+07	2.388E+04
Pancreas	9.176E-13	2.142E-11	3.297E+07	9.204E+03
Skin	9.176E-13	2.142E-11	2.936E+08	9.996E+04
Testes	3.582E-12	8.636E-11	6.279E+07	2.819E+04
Thyroid	9.176E-13	2.142E-11	5.825E+07	1.643E+04
EFFEC	1.243E-06	1.236E-06	5.347E+07	1.817E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.956E-13	4.366E-12	3.798E-02	9.635E-06
Stomach	4.255E-09	8.288E-10	1.736E-01	4.800E-05
Colon	1.750E-07	3.374E-08	3.705E-01	1.071E-04
Liver	9.250E-12	1.036E-11	6.606E-02	1.806E-05
LUNG	9.731E-12	8.473E-08	4.951E-01	1.282E-04
Bone	2.253E-12	1.040E-11	1.806E-02	5.289E-06
Skin	1.676E-13	1.025E-13	2.924E-02	9.972E-06
Breast	2.549E-12	1.513E-11	3.821E-01	1.549E-04
Ovary	1.365E-10	2.990E-11	4.520E-02	1.468E-05
Bladder	3.693E-11	7.881E-12	9.774E-02	2.959E-05
Kidneys	3.548E-12	1.928E-12	2.365E-02	6.967E-06
Thyroid	5.180E-14	4.144E-13	1.852E-02	5.231E-06
Leukemia	4.847E-11	1.965E-11	2.423E-01	7.060E-05
Residual	1.058E-10	6.290E-11	6.198E-01	2.144E-04
Total	1.798E-07	1.195E-07	2.621E+00	8.213E-04

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* NUCLIDE Pa-231 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	1.033E-05	1.951E-03	1.526E+08	3.472E+04
B Surfac	4.640E-03	8.776E-01	4.241E+08	8.341E+04
Breasts	1.033E-05	1.951E-03	2.318E+08	5.627E+04
St Wall	1.054E-05	1.951E-03	1.654E+08	3.740E+04
ULI Wall	1.493E-05	2.216E-03	1.514E+08	3.600E+04
Kidneys	6.290E-05	1.193E-02	1.678E+08	3.833E+04
Lungs	1.033E-05	7.437E-03	1.887E+08	3.973E+04
Ovaries	3.974E-05	7.518E-03	1.386E+08	3.740E+04
R Marrow	1.709E-04	3.245E-02	1.771E+08	4.008E+04
Spleen	1.036E-05	1.958E-03	1.689E+08	3.740E+04
Thymus	1.033E-05	1.951E-03	1.771E+08	3.775E+04
Uterus	1.033E-05	1.951E-03	1.410E+08	3.495E+04
Bld Wall	1.034E-05	1.954E-03	1.561E+08	3.763E+04
Brain	1.033E-05	1.951E-03	1.957E+08	3.600E+04
Esophagu	1.033E-05	3.155E-03	1.491E+08	3.180E+04
SI Wall	1.086E-05	1.951E-03	1.445E+08	3.483E+04
LLI Wall	2.365E-05	2.696E-03	1.468E+08	3.600E+04
Liver	1.210E-04	2.298E-02	1.678E+08	3.740E+04
Muscle	1.033E-05	1.951E-03	1.876E+08	5.079E+04
Pancreas	1.033E-05	1.951E-03	1.445E+08	3.320E+04
Skin	1.033E-05	1.951E-03	2.843E+08	1.247E+05
Testes	4.033E-05	7.629E-03	1.992E+08	5.417E+04
Thyroid	1.033E-05	1.951E-03	1.980E+08	4.299E+04
EFFEC	1.772E-03	3.458E-01	1.829E+08	4.404E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	1.469E-07	2.283E-05	1.713E-01	3.658E-05
Stomach	3.293E-07	4.218E-05	6.675E-01	1.514E-04
Colon	3.019E-06	9.250E-05	1.538E+00	3.716E-04
Liver	2.527E-06	3.885E-04	2.540E-01	5.662E-05
LUNG	9.509E-07	1.299E-03	1.841E+00	3.879E-04
Bone	5.254E-06	8.695E-04	4.031E-02	7.922E-06
Skin	9.287E-09	1.336E-06	2.831E-02	1.247E-05
Breast	1.661E-07	2.372E-05	1.120E+00	2.714E-04
Ovary	7.326E-07	1.221E-04	1.969E-01	5.324E-05
Bladder	3.700E-07	5.624E-05	3.775E-01	9.099E-05
Kidneys	5.069E-07	7.807E-05	8.726E-02	1.992E-05
Thyroid	2.542E-08	3.630E-06	6.303E-02	1.363E-05
Leukemia	8.140E-07	1.288E-04	9.937E-01	2.248E-04
Residual	1.029E-06	1.391E-04	2.400E+00	5.895E-04
Total	1.587E-05	3.267E-03	9.798E+00	2.283E-03

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* NUCLIDE Ac-227 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	8.725E-06	1.635E-03	4.613E+05	1.121E+02
B Surfac	1.730E-03	3.250E-01	1.957E+06	4.322E+02
Breasts	8.725E-06	1.635E-03	8.132E+05	2.470E+02
St Wall	8.728E-06	1.635E-03	5.208E+05	1.235E+02
ULI Wall	1.001E-05	1.845E-03	4.648E+05	1.177E+02
Kidneys	1.313E-05	2.511E-03	5.371E+05	1.270E+02
Lungs	8.725E-06	2.066E-02	6.081E+05	1.328E+02
Ovaries	3.455E-05	6.479E-03	4.171E+05	1.162E+02
R Marrow	9.080E-05	1.711E-02	5.347E+05	1.316E+02
Spleen	8.773E-06	1.643E-03	5.312E+05	1.247E+02
Thymus	8.725E-06	1.635E-03	5.778E+05	1.235E+02
Uterus	8.725E-06	1.635E-03	4.264E+05	1.136E+02
Bld Wall	8.739E-06	1.637E-03	4.928E+05	1.247E+02
Brain	8.725E-06	1.635E-03	6.023E+05	1.155E+02
Esophagu	8.725E-06	6.601E-03	4.334E+05	1.018E+02
SI Wall	8.739E-06	1.635E-03	4.369E+05	1.125E+02
LLI Wall	1.295E-05	2.226E-03	4.415E+05	1.165E+02
Liver	3.737E-04	7.008E-02	5.324E+05	1.235E+02
Muscle	8.725E-06	1.635E-03	6.186E+05	2.027E+02
Pancreas	8.725E-06	1.635E-03	4.299E+05	1.087E+02
Skin	8.725E-06	1.635E-03	1.282E+06	8.656E+02
Testes	3.431E-05	6.434E-03	6.734E+05	2.202E+02
Thyroid	8.725E-06	1.635E-03	6.524E+05	1.456E+02
EFFEC	1.194E-03	2.695E-01	5.976E+05	1.643E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	1.506E-07	2.394E-05	4.986E-04	1.177E-07
Stomach	4.107E-07	5.698E-05	2.097E-03	4.986E-07
Colon	1.391E-06	1.443E-04	4.695E-03	1.212E-06
Liver	1.066E-05	1.724E-03	8.073E-04	1.876E-07
LUNG	1.084E-06	4.218E-03	5.942E-03	1.293E-06
Bone	2.549E-06	4.218E-04	1.864E-04	4.101E-08
Skin	1.128E-08	1.624E-06	1.282E-04	8.633E-08
Breast	2.264E-07	3.193E-05	3.926E-03	1.188E-06
Ovary	7.067E-07	1.221E-04	5.930E-04	1.654E-07
Bladder	3.585E-07	5.550E-05	1.188E-03	3.017E-07
Kidneys	1.384E-07	2.168E-05	2.796E-04	6.606E-08
Thyroid	3.201E-08	4.477E-06	2.074E-04	4.637E-08
Leukemia	5.661E-07	8.769E-05	3.006E-03	7.386E-07
Residual	1.476E-06	1.991E-04	7.491E-03	2.097E-06
Total	1.976E-05	7.104E-03	3.111E-02	8.050E-06

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* NUCLIDE Sr-90 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.457E-06	1.273E-07	5.441E+05	1.957E+02
B Surfac	1.511E-03	6.997E-05	2.656E+06	9.681E+02
Breasts	2.457E-06	1.273E-07	1.106E+06	4.078E+02
St Wall	3.335E-06	8.447E-07	6.326E+05	2.318E+02
ULI Wall	2.165E-05	1.310E-05	5.429E+05	2.050E+02
Kidneys	2.457E-06	1.273E-07	6.745E+05	2.516E+02
Lungs	2.457E-06	4.773E-03	7.503E+05	2.551E+02
Ovaries	2.457E-06	1.273E-07	4.695E+05	1.864E+02
R Marrow	6.627E-04	3.127E-05	6.338E+05	2.248E+02
Spleen	2.457E-06	1.273E-07	6.396E+05	2.318E+02
Thymus	2.457E-06	1.273E-07	7.246E+05	2.458E+02
Uterus	2.457E-06	1.273E-07	4.835E+05	1.887E+02
Bld Wall	5.487E-06	3.260E-07	5.965E+05	2.330E+02
Brain	2.457E-06	1.273E-07	7.200E+05	2.004E+02
Esophagu	2.457E-06	1.611E-04	4.835E+05	1.608E+02
SI Wall	4.196E-06	1.986E-06	5.010E+05	1.911E+02
LLI Wall	8.103E-05	4.444E-05	5.068E+05	1.981E+02
Liver	2.457E-06	1.273E-07	6.442E+05	2.318E+02
Muscle	2.457E-06	1.274E-07	7.957E+05	3.390E+02
Pancreas	2.457E-06	1.273E-07	4.835E+05	1.782E+02
Skin	2.457E-06	1.273E-07	1.072E+09	1.631E+05
Testes	2.457E-06	1.273E-07	9.064E+05	3.879E+02
Thyroid	2.457E-06	1.273E-07	8.539E+05	2.901E+02
EFFEC	1.024E-04	5.805E-04	1.145E+07	1.911E+03

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.070E-09	1.387E-10	5.557E-04	1.852E-07
Stomach	2.190E-08	3.848E-09	2.551E-03	9.355E-07
Colon	8.251E-07	3.811E-07	5.441E-03	2.085E-06
Liver	5.624E-09	1.876E-10	9.763E-04	3.518E-07
LUNG	4.144E-08	3.959E-05	7.340E-03	2.493E-06
Bone	2.176E-07	6.697E-09	2.516E-04	9.192E-08
Skin	4.107E-10	1.151E-11	1.069E-01	1.631E-05
Breast	2.028E-08	5.291E-10	5.336E-03	1.969E-06
Ovary	4.736E-09	1.669E-10	6.675E-04	2.656E-07
Bladder	1.880E-08	7.585E-10	1.445E-03	5.639E-07
Kidneys	1.950E-09	6.438E-11	3.507E-04	1.305E-07
Thyroid	1.391E-09	3.533E-11	2.714E-04	9.238E-08
Leukemia	4.773E-06	1.606E-07	3.553E-03	1.258E-06
Residual	6.475E-08	1.665E-09	9.040E-03	3.542E-06
Total	5.994E-06	3.996E-05	1.445E-01	3.029E-05

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* NUCLIDE Y-90 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	4.769E-11	1.324E-08	1.631E+07	4.707E+03
B Surfac	1.379E-09	3.829E-07	5.173E+07	1.363E+04
Breasts	4.769E-11	1.324E-08	2.563E+07	6.664E+03
St Wall	3.948E-06	7.903E-07	1.794E+07	5.173E+03
ULI Wall	5.010E-05	1.003E-05	1.631E+07	4.940E+03
Kidneys	4.773E-11	1.324E-08	1.841E+07	5.312E+03
Lungs	4.769E-11	2.566E-05	2.062E+07	5.545E+03
Ovaries	5.280E-11	1.324E-08	1.491E+07	4.858E+03
R Marrow	1.379E-09	3.826E-07	1.887E+07	5.324E+03
Spleen	4.773E-11	1.324E-08	1.829E+07	5.208E+03
Thymus	4.769E-11	1.324E-08	1.946E+07	5.219E+03
Uterus	4.780E-11	1.324E-08	1.503E+07	4.753E+03
Bld Wall	2.242E-10	6.220E-08	1.689E+07	5.208E+03
Brain	4.769E-11	1.324E-08	2.109E+07	4.916E+03
Esophagu	4.769E-11	3.785E-06	1.561E+07	4.287E+03
SI Wall	9.457E-06	1.874E-06	1.538E+07	4.765E+03
LLI Wall	1.166E-04	2.332E-05	1.561E+07	4.940E+03
Liver	1.353E-09	3.756E-07	1.829E+07	5.184E+03
Muscle	4.788E-11	1.324E-08	2.050E+07	6.326E+03
Pancreas	4.777E-11	1.324E-08	1.514E+07	4.520E+03
Skin	4.773E-11	1.324E-08	7.270E+09	1.223E+07
Testes	4.769E-11	1.324E-08	2.202E+07	6.699E+03
Thyroid	4.769E-11	1.324E-08	2.179E+07	5.848E+03
EFFEC	9.942E-06	5.147E-06	9.238E+07	1.282E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	7.918E-14	1.846E-11	1.794E-02	4.928E-06
Stomach	2.316E-08	4.403E-09	7.246E-02	2.085E-05
Colon	1.443E-06	2.731E-07	1.654E-01	5.103E-05
Liver	2.986E-12	6.882E-10	2.773E-02	7.852E-06
LUNG	8.436E-13	2.675E-07	2.015E-01	5.417E-05
Bone	1.735E-13	4.181E-11	4.916E-03	1.293E-06
Skin	8.399E-15	1.732E-12	7.258E-01	1.223E-03
Breast	4.144E-13	8.658E-11	1.235E-01	3.215E-05
Ovary	1.058E-13	2.239E-11	2.120E-02	6.908E-06
Bladder	6.882E-13	1.695E-10	4.089E-02	1.258E-05
Kidneys	3.811E-14	8.547E-12	9.576E-03	2.761E-06
Thyroid	2.901E-14	5.772E-12	6.932E-03	1.864E-06
Leukemia	1.399E-11	2.942E-09	1.059E-01	2.994E-05
Residual	1.295E-12	2.631E-10	2.575E-01	7.712E-05
Total	1.465E-06	5.476E-07	1.782E+00	1.526E-03

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* NUCLIDE Cs-137 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	5.195E-05	1.763E-05	5.697E+05	2.004E+02
B Surfac	5.091E-05	1.729E-05	2.668E+06	9.495E+02
Breasts	4.148E-05	1.407E-05	1.127E+06	4.043E+02
St Wall	4.958E-05	1.652E-05	6.582E+05	2.353E+02
ULI Wall	5.343E-05	1.807E-05	5.697E+05	2.097E+02
Kidneys	4.991E-05	1.693E-05	6.990E+05	2.540E+02
Lungs	4.692E-05	1.602E-05	7.782E+05	2.586E+02
Ovaries	5.298E-05	1.797E-05	4.940E+05	1.934E+02
R Marrow	4.854E-05	1.649E-05	6.640E+05	2.295E+02
Spleen	4.995E-05	1.694E-05	6.664E+05	2.353E+02
Thymus	4.847E-05	1.648E-05	7.491E+05	2.481E+02
Uterus	5.347E-05	1.814E-05	5.091E+05	1.946E+02
Bld Wall	5.354E-05	1.816E-05	6.209E+05	2.365E+02
Brain	4.359E-05	1.482E-05	7.526E+05	2.050E+02
Esophagu	4.836E-05	2.747E-05	5.114E+05	1.666E+02
SI Wall	5.187E-05	1.759E-05	5.266E+05	1.957E+02
LLI Wall	6.186E-05	2.086E-05	5.336E+05	2.039E+02
Liver	5.025E-05	1.705E-05	6.710E+05	2.353E+02
Muscle	4.640E-05	1.577E-05	8.202E+05	3.390E+02
Pancreas	5.332E-05	1.808E-05	5.103E+05	1.829E+02
Skin	3.966E-05	1.346E-05	1.005E+09	3.204E+05
Testes	4.651E-05	1.578E-05	9.273E+05	3.856E+02
Thyroid	4.836E-05	1.644E-05	8.796E+05	2.924E+02
EFFEC	5.017E-05	1.729E-05	1.081E+07	3.483E+03

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	5.180E-08	1.746E-08	5.883E-04	1.922E-07
Stomach	1.850E-07	5.698E-08	2.656E-03	9.506E-07
Colon	5.143E-07	1.576E-07	5.720E-03	2.144E-06
Liver	7.659E-08	2.457E-08	1.017E-03	3.565E-07
LUNG	3.811E-07	1.254E-07	7.607E-03	2.528E-06
Bone	4.662E-09	1.536E-09	2.528E-04	9.017E-08
Skin	3.589E-09	1.140E-09	1.003E-01	3.192E-05
Breast	1.528E-07	5.143E-08	5.441E-03	1.957E-06
Ovary	6.327E-08	2.257E-08	7.025E-04	2.749E-07
Bladder	1.325E-07	4.292E-08	1.503E-03	5.720E-07
Kidneys	2.612E-08	8.362E-09	3.635E-04	1.316E-07
Thyroid	1.258E-08	4.070E-09	2.796E-04	9.308E-08
Leukemia	2.649E-07	8.658E-08	3.728E-03	1.293E-06
Residual	6.771E-07	2.098E-07	9.425E-03	3.588E-06
Total	2.546E-06	8.103E-07	1.398E-01	4.613E-05

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* NUCLIDE Ba-137m *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	2.738E+09	5.837E+05
B Surfac	0.000E+00	0.000E+00	5.394E+09	9.635E+05
Breasts	0.000E+00	0.000E+00	3.751E+09	6.874E+05
St Wall	0.000E+00	0.000E+00	2.912E+09	6.186E+05
ULI Wall	0.000E+00	0.000E+00	2.714E+09	6.140E+05
Kidneys	0.000E+00	0.000E+00	2.924E+09	6.244E+05
Lungs	0.000E+00	0.000E+00	3.262E+09	6.536E+05
Ovaries	0.000E+00	0.000E+00	2.563E+09	6.291E+05
R Marrow	0.000E+00	0.000E+00	3.180E+09	6.641E+05
Spleen	0.000E+00	0.000E+00	2.959E+09	6.233E+05
Thymus	0.000E+00	0.000E+00	3.029E+09	6.163E+05
Uterus	0.000E+00	0.000E+00	2.540E+09	6.023E+05
Bld Wall	0.000E+00	0.000E+00	2.703E+09	6.233E+05
Brain	0.000E+00	0.000E+00	3.507E+09	6.163E+05
Esophagu	0.000E+00	0.000E+00	2.726E+09	5.592E+05
SI Wall	0.000E+00	0.000E+00	2.610E+09	6.046E+05
LLI Wall	0.000E+00	0.000E+00	2.668E+09	6.291E+05
Liver	0.000E+00	0.000E+00	2.947E+09	6.198E+05
Muscle	0.000E+00	0.000E+00	3.192E+09	7.083E+05
Pancreas	0.000E+00	0.000E+00	2.586E+09	5.697E+05
Skin	0.000E+00	0.000E+00	4.345E+09	1.922E+06
Testes	0.000E+00	0.000E+00	3.285E+09	7.188E+05
Thyroid	0.000E+00	0.000E+00	3.355E+09	6.839E+05
EFFEC	0.000E+00	0.000E+00	3.134E+09	6.734E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	3.134E+00	6.431E-04
Stomach	0.000E+00	0.000E+00	1.177E+01	2.493E-03
Colon	0.000E+00	0.000E+00	2.784E+01	6.407E-03
Liver	0.000E+00	0.000E+00	4.462E+00	9.390E-04
LUNG	0.000E+00	0.000E+00	3.192E+01	6.396E-03
Bone	0.000E+00	0.000E+00	5.126E-01	9.145E-05
Skin	0.000E+00	0.000E+00	4.334E-01	1.922E-04
Breast	0.000E+00	0.000E+00	1.817E+01	3.320E-03
Ovary	0.000E+00	0.000E+00	3.646E+00	8.947E-04
Bladder	0.000E+00	0.000E+00	6.536E+00	1.503E-03
Kidneys	0.000E+00	0.000E+00	1.526E+00	3.250E-04
Thyroid	0.000E+00	0.000E+00	1.068E+00	2.179E-04
Leukemia	0.000E+00	0.000E+00	1.782E+01	3.728E-03
Residual	0.000E+00	0.000E+00	4.229E+01	9.238E-03
Total	0.000E+00	0.000E+00	1.713E+02	3.635E-02

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* NUCLIDE U-233 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	5.254E-06	3.237E-06	1.212E+06	3.087E+02
B Surfac	1.551E-04	1.477E-04	4.800E+06	1.549E+03
Breasts	5.254E-06	3.237E-06	2.586E+06	1.491E+03
St Wall	5.461E-06	3.303E-06	1.351E+06	3.483E+02
ULI Wall	8.306E-06	4.244E-06	1.200E+06	3.122E+02
Kidneys	5.383E-05	3.673E-05	1.410E+06	3.891E+02
Lungs	5.254E-06	1.473E-02	1.573E+06	3.728E+02
Ovaries	5.280E-06	3.570E-06	1.078E+06	3.390E+02
R Marrow	1.553E-05	1.261E-05	1.445E+06	4.206E+02
Spleen	5.254E-06	3.238E-06	1.375E+06	3.379E+02
Thymus	5.254E-06	3.237E-06	1.503E+06	3.728E+02
Uterus	5.254E-06	3.237E-06	1.103E+06	2.982E+02
Bld Wall	5.272E-06	3.249E-06	1.282E+06	3.542E+02
Brain	5.254E-06	3.237E-06	1.561E+06	3.076E+02
Esophagu	5.254E-06	6.712E-03	1.132E+06	2.633E+02
SI Wall	5.757E-06	3.403E-06	1.132E+06	2.971E+02
LLI Wall	1.421E-05	6.198E-06	1.146E+06	3.099E+02
Liver	2.049E-05	1.564E-05	1.375E+06	3.448E+02
Muscle	5.254E-06	3.237E-06	1.794E+06	1.038E+03
Pancreas	5.254E-06	3.237E-06	1.115E+06	2.819E+02
Skin	5.254E-06	3.237E-06	5.324E+06	6.920E+03
Testes	5.280E-06	3.575E-06	1.969E+06	1.212E+03
Thyroid	5.254E-06	3.237E-06	1.806E+06	5.149E+02
EFFEC	1.897E-04	3.549E-02	1.654E+06	6.990E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	8.177E-08	3.996E-08	1.305E-03	3.029E-07
Stomach	2.309E-07	8.843E-08	5.452E-03	1.410E-06
Colon	2.523E-06	7.289E-07	1.212E-02	3.215E-06
Liver	5.698E-07	3.060E-07	2.085E-03	5.231E-07
LUNG	5.735E-07	2.686E-03	1.538E-02	3.646E-06
Bone	3.622E-07	2.168E-07	4.555E-04	1.468E-07
Skin	5.883E-09	2.497E-09	5.312E-04	6.908E-07
Breast	1.128E-07	4.588E-08	1.247E-02	7.200E-06
Ovary	9.435E-08	5.217E-08	1.538E-03	4.823E-07
Bladder	2.002E-07	9.694E-08	3.099E-03	8.563E-07
Kidneys	6.438E-07	3.127E-07	7.328E-04	2.027E-07
Thyroid	1.650E-08	6.771E-09	5.755E-04	1.643E-07
Leukemia	9.176E-08	5.365E-08	8.108E-03	2.365E-06
Residual	7.363E-07	2.775E-07	2.039E-02	8.085E-06
Total	6.253E-06	2.690E-03	8.435E-02	2.924E-05

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* NUCLIDE U-238 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	4.492E-06	2.648E-06	6.850E+04	4.520E+01
B Surfac	1.301E-04	8.321E-05	8.621E+05	9.425E+02
Breasts	4.492E-06	2.648E-06	9.949E+05	1.503E+03
St Wall	4.669E-06	2.706E-06	9.623E+04	6.151E+01
ULI Wall	7.145E-06	3.522E-06	6.559E+04	3.134E+01
Kidneys	4.666E-05	3.119E-05	1.247E+05	1.075E+02
Lungs	4.492E-06	1.214E-02	1.160E+05	6.512E+01
Ovaries	4.492E-06	2.649E-06	5.079E+04	8.050E+01
R Marrow	1.320E-05	8.469E-06	1.445E+05	1.491E+02
Spleen	4.492E-06	2.648E-06	8.738E+04	4.310E+01
Thymus	4.492E-06	2.648E-06	1.375E+05	9.600E+01
Uterus	4.492E-06	2.648E-06	5.324E+04	2.645E+01
Bld Wall	4.507E-06	2.658E-06	9.227E+04	6.687E+01
Brain	4.492E-06	2.648E-06	9.262E+04	2.843E+01
Esophagu	4.492E-06	5.705E-03	4.905E+04	1.876E+01
SI Wall	4.928E-06	2.792E-06	5.685E+04	2.738E+01
LLI Wall	1.228E-05	5.213E-06	5.790E+04	3.146E+01
Liver	1.749E-05	1.127E-05	9.436E+04	5.557E+01
Muscle	4.492E-06	2.648E-06	4.299E+05	9.134E+02
Pancreas	4.492E-06	2.648E-06	5.091E+04	2.283E+01
Skin	4.492E-06	2.648E-06	3.390E+06	8.644E+03
Testes	4.492E-06	2.648E-06	5.114E+05	1.124E+03
Thyroid	4.492E-06	2.648E-06	3.169E+05	2.377E+02
EFFEC	1.648E-04	2.973E-02	2.924E+05	4.940E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	7.067E-08	3.574E-08	5.639E-05	2.155E-08
Stomach	2.013E-07	7.992E-08	3.879E-04	2.481E-07
Colon	2.283E-06	7.622E-07	6.431E-04	3.239E-07
Liver	4.921E-07	2.368E-07	1.433E-04	8.423E-08
LUNG	4.995E-07	2.246E-03	1.135E-03	6.373E-07
Bone	3.104E-07	1.480E-07	8.190E-05	8.947E-08
Skin	5.106E-09	2.135E-09	3.378E-04	8.621E-07
Breast	9.953E-08	4.588E-08	4.811E-03	7.258E-06
Ovary	8.103E-08	4.033E-08	7.223E-05	1.145E-07
Bladder	1.732E-07	8.103E-08	2.237E-04	1.619E-07
Kidneys	5.624E-07	2.708E-07	6.489E-05	5.592E-08
Thyroid	1.436E-08	5.883E-09	1.009E-04	7.572E-08
Leukemia	1.502E-07	9.139E-08	8.108E-04	8.365E-07
Residual	6.401E-07	2.512E-07	2.726E-03	4.870E-06
Total	5.587E-06	2.246E-03	1.159E-02	1.561E-05

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* NUCLIDE Th-234 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.006E-13	1.020E-12	2.540E+07	6.652E+03
B Surfac	4.684E-12	2.988E-11	1.305E+08	3.064E+04
Breasts	2.006E-13	1.020E-12	4.695E+07	1.066E+04
St Wall	2.007E-13	1.025E-12	2.959E+07	7.607E+03
ULI Wall	2.184E-13	1.101E-12	2.563E+07	7.153E+03
Kidneys	3.101E-12	1.321E-11	3.087E+07	7.747E+03
Lungs	2.006E-13	3.132E-09	3.507E+07	8.283E+03
Ovaries	1.803E-12	3.357E-12	2.225E+07	6.792E+03
R Marrow	4.939E-13	3.067E-12	2.901E+07	7.456E+03
Spleen	2.006E-13	1.020E-12	3.017E+07	7.736E+03
Thymus	2.006E-13	1.020E-12	3.344E+07	7.794E+03
Uterus	2.006E-13	1.020E-12	2.307E+07	6.792E+03
Bld Wall	2.007E-13	1.023E-12	2.784E+07	7.666E+03
Brain	2.006E-13	1.020E-12	3.378E+07	6.967E+03
Esophagu	2.006E-13	1.722E-09	2.283E+07	5.965E+03
SI Wall	2.014E-13	1.033E-12	2.377E+07	6.780E+03
LLI Wall	3.193E-13	1.275E-12	2.412E+07	7.060E+03
Liver	5.946E-13	3.992E-12	3.017E+07	7.666E+03
Muscle	2.006E-13	1.020E-12	3.530E+07	9.670E+03
Pancreas	2.006E-13	1.020E-12	2.307E+07	6.524E+03
Skin	2.006E-13	1.020E-12	8.737E+07	2.004E+04
Testes	1.831E-12	3.398E-12	3.938E+07	1.037E+04
Thyroid	2.006E-13	1.020E-12	3.786E+07	8.551E+03
EFFEC	1.259E-05	2.847E-05	3.437E+07	8.738E+03

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.514E-12	8.806E-11	2.633E-02	6.862E-06
Stomach	2.187E-08	4.958E-09	1.200E-01	3.076E-05
Colon	1.854E-06	3.959E-07	2.575E-01	7.340E-05
Liver	5.809E-11	1.332E-10	4.578E-02	1.162E-05
LUNG	6.179E-11	2.227E-06	3.425E-01	8.097E-05
Bone	2.338E-11	3.101E-11	1.235E-02	2.912E-06
Skin	8.917E-13	1.728E-12	8.714E-03	2.004E-06
Breast	2.535E-11	3.252E-10	2.272E-01	5.149E-05
Ovary	2.035E-10	6.623E-11	3.169E-02	9.658E-06
Bladder	1.169E-10	3.774E-11	6.734E-02	1.852E-05
Kidneys	4.403E-11	5.661E-11	1.608E-02	4.031E-06
Thyroid	1.284E-12	9.805E-12	1.200E-02	2.726E-06
Leukemia	1.110E-09	1.262E-09	1.631E-01	4.182E-05
Residual	2.756E-10	7.992E-10	4.159E-01	1.134E-04
Total	1.876E-06	2.631E-06	1.748E+00	4.497E-04

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* NUCLIDE Pa-234m *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	6.652E+07	1.480E+04
B Surfac	0.000E+00	0.000E+00	1.445E+08	2.936E+04
Breasts	0.000E+00	0.000E+00	9.378E+07	1.817E+04
St Wall	0.000E+00	0.000E+00	7.176E+07	1.584E+04
ULI Wall	0.000E+00	0.000E+00	6.699E+07	1.561E+04
Kidneys	0.000E+00	0.000E+00	7.258E+07	1.608E+04
Lungs	0.000E+00	0.000E+00	8.085E+07	1.666E+04
Ovaries	0.000E+00	0.000E+00	6.571E+07	1.503E+04
R Marrow	0.000E+00	0.000E+00	7.806E+07	1.678E+04
Spleen	0.000E+00	0.000E+00	7.305E+07	1.596E+04
Thymus	0.000E+00	0.000E+00	7.584E+07	1.549E+04
Uterus	0.000E+00	0.000E+00	6.291E+07	1.515E+04
Bld Wall	0.000E+00	0.000E+00	6.664E+07	1.596E+04
Brain	0.000E+00	0.000E+00	8.586E+07	1.549E+04
Esophagu	0.000E+00	0.000E+00	6.710E+07	1.398E+04
SI Wall	0.000E+00	0.000E+00	6.466E+07	1.538E+04
LLI Wall	0.000E+00	0.000E+00	6.594E+07	1.596E+04
Liver	0.000E+00	0.000E+00	7.281E+07	1.584E+04
Muscle	0.000E+00	0.000E+00	7.922E+07	1.841E+04
Pancreas	0.000E+00	0.000E+00	6.373E+07	1.445E+04
Skin	0.000E+00	0.000E+00	6.384E+09	1.094E+07
Testes	0.000E+00	0.000E+00	8.213E+07	1.876E+04
Thyroid	0.000E+00	0.000E+00	8.365E+07	1.713E+04
EFFEC	0.000E+00	0.000E+00	1.410E+08	1.258E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	7.724E-02	1.608E-05
Stomach	0.000E+00	0.000E+00	2.901E-01	6.396E-05
Colon	0.000E+00	0.000E+00	6.874E-01	1.631E-04
Liver	0.000E+00	0.000E+00	1.103E-01	2.400E-05
LUNG	0.000E+00	0.000E+00	7.910E-01	1.631E-04
Bone	0.000E+00	0.000E+00	1.375E-02	2.784E-06
Skin	0.000E+00	0.000E+00	6.373E-01	1.092E-03
Breast	0.000E+00	0.000E+00	4.532E-01	8.784E-05
Ovary	0.000E+00	0.000E+00	9.343E-02	2.144E-05
Bladder	0.000E+00	0.000E+00	1.608E-01	3.856E-05
Kidneys	0.000E+00	0.000E+00	3.775E-02	8.365E-06
Thyroid	0.000E+00	0.000E+00	2.668E-02	5.452E-06
Leukemia	0.000E+00	0.000E+00	4.380E-01	9.413E-05
Residual	0.000E+00	0.000E+00	1.039E+00	2.365E-04
Total	0.000E+00	0.000E+00	4.858E+00	2.015E-03

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* NUCLIDE Pa-234 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	6.449E-15	1.119E-13	8.796E+09	1.841E+06
B Surfac	1.833E-13	2.994E-12	1.747E+10	3.122E+06
Breasts	6.449E-15	1.119E-13	1.212E+10	2.155E+06
St Wall	6.512E-15	1.120E-13	9.425E+09	1.957E+06
ULI Wall	1.341E-14	1.138E-13	8.842E+09	1.934E+06
Kidneys	7.012E-14	1.401E-12	9.506E+09	1.969E+06
Lungs	6.449E-15	1.553E-11	1.059E+10	2.050E+06
Ovaries	1.117E-14	4.651E-13	8.691E+09	1.887E+06
R Marrow	1.863E-14	3.053E-13	1.032E+10	2.085E+06
Spleen	6.449E-15	1.119E-13	9.611E+09	1.969E+06
Thymus	6.449E-15	1.119E-13	9.891E+09	1.899E+06
Uterus	6.449E-15	1.119E-13	8.318E+09	1.899E+06
Bld Wall	6.471E-15	1.122E-13	8.749E+09	1.957E+06
Brain	6.449E-15	1.119E-13	1.132E+10	1.934E+06
Esophagu	6.449E-15	3.517E-12	8.924E+09	1.759E+06
SI Wall	7.008E-15	1.121E-13	8.563E+09	1.911E+06
LLI Wall	3.227E-14	1.183E-13	8.726E+09	1.992E+06
Liver	2.422E-14	3.700E-13	9.565E+09	1.957E+06
Muscle	6.449E-15	1.119E-13	1.035E+10	2.225E+06
Pancreas	6.449E-15	1.119E-13	8.435E+09	1.806E+06
Skin	6.449E-15	1.119E-13	1.445E+10	4.532E+06
Testes	1.125E-14	4.714E-13	1.065E+10	2.248E+06
Thyroid	6.449E-15	1.119E-13	1.089E+10	2.097E+06
EFFEC	1.937E-06	1.444E-06	1.017E+10	2.097E+06

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	3.563E-11	1.528E-10	1.026E+01	2.027E-03
Stomach	1.650E-08	3.060E-09	3.810E+01	7.899E-03
Colon	1.850E-07	3.271E-08	9.075E+01	2.027E-02
Liver	4.551E-10	1.735E-10	1.445E+01	2.971E-03
LUNG	7.992E-10	6.364E-08	1.036E+02	2.004E-02
Bone	1.495E-11	1.839E-11	1.654E+00	2.959E-04
Skin	9.398E-12	4.810E-12	1.445E+00	4.520E-04
Breast	2.716E-10	4.440E-10	5.848E+01	1.042E-02
Ovary	2.087E-09	4.218E-10	1.235E+01	2.680E-03
Bladder	1.099E-09	2.290E-10	2.120E+01	4.730E-03
Kidneys	1.972E-10	5.920E-11	4.951E+00	1.024E-03
Thyroid	4.366E-12	2.068E-11	3.472E+00	6.675E-04
Leukemia	1.702E-09	7.030E-10	5.790E+01	1.165E-02
Residual	4.995E-09	1.850E-09	1.363E+02	2.912E-02
Total	2.135E-07	1.036E-07	5.557E+02	1.143E-01

C A P 8 8 - P C
Version 3.0

Clean Air Act Assessment Package - 1988

C H I / Q T A B L E S
Non-Radon Individual Assessment
May 7, 2014 02:11 pmm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2012

Comments: CY 2012 WIPP Compliance Report bias corr
40 CFR part 191, Subpart A at MEOSI

Dataset Name: 2012_191SubpartA
Dataset Date: 5/7/2014 1:24:00 PM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\2012VET.WND

May 7, 2014 02:11 pmm CHIQ
Page 1

GROUND-LEVEL CHI/Q VALUES FOR Am-241
SOLUBILITY: M
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	7500
N	3.403E-08
NNW	6.029E-08
NW	9.850E-08
WNW	7.876E-08
W	3.703E-08
WSW	2.745E-08
SW	2.997E-08
SSW	2.447E-08
S	1.034E-08
SSE	1.302E-08
SE	1.579E-08
ESE	1.512E-08
E	1.877E-08
ENE	1.539E-08
NE	1.506E-08
NNE	2.059E-08

May 7, 2014 02:11 pmm CHIQ
Page 2

GROUND-LEVEL CHI/Q VALUES FOR Pu-238
SOLUBILITY: M
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	7500
N	3.403E-08
NNW	6.028E-08
NW	9.848E-08
WNW	7.874E-08
W	3.702E-08
WSW	2.744E-08
SW	2.996E-08
SSW	2.447E-08
S	1.034E-08
SSE	1.302E-08
SE	1.578E-08
ESE	1.512E-08
E	1.877E-08
ENE	1.539E-08
NE	1.506E-08
NNE	2.059E-08

May 7, 2014 02:11 pmm CHIQ
Page 3

GROUND-LEVEL CHI/Q VALUES FOR Pu-239
SOLUBILITY: M
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	7500
N	3.403E-08
NNW	6.033E-08
NW	9.857E-08
WNW	7.886E-08
W	3.708E-08
WSW	2.748E-08
SW	3.000E-08
SSW	2.449E-08
S	1.035E-08
SSE	1.303E-08
SE	1.578E-08
ESE	1.512E-08
E	1.880E-08
ENE	1.537E-08
NE	1.506E-08
NNE	2.058E-08

GROUND-LEVEL CHI/Q VALUES FOR Sr-90
SOLUBILITY: S
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	7500
N	3.403E-08
NNW	6.027E-08
NW	9.847E-08
WNW	7.872E-08
W	3.701E-08
WSW	2.743E-08
SW	2.995E-08
SSW	2.446E-08
S	1.034E-08
SSE	1.302E-08
SE	1.579E-08
ESE	1.512E-08
E	1.876E-08
ENE	1.539E-08
NE	1.506E-08
NNE	2.059E-08

May 7, 2014 02:11 pmm CHIQ
Page 5

GROUND-LEVEL CHI/Q VALUES FOR Cs-137
SOLUBILITY: F
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	7500
N	3.404E-08
NNW	6.029E-08
NW	9.850E-08
WNW	7.876E-08
W	3.703E-08
WSW	2.745E-08
SW	2.997E-08
SSW	2.447E-08
S	1.035E-08
SSE	1.302E-08
SE	1.579E-08
ESE	1.512E-08
E	1.877E-08
ENE	1.539E-08
NE	1.506E-08
NNE	2.059E-08

GROUND-LEVEL CHI/Q VALUES FOR U-233
SOLUBILITY: S
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	7500
N	3.408E-08
NNW	6.039E-08
NW	9.874E-08
WNW	7.899E-08
W	3.712E-08
WSW	2.753E-08
SW	3.007E-08
SSW	2.454E-08
S	1.036E-08
SSE	1.304E-08
SE	1.581E-08
ESE	1.514E-08
E	1.880E-08
ENE	1.540E-08
NE	1.507E-08
NNE	2.061E-08

May 7, 2014 02:11 pmm CHIQ
Page 7

GROUND-LEVEL CHI/Q VALUES FOR U-238
SOLUBILITY: S
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	7500
N	3.409E-08
NNW	6.040E-08
NW	9.875E-08
WNW	7.899E-08
W	3.712E-08
WSW	2.754E-08
SW	3.007E-08
SSW	2.454E-08
S	1.036E-08
SSE	1.304E-08
SE	1.582E-08
ESE	1.514E-08
E	1.880E-08
ENE	1.540E-08
NE	1.507E-08
NNE	2.061E-08

Annual Periodic Confirmatory Measurement Compliance Report for the U.S. Department of Energy Waste Isolation Pilot Plant

For Calendar Year 2013

As Required By
40 CFR Part 191, Subpart A,
"Environmental Standards for Management and Storage"

CALENDAR YEAR 2013 REPORT SUMMARY

This report satisfies the reporting requirements established by 40 CFR Part 191, Subpart A, "Environmental Management and Storage." Emission monitoring and compliance procedures for U.S. Department of Energy (DOE) facilities require the use of CAP88-PC (Clean Air Act Assessment Package – 1988) or AIRDOS-PC computer models, or other approved procedures, to calculate effective dose equivalent (EDE) values to members of the public.

The CAP88-PC computer model is a set of computer programs, databases and associated utility programs for estimation of dose and risk from radionuclide emissions to air. The CAP88-PC, Version 3.0 dose assessment computer model was used to estimate the dose(s) reported in this summary. Copies of the output data from CAP88-PC are attached.

Year of Reporting Period: Calendar Year (CY) 2013

SUMMARY OF SOURCE TERM AND CALCULATED EFFECTIVE DOSE EQUIVALENT

Calculations made using the above referenced code indicate that the EDE value to the maximally exposed individual resulting from normal operations conducted at this facility is $5.25x10^{-04}$ millirem (mrem) per year whole body and 1.31×10^{-03} mrem per year to the critical organ at 350 meters northwest from the Waste Isolation Pilot Plant (WIPP) facility. At 7500 meters west-northwest from the WIPP facility, the EDE value to the maximally exposed individual resulting from normal operations conducted at this facility is $7.39x10^{-06}$ mrem per year whole body and $1.81x10^{-05}$ mrem per year to the critical organ.

These values are in compliance with the standard from 40 Code of Federal Regulations (CFR) Part 191, Subpart A, which states that management and storage of spent nuclear fuel or high-level or transuranic radioactive wastes at all facilities for the disposal of such fuel or waste that are operated by the DOE shall be conducted in such a manner as to provide reasonable assurance that the combined annual dose equivalent to any member of the public in the general environment resulting from discharges of radioactive material and direct radiation from such management and storage shall not exceed 25 mrem to the whole body and 75 mrem to any critical organ.

FACILITY NAME AND LOCATION

Facility:	Waste Isolation Pilot Plant 34 Louis Whitlock Road PO Box 2078 Carlsbad, New Mexico 88221
Facility Location:	26 miles (42 kilometers [km]) east of Carlsbad, New Mexico Latitude 32.372, Longitude -103.792

RADIOACTIVE MATERIALS USED

The waste managed at WIPP contains contact-handled and remote-handled transuranic (TRU) radionuclides. TRU waste is radioactive waste that contains alpha-emitting radionuclides of atomic numbers greater than 92, with half-lives longer than 20 years, and which are present in concentrations greater than 100 nanocuries per gram of waste.

During 2013, the WIPP radionuclides of interests are ^{238}Pu, $^{239/240}$Pu, ^{241}Am, ^{90}Sr, ^{137}Cs, $^{233/234}$U, and ^{238}U, as indicated in tables A-4 and A-5. Operations at the WIPP facility do not involve handling any uncontained radioactive material. Waste containers are closed at the waste-generating facilities and remain closed at the WIPP facility. Removable contamination on the exterior surfaces of containers is restricted to minimal levels in accordance with DOE/WIPP-02-3122, *Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, and does not present a significant source of radionuclides that would be subject to release in airborne effluents. During normal operating conditions, there is essentially no potential for airborne emissions of radionuclides contained in the TRU waste managed at the WIPP facility.

Table A-4: Summary of Radionuclide Effluents from Underground Disposal Areas: Calendar Year 2013

Station	Radionuclide	Activity Released (Ci/Yr)	Particle Size (μm)[1]	Type (F, M, S)[2]
A	^{238}Pu	3.04×10^{-08}	1	M
A	$^{239/240}$Pu	2.48×10^{-08}	1	M
A	^{241}Am	3.62×10^{-08}	1	M
A	^{90}Sr	2.21×10^{-06}	1	M
A	^{137}Cs	2.25×10^{-05}	1	F
A	$^{233/234}$U	4.79×10^{-08}	1	M
A	^{238}U	5.40×10^{-08}	1	M
B	^{238}Pu	1.71×10^{-09}	1	M
B	$^{239/240}$Pu	4.72×10^{-10}	1	M
B	^{241}Am	1.50×10^{-09}	1	M
B	^{90}Sr	9.05×10^{-08}	1	M
B	^{137}Cs	1.22×10^{-06}	1	F
B	$^{233/234}$U	6.77×10^{-09}	1	M
B	^{238}U	7.14×10^{-09}	1	M

[1] The default particle size in micrometers (μm) for inhaled particles.

[2] Absorption Type: These are established to describe the absorption type of the materials from the respiratory tract into the blood for inhaled particles. The absorption types are F (fast), M (moderate), and S (slow), as defined in International Commission on Radiological Protection (ICRP) Publication 66. CAP88-PC Version 3 default radionuclide class types are used.

Table A-5: Summary of Radionuclide Effluents from the Waste Handling Building: Calendar Year 2013

Station	Radionuclide	Activity Released (Ci/Yr)	Particle Size (μm)[1]	Type (F, M, S)[2]
C	^{238}Pu	$6.77x10^{-09}$	1	M
C	$^{239/240}Pu$	$4.98x10^{-09}$	1	M
C	^{241}Am	$1.09x10^{-08}$	1	M
C	^{90}Sr	$4.98\ x10^{-07}$	1	M
C	^{137}Cs	$1.12x10^{-05}$	1	F
C	$^{233/234}U$	$5.40x10^{-09}$	1	M
C	^{238}U	$5.18x10^{-09}$	1	M

[1] The default particle size in μm for inhaled particles.

[2] Absorption Type: These are established to describe the absorption type of the materials from the respiratory tract into the blood for inhaled particles. The absorption types are F (fast), M (moderate), and S (slow), as defined in ICRP Publication 66. CAP88-PC Version 3 default radionuclide class types are used.

Small activity radioactive materials (sealed sources and plated sources) are used at the WIPP facility to calibrate and verify the operation of various radiation detection instrumentation and for quality assurance checks for the method of analysis. Some consumable radioactive standards are stored at the WIPP facility. These standards are used to make the laboratory control standards for isotopic analysis of samples. All are stored in a locked safe in a posted, access-controlled Radioactive Materials Area. This source of radioactive material does not have the potential to result in measurable off-site dose consequences.

DESCRIPTION OF OPERATIONS

The WIPP facility is a TRU waste disposal facility owned by the DOE, and managed and operated by Nuclear Waste Partnership LLC (NWP). The principal operation of the WIPP facility involves the receipt of TRU waste and disposal in the underground repository. Only waste that conforms to the requirements of DOE/WIPP-02-3122 is accepted for management in the WIPP facility. Administrative controls prohibit the waste containers from being opened once they are accepted at the WIPP facility.

DOE radioactive waste is handled and processed in a manner that is protective of workers, public health and safety, and the environment. The receipt and emplacement of TRU waste are safely performed and implemented by NWP personnel through approved and controlled waste management procedures, waste handling procedures, and by the engineering design of the Waste Handling Building (WHB) and equipment, and the underground disposal panel and room configurations.

EMISSION POINTS

The WIPP facility has three effluent air monitoring stations known as Stations A, B, and C. Stations A and B, when in use, measure the total exhaust from the underground and Station C measures all exhaust from the WHB. Immediately after passing Station A, unfiltered air is

exhausted from the repository. Prior to Station B, high-efficiency particulate air (HEPA) filters are first used to filter the exhaust from the repository. Both Stations A and B sample the same air when operated in the maintenance bypass, reduced, or minimum mode. Station C is used to sample the exhaust from the WHB. Prior to sampling activities at Station C, and then venting to the atmosphere, the collective air passes through the HEPA filters. Characteristics of WIPP emission points for CY 2013 are provided in table A-6.

A fixed air sampler unit located in the underground repository is Station D, which was designed according to the methodology specified by the ANSI N13.1-1999 Standard. Station D samples the exhaust air from the waste disposal area. The filter samples collected from this location are counted for gross alpha/beta activity and submitted for isotopic composite analysis as required. Radiochemistry results of Station D sampling activities would be used for confirmation (affirmation) only in the event of a release at any of the mine effluent air monitoring stations.

EFFLUENT CONTROLS

Continuous air monitors are maintained at strategic locations in the WHB and in the underground repository to monitor the real-time levels of airborne radioactivity. Readouts from the underground air monitors are displayed in the Central Monitoring Room, a continuously occupied location from which WIPP facility operations are monitored. During normal conditions, the underground repository effluent does not pass through HEPA filtration units before being discharged to the atmosphere. The WHB effluent, generated by surface waste handling operations, is subject to continuous HEPA filtration before being discharged to the environment. Underground ventilation and WHB HEPA filtration units are polyalphaolefin-tested annually and exhibit a minimum efficiency of 99.97 percent.

The WHB ventilation system maintains the interior of the WHB at a negative pressure relative to the outside environment. This provides a secondary confinement barrier against the release of radionuclides to the environment, where the waste containers themselves are considered the primary barrier. A negative pressure differential ensures that any leaks in the WHB structure will result in an in-leakage of outside air, which precludes the release of airborne contamination to the environment. WIPP's primary mitigation for failure of a waste container is HEPA filtration for the surface and automatic shift to filtration for the underground facility.

The WIPP facility uses fixed air samplers (FAS) at each effluent air monitoring station (Stations A, B, and C) to collect representative samples of airborne particulates. Each FAS has two independent vacuum pumps; one vacuum pump supplies the vacuum and the other functions as a backup unit. In the event of an external power failure, an uninterruptible power supply provides sufficient power to all FAS units for approximately 30 minutes. Diesel generators are available to supply electrical power should the electrical outage last longer than 30 minutes.

Approved and controlled operating procedures are used at the WIPP facility to ensure uniform methods are used to collect, package, and transport FAS filter samples. The use of such procedures provides a means for demonstrating quality of air emission data. Station A FAS filter samples are collected as needed each working shift in order to ensure a representative sample. Station B FAS filter samples are collected weekly and at the end of each underground effluent filtration event, as needed based on the information and situation. Station C FAS filter samples are collected weekly.

Filter samples from all three effluent air monitoring stations were analyzed for ^{238}Pu, $^{239/240}Pu$[3], ^{241}Am, ^{90}Sr, ^{137}Cs, $^{233/234}U$[4], and ^{238}U, during CY 2013 for TRU waste activities. The radionuclide ^{242}Pu is used as a tracer in the WIPP Laboratories. These results are being obtained from all three effluent air monitoring stations (Stations A, B, and C).

DISTANCES TO NEAREST RECEPTORS FROM RELEASE POINTS

The WIPP facility is located in an area of low population density that has fewer than 11 permanent residents living within a 10-mile (16-km) radius (DOE/WIPP-93-004). The area surrounding the WIPP facility is used primarily for livestock grazing and development of potash, oil, and gas resources. Land within the WIPP site boundary up to the "exclusive use area" is leased for livestock grazing, which is the only significant agricultural activity in the vicinity of the WIPP facility. Development of the natural resources results in a transient (nonpermanent) population consisting primarily of workers at two potash mines and numerous oil and gas wells located within 10 miles (16 km) of the WIPP facility.

In compliance with 40 CFR Part 191, Subpart A, the location of the maximally exposed individual is the location where an actual individual lives or works who receives the maximum annual radiation dose from the source. The Guidance for the Implementation of EPA's Standards for Management and Storage of Transuranic Waste (40 CFR Part 191, Subpart A) at the Waste Isolation Pilot Plant (EPA 402-R-97-001), states, "The U.S. Environmental Protection Agency expects the DOE to examine radiation doses to individuals at any off-site point where there is a residence, school, business, or office. At WIPP, consideration of business should include activities such as grazing, mining, or oil drilling in the vicinity of the site."

Based on this U.S. Environmental Protection Agency (EPA) guidance document and the WIPP facility's meteorological condition (i.e., the prevailing wind direction), the receptors selected are individuals at the WIPP fence line located 350 and 7500 meters in the northwest sector from the WIPP facility. These receptors have been selected as the location for the maximally exposed individual. In CY 2013, the complete set of dose and risk factors used in CAP88-PC to calculate the EDE returned a result of $5.25x10^{-04}$ mrem per year whole body and 1.31×10^{-03} mrem per year to the critical organ at 350 meters northwest from the WIPP facility. At 7,500 meters west-northwest from the WIPP facility, the EDE to the maximally exposed individual is approximately $7.39x10^{-06}$ mrem per year whole body and 1.81×10^{-05} mrem per year to the critical organ.

EPA 402-R-97-001 further states:

> *In implementing Subpart A at the WIPP, the EPA expects the DOE to analyze potential exposure pathways and then examine demographic information and conduct field investigations to identify the locations of actual individuals who could be exposed via those pathways. As a conservative simplifying assumption, the DOE could conduct separate analyses of potential doses received from each*

[3] The main alpha peaks for ^{239}Pu and ^{240}Pu differ by less than 0.02 megaelectron-volt (MeV). Spectral resolution of these peaks is insufficient to discriminate individual isotopic contributions. Therefore, these two radionuclides are reported as $^{239/240}Pu$.

[4] The ^{233}U and ^{234}U spectral peaks are separated by less than 0.05 MeV. Resolution of these peaks is insufficient to discriminate the individual isotopic contributions. Results are reported as $^{233/234}U$.

exposure pathway, then assume that a member of the public resides at the single geographic point on the surface where the maximum dose would be received.

This dose can be calculated by summing the dose from all pathways to calculate the maximum dose to a member of the public at the single geographic point.

Based on the above-referenced EPA guidance document, demographic information, and the WIPP facility's meteorological condition (i.e., the prevailing wind direction), the receptor selected is an individual at the Smith Ranch, located 7,500 meters from the WIPP facility, in the west-northwest sector. This receptor has been selected as the location for the maximally exposed individual. Dose and risk factors used in the CAP88-PC, Version 3.0 to calculate the effective dose equivalent values to members of the public is provided in Enclosure 2.

Table A-6: Characteristics of WIPP's Emission Points: Calendar Year 2013

Characteristics	Station A	Station B	Station C[1]
Effective Station Height (m)	7.7	6.7	20.0
Effective Station Diameter (m)	5.2	1.8	2.6
Station Area (m^2)	21.2	2.6	6.8
Flow Rate (ft^3/min) English equivalent	4.25×10^5	6.0×10^4	4.7×10^4 (top-end) 2.0×10^4 (low-end)
Flow Rate (m^3/min)	1.2×10^4	1699	1331 (top-end) 566 (low-end)
Exit Velocity (m/sec)	9.4	10.8	3.3 (top-end) 1.4 (low-end)
Effective Exit Velocity (m/sec)	6.7	NA	NA
Orientation	45° Angle	Vertical	Vertical
Shape	Rectangle	Round	Square
HEPA filtered	No	Yes	Yes

[1] For Station C, when a portion of the air in the WHB is being recirculated, it will yield a lower effluent flow rate and exit velocity. Although a range of flow rates and exit velocities are provided, the top-end values are provided as input into the CAP88-PC Version 3.0 source data. The recirculation system was implemented in March 2010.

INPUT DATA FOR CAP88-PC DOSE ASSESSMENT COMPUTER MODEL

Meteorological Data File: WIPP2013.WND (Annual average, 2013)

Population Data File: WIPP2010.pop (Population data for WIPP region)

Annual precipitation: 23 cm/year (CY 2013)

Annual ambient temperature: 18°C (CY 2013)

Lid height: 1,000 meters

Agricultural Scenario: Local

Absolute Humidity: 8 (grams/cu meter)

DESCRIPTION OF CONSTRUCTION AND MODIFICATIONS COMPLETED DURING REPORTING PERIOD

No construction or modifications were undertaken on the three effluent monitoring stations, known as Stations A, B, and C. A sample flow control valve calibration bias was found at Station C in late 2013. Recalculations were completed as described below, and the emissions point equipment was repaired and recalibrated, and returned to normal operation in November 2013.

Since the emissions estimates from WIPP exhaust points are dependent upon accurate ratios of sample flow to exhaust flow, the emissions from Station C were re-calculated assuming that the bias existed since equipment installation in May 2011. In CY 2011, the effects were calculated to be negligible (less than 1% change); in CY 2012, the increase in dose was estimated to be about 11% higher than originally reported. The bias correction for CY 2013, estimated to be less than 10%, was incorporated into all CY 2013 calculations at the start.

The corrected emissions activities and dose calculations are included in this report for Station C effects for CY 2012 and CY 2013 as calculated in 2014.

FOLLOWING TABLES CHANGED TO ACCOUNT FOR 05/15/14 STATION C CORRECTIONS

CY 2013 CAP88-PC Output Data for the Maximum Exposed Individual at the DOE Exclusive Use Area Boundary (350 meters)

C A P 8 8 - P C

Version 3.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
May 15, 2014 11:54 am

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2013

Comments: CY 2013 WIPP Compliance Report
40 CFR Part 191, Subpart A

Effective Dose Equivalent (mrem/year)
5.25E-04

At This Location: 350 Meters Northwest

Dataset Name: 2013-191SubpartA
Dataset Date: 5/15/2014 10:56:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\WIPP201

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 350 Meters Northwest
Lifetime Fatal Cancer Risk: 2.62E-10

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
Adrenals	4.42E-04
B Surfac	1.31E-03
Breasts	3.55E-04
St Wall	4.23E-04
ULI Wall	4.65E-04
Kidneys	4.25E-04
Lungs	4.27E-04
Ovaries	4.52E-04
R Marrow	7.74E-04
Spleen	4.25E-04
Thymus	4.13E-04
Uterus	4.55E-04
Bld Wall	4.57E-04
Brain	3.72E-04
Esophagu	4.15E-04
SI Wall	4.42E-04
LLI Wall	5.68E-04
Liver	4.36E-04
Muscle	3.96E-04
Pancreas	4.53E-04
Skin	3.63E-04
Testes	3.98E-04
Thyroid	4.13E-04
EFFEC	5.25E-04

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RADIONUCLIDE EMISSIONS DURING THE YEAR 2013

Nuclide	Type	Size	Source #1 Ci/y	Source #2 Ci/y	Source #3 Ci/y	TOTAL Ci/y
Am-241	M	1	3.6E-08	1.5E-09	1.1E-08	4.9E-08
Pu-238	M	1	3.0E-08	1.7E-09	6.8E-09	3.9E-08
Pu-239	M	1	2.5E-08	4.7E-10	5.0E-09	3.0E-08
Sr-90	S	1	2.2E-06	9.1E-08	5.0E-07	2.8E-06
Cs-137	F	1	2.3E-05	1.2E-06	1.1E-05	3.5E-05
U-233	S	1	4.8E-08	6.8E-09	5.4E-09	6.0E-08
U-238	S	1	5.4E-08	7.1E-09	5.2E-09	6.6E-08

SITE INFORMATION

Temperature:	18	degrees C
Precipitation:	23	cm/y
Humidity:	8	g/cu m
Mixing Height:	1000	m

SOURCE INFORMATION

Source Number:	1	2	3
Stack Height (m):	7.70	6.70	20.00
Diameter (m):	5.20	1.80	2.60
Plume Rise Momentum (m/s): (Exit Velocity)	6.70	10.80	3.30

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	1.000	1.000	1.000
Fraction From Assessment Area:	0.000	0.000	0.000
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

350

C A P 8 8 - P C
Version 3.0

Clean Air Act Assessment Package - 1988

G E N E R A L D A T A
Non-Radon Individual Assessment
May 15, 2014 11:54 am

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2013

Comments: CY 2013 WIPP Compliance Report
40 CFR Part 191, Subpart A

Dataset Name: 2013-191SubpartA
Dataset Date: 5/15/2014 10:56:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\WIPP2013.WND

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VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

Nuclide	Clearance Type	Particle Size (microns)	Scavenging Coefficient (per second)	Dry Deposition Velocity (m/s)
Am-241	M	1	2.25E-06	1.80E-03
Np-237	M	1	2.25E-06	1.80E-03
Pa-233	M	1	2.25E-06	1.80E-03
U-233	M	1	2.25E-06	1.80E-03
Th-229	S	1	2.25E-06	1.80E-03
Ra-225	M	1	2.25E-06	1.80E-03
Ac-225	M	1	2.25E-06	1.80E-03
Fr-221	M	1	2.25E-06	1.80E-03
At-217	M	1	2.25E-06	1.80E-03
Bi-213	M	1	2.25E-06	1.80E-03
Pu-238	M	1	2.25E-06	1.80E-03
U-234	M	1	2.25E-06	1.80E-03
Th-230	S	1	2.25E-06	1.80E-03
Ra-226	M	1	2.25E-06	1.80E-03
Rn-222	G	0	0.00E+00	0.00E+00
Pu-239	M	1	2.25E-06	1.80E-03
U-235	M	1	2.25E-06	1.80E-03
Th-231	S	1	2.25E-06	1.80E-03
Pa-231	M	1	2.25E-06	1.80E-03
Ac-227	M	1	2.25E-06	1.80E-03
Sr-90	S	1	2.25E-06	1.80E-03
Y-90	M	1	2.25E-06	1.80E-03
Cs-137	F	1	2.25E-06	1.80E-03
Ba-137m	M	1	2.25E-06	1.80E-03
U-233	S	1	2.25E-06	1.80E-03
U-238	S	1	2.25E-06	1.80E-03
Th-234	S	1	2.25E-06	1.80E-03
Pa-234m	M	1	2.25E-06	1.80E-03
Pa-234	M	1	2.25E-06	1.80E-03

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VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

	DECAY CONSTANT (PER DAY)		TRANSFER COEFFICIENT		
Nuclide	Radio-active (1)	Surface	Water	Milk (2)	Meat (3)
Am-241	4.39E-06	5.48E-05	0.00E+00	2.00E-06	5.00E-05
Np-237	8.87E-10	5.48E-05	0.00E+00	1.00E-05	1.00E-03
Pa-233	2.57E-02	5.48E-05	0.00E+00	5.00E-06	5.00E-06
U-233	1.20E-08	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-229	2.58E-07	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Ra-225	4.68E-02	5.48E-05	0.00E+00	1.00E-03	2.00E-03
Ac-225	6.93E-02	5.48E-05	0.00E+00	2.00E-06	2.00E-05
Fr-221	2.08E+02	5.48E-05	0.00E+00	8.00E-03	3.00E-02
At-217	1.85E+06	5.48E-05	0.00E+00	1.00E-02	1.00E-02
Bi-213	2.19E+01	5.48E-05	0.00E+00	1.00E-03	2.00E-03
Pu-238	2.16E-05	5.48E-05	0.00E+00	1.00E-06	1.00E-04
U-234	7.76E-09	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-230	2.46E-08	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Ra-226	1.19E-06	5.48E-05	0.00E+00	1.00E-03	2.00E-03
Rn-222	1.81E-01	5.48E-05	0.00E+00	0.00E+00	0.00E+00
Pu-239	7.88E-08	5.48E-05	0.00E+00	1.00E-06	1.00E-04
U-235	2.70E-12	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-231	6.52E-01	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Pa-231	5.79E-08	5.48E-05	0.00E+00	5.00E-06	5.00E-06
Ac-227	8.71E-05	5.48E-05	0.00E+00	2.00E-06	2.00E-05
Sr-90	6.52E-05	5.48E-05	0.00E+00	2.00E-03	1.00E-02
Y-90	2.60E-01	5.48E-05	0.00E+00	6.00E-05	2.00E-03
Cs-137	6.32E-05	5.48E-05	0.00E+00	1.00E-02	5.00E-02
Ba-137m	3.91E+02	5.48E-05	0.00E+00	5.00E-04	2.00E-04
U-233	1.20E-08	5.48E-05	0.00E+00	4.00E-04	8.00E-04
U-238	4.25E-13	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-234	2.88E-02	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Pa-234m	8.53E+02	5.48E-05	0.00E+00	5.00E-06	5.00E-06
Pa-234	2.48E+00	5.48E-05	0.00E+00	5.00E-06	5.00E-06

FOOTNOTES:

(1) Fraction of animal's daily intake of nuclide which appears in each L of milk (days/L)
(2) Fraction of animal's daily intake of nuclide which appears in each kg of meat (days/kg)

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VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

	CONCENTRATION UPTAKE FACTOR		GI UPTAKE FRACTION	
Nuclide	Forage (1)	Edible (2)	Inhalation	Ingestion
Am-241	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Np-237	1.00E-01	2.00E-02	5.00E-04	5.00E-04
Pa-233	1.00E-01	1.00E-02	5.00E-04	5.00E-04
U-233	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-229	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Ra-225	2.00E-01	4.00E-02	2.00E-01	2.00E-01
Ac-225	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Fr-221	1.00E-01	3.00E-02	1.00E+00	1.00E+00
At-217	9.00E-01	2.00E-01	1.00E+00	1.00E+00
Bi-213	5.00E-01	1.00E-01	5.00E-02	5.00E-02
Pu-238	1.00E-01	1.00E-03	5.00E-04	5.00E-04
U-234	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-230	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Ra-226	2.00E-01	4.00E-02	2.00E-01	2.00E-01
Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pu-239	1.00E-01	1.00E-03	5.00E-04	5.00E-04
U-235	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-231	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Pa-231	1.00E-01	1.00E-02	5.00E-04	5.00E-04
Ac-227	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Sr-90	4.00E+00	3.00E-01	3.00E-01	3.00E-01
Y-90	1.00E-01	2.00E-03	1.00E-04	1.00E-04
Cs-137	1.00E+00	2.00E-01	1.00E+00	1.00E+00
Ba-137m	1.00E-01	1.00E-02	2.00E-01	2.00E-01
U-233	1.00E-01	2.00E-03	2.00E-02	2.00E-02
U-238	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-234	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Pa-234m	1.00E-01	1.00E-02	5.00E-04	5.00E-04
Pa-234	1.00E-01	1.00E-02	5.00E-04	5.00E-04

FOOTNOTES: (1) Concentration factor for uptake of nuclide from soil for pasture and forage (in pCi/kg dry weight per pCi/kg dry soil)
(2) Concentration factor for uptake of nuclide from soil by edible parts of crops (in pCi/kg wet weight per pCi/kg dry soil)

DECAY CHAIN ACTIVITIES

Nuclide	Stack	Activity at 500. seconds	Activity at 100.00 years
Am-241	1	3.6200E-08	0.0000E+00
Am-241	2	1.5000E-09	0.0000E+00
Am-241	3	1.0900E-08	0.0000E+00
Np-237	1	0.0000E+00	0.0000E+00
Np-237	2	0.0000E+00	0.0000E+00
Np-237	3	0.0000E+00	0.0000E+00
Pa-233	1	0.0000E+00	0.0000E+00
Pa-233	2	0.0000E+00	0.0000E+00
Pa-233	3	0.0000E+00	0.0000E+00
U-233	1	0.0000E+00	0.0000E+00
U-233	2	0.0000E+00	0.0000E+00
U-233	3	0.0000E+00	0.0000E+00
Th-229	1	0.0000E+00	0.0000E+00
Th-229	2	0.0000E+00	0.0000E+00
Th-229	3	0.0000E+00	0.0000E+00
Ra-225	1	0.0000E+00	0.0000E+00
Ra-225	2	0.0000E+00	0.0000E+00
Ra-225	3	0.0000E+00	0.0000E+00
Ac-225	1	0.0000E+00	0.0000E+00
Ac-225	2	0.0000E+00	0.0000E+00
Ac-225	3	0.0000E+00	0.0000E+00
Fr-221	1	0.0000E+00	0.0000E+00
Fr-221	2	0.0000E+00	0.0000E+00
Fr-221	3	0.0000E+00	0.0000E+00
At-217	1	0.0000E+00	0.0000E+00
At-217	2	0.0000E+00	0.0000E+00
At-217	3	0.0000E+00	0.0000E+00
Bi-213	1	0.0000E+00	0.0000E+00
Bi-213	2	0.0000E+00	0.0000E+00
Bi-213	3	0.0000E+00	0.0000E+00
Pu-238	1	3.0400E-08	0.0000E+00
Pu-238	2	1.7100E-09	0.0000E+00
Pu-238	3	6.7700E-09	0.0000E+00
U-234	1	0.0000E+00	0.0000E+00
U-234	2	0.0000E+00	0.0000E+00
U-234	3	0.0000E+00	0.0000E+00
Th-230	1	0.0000E+00	0.0000E+00
Th-230	2	0.0000E+00	0.0000E+00
Th-230	3	0.0000E+00	0.0000E+00
Ra-226	1	0.0000E+00	0.0000E+00
Ra-226	2	0.0000E+00	0.0000E+00
Ra-226	3	0.0000E+00	0.0000E+00
Rn-222	1	0.0000E+00	0.0000E+00
Rn-222	2	0.0000E+00	0.0000E+00
Rn-222	3	0.0000E+00	0.0000E+00
Pu-239	1	2.4800E-08	0.0000E+00
Pu-239	2	0.0000E+00	0.0000E+00
Pu-239	3	4.9800E-09	0.0000E+00
U-235	1	0.0000E+00	0.0000E+00
U-235	2	0.0000E+00	0.0000E+00

U-235	3	0.0000E+00	0.0000E+00
Th-231	1	0.0000E+00	0.0000E+00
Th-231	2	0.0000E+00	0.0000E+00
Th-231	3	0.0000E+00	0.0000E+00
Pa-231	1	0.0000E+00	0.0000E+00
Pa-231	2	0.0000E+00	0.0000E+00
Pa-231	3	0.0000E+00	0.0000E+00
Ac-227	1	0.0000E+00	0.0000E+00
Ac-227	2	0.0000E+00	0.0000E+00
Ac-227	3	0.0000E+00	0.0000E+00
Sr-90	1	2.2100E-06	1.0120E-06
Sr-90	2	9.0500E-08	0.0000E+00
Sr-90	3	4.9800E-07	2.2800E-07
Y-90	1	3.3210E-09	9.9150E-07
Y-90	2	0.0000E+00	0.0000E+00
Y-90	3	0.0000E+00	2.2000E-07
Cs-137	1	2.2500E-05	1.0300E-05
Cs-137	2	1.2200E-06	5.5860E-07
Cs-137	3	1.1200E-05	5.1280E-06

Ba-137m	1	1.9070E-05	9.7450E-06
Ba-137m	2	1.0340E-06	5.2840E-07
Ba-137m	3	9.4930E-06	4.8510E-06
U-233	1	4.7900E-08	0.0000E+00
U-233	2	6.7700E-09	0.0000E+00
U-233	3	5.4000E-09	0.0000E+00
U-238	1	5.4000E-08	0.0000E+00
U-238	2	7.1400E-09	0.0000E+00
U-238	3	5.1800E-09	0.0000E+00
Th-234	1	0.0000E+00	0.0000E+00
Th-234	2	0.0000E+00	0.0000E+00
Th-234	3	0.0000E+00	0.0000E+00
Pa-234m	1	0.0000E+00	0.0000E+00
Pa-234m	2	0.0000E+00	0.0000E+00
Pa-234m	3	0.0000E+00	0.0000E+00
Pa-234	1	0.0000E+00	0.0000E+00
Pa-234	2	0.0000E+00	0.0000E+00
Pa-234	3	0.0000E+00	0.0000E+00

VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS

HUMAN INHALATION RATE	
Cubic centimeters/hr	9.17E+05
SOIL PARAMETERS	
Effective surface density (kg/sq m, dry weight) (Assumes 15 cm plow layer)	2.15E+02
BUILDUP TIMES	
For activity in soil (years)	1.00E+02
For radionuclides deposited on ground/water (days)	3.65E+04
DELAY TIMES	
Ingestion of pasture grass by animals (hr)	0.00E+00
Ingestion of stored feed by animals (hr)	2.16E+03
Ingestion of leafy vegetables by man (hr)	3.36E+02
Ingestion of produce by man (hr)	3.36E+02
Transport time from animal feed-milk-man (day)	2.00E+00
Time from slaughter to consumption (day)	2.00E+01
WEATHERING	
Removal rate constant for physical loss (per hr)	2.90E-03
CROP EXPOSURE DURATION	
Pasture grass (hr)	7.20E+02
Crops/leafy vegetables (hr)	1.44E+03
AGRICULTURAL PRODUCTIVITY	
Grass-cow-milk-man pathway (kg/sq m)	2.80E-01
Produce/leafy veg for human consumption (kg/sq m)	7.16E-01
FALLOUT INTERCEPTION FRACTIONS	
Vegetables	2.00E-01
Pasture	5.70E-01
GRAZING PARAMETERS	
Fraction of year animals graze on pasture	4.00E-01
Fraction of daily feed that is pasture grass when animal grazes on pasture	4.30E-01

VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS

ANIMAL FEED CONSUMPTION FACTORS	
Contaminated feed/forage (kg/day, dry weight)	1.56E+01
DAIRY PRODUCTIVITY	
Milk production of cow (L/day)	1.10E+01
MEAT ANIMAL SLAUGHTER PARAMETERS	
Muscle mass of animal at slaughter (kg)	2.00E+02
Fraction of herd slaughtered (per day)	3.81E-03
DECONTAMINATION	
Fraction of radioactivity retained after washing for leafy vegetables and produce	5.00E-01
FRACTIONS GROWN IN GARDEN OF INTEREST	
Produce ingested	1.00E+00
Leafy vegetables ingested	1.00E+00
INGESTION RATIOS:	
IMMEDIATE SURROUNDING AREA/TOTAL WITHIN AREA	
Vegetables	1.00E+00
Meat	1.00E+00
Milk	1.00E+00
MINIMUM INGESTION FRACTIONS FROM OUTSIDE AREA (Minimum fractions of food types from outside area listed below are actual fixed values.)	
Vegetables	0.00E+00
Meat	0.00E+00
Milk	0.00E+00
HUMAN FOOD UTILIZATION FACTORS	
Produce ingestion (kg/y)	1.76E+02
Milk ingestion (L/y)	1.12E+02
Meat ingestion (kg/y)	8.50E+01
Leafy vegetable ingestion (kg/y)	1.80E+01
SWIMMING PARAMETERS	
Fraction of time spent swimming	0.00E+00
Dilution factor for water (cm)	1.00E+00

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Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S
Non-Radon Individual Assessment
May 15, 2014 11:54 am

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2013

Comments: CY 2013 WIPP Compliance Report
40 CFR Part 191, Subpart A

Dataset Name: 2013-191SubpartA
Dataset Date: 5/15/2014 10:56:00 AM
Wind File: . C:\Program Files\CAP88-PC30\WndFiles\WIPP2013.WND

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
Adrenals	4.42E-04
B Surfac	1.31E-03
Breasts	3.55E-04
St Wall	4.23E-04
ULI Wall	4.65E-04
Kidneys	4.25E-04
Lungs	4.27E-04
Ovaries	4.52E-04
R Marrow	7.74E-04
Spleen	4.25E-04
Thymus	4.13E-04
Uterus	4.55E-04
Bld Wall	4.57E-04
Brain	3.72E-04
Esophagu	4.15E-04
SI Wall	4.42E-04
LLI Wall	5.68E-04
Liver	4.36E-04
Muscle	3.96E-04
Pancreas	4.53E-04
Skin	3.63E-04
Testes	3.98E-04
Thyroid	4.13E-04
EFFEC	5.25E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	4.75E-04
INHALATION	4.37E-05
AIR IMMERSION	1.84E-08
GROUND SURFACE	6.20E-06
INTERNAL	5.18E-04
EXTERNAL	6.22E-06
TOTAL	5.25E-04

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NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
Am-241	1.23E-05
Np-237	0.00E+00
Pa-233	0.00E+00
U-233	0.00E+00
Th-229	0.00E+00
Ra-225	0.00E+00
Ac-225	0.00E+00
Fr-221	0.00E+00
At-217	0.00E+00
Bi-213	0.00E+00
Pu-238	1.12E-05
U-234	0.00E+00
Th-230	0.00E+00
Ra-226	0.00E+00
Rn-222	0.00E+00
Pu-239	9.09E-06
U-235	0.00E+00
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Sr-90	5.81E-05
Y-90	9.52E-08
Cs-137	4.20E-04
Ba-137m	6.09E-06
U-233	3.86E-06
U-238	3.57E-06
Th-234	0.00E+00
Pa-234m	0.00E+00
Pa-234	0.00E+00
TOTAL	5.25E-04

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
Esophagu	4.43E-12
Stomach	1.59E-11
Colon	4.82E-11
Liver	8.10E-12
LUNG	4.28E-11
Bone	2.18E-12
Skin	3.33E-13
Breast	1.32E-11
Ovary	5.56E-12
Bladder	1.14E-11
Kidneys	2.25E-12
Thyroid	1.08E-12
Leukemia	4.85E-11
Residual	5.80E-11
Total	2.62E-10
TOTAL	5.24E-10

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	2.45E-10
INHALATION	1.33E-11
AIR IMMERSION	1.00E-14
GROUND SURFACE	3.29E-12
INTERNAL	2.58E-10
EXTERNAL	3.30E-12
TOTAL	2.62E-10

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NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
Am-241	1.95E-12
Np-237	0.00E+00
Pa-233	0.00E+00
U-233	0.00E+00
Th-229	0.00E+00
Ra-225	0.00E+00
Ac-225	0.00E+00
Fr-221	0.00E+00
At-217	0.00E+00
Bi-213	0.00E+00
Pu-238	1.95E-12
U-234	0.00E+00
Th-230	0.00E+00
Ra-226	0.00E+00
Rn-222	0.00E+00
Pu-239	1.44E-12
U-235	0.00E+00
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Sr-90	3.43E-11
Y-90	1.14E-14
Cs-137	2.13E-10
Ba-137m	3.29E-12
U-233	2.92E-12
U-238	2.70E-12
Th-234	0.00E+00
Pa-234m	0.00E+00
Pa-234	0.00E+00
TOTAL	2.62E-10

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INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)
Direction	350
N	2.3E-04
NNW	3.8E-04
NW	5.2E-04
WNW	3.0E-04
W	1.8E-04
WSW	1.2E-04
SW	1.3E-04
SSW	1.4E-04
S	1.1E-04
SSE	1.1E-04
SE	1.1E-04
ESE	9.4E-05
E	1.3E-04
ENE	1.7E-04
NE	1.5E-04
NNE	1.7E-04

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INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)
Direction	350
N	1.2E-10
NNW	1.9E-10
NW	2.6E-10
WNW	1.5E-10
W	8.9E-11
WSW	5.9E-11
SW	6.3E-11
SSW	6.8E-11
S	5.7E-11
SSE	5.4E-11
SE	5.6E-11
ESE	4.7E-11
E	6.2E-11
ENE	8.3E-11
NE	7.3E-11
NNE	8.4E-11

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Clean Air Act Assessment Package - 1988

W E A T H E R D A T A
Non-Radon Individual Assessment
May 15, 2014 11:54 am

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2013

Comments: CY 2013 WIPP Compliance Report
40 CFR Part 191, Subpart A

Dataset Name: 2013-191SubpartA
Dataset Date: 5/15/2014 10:56:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\WIPP2013.WND

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HARMONIC AVERAGE WIND SPEEDS (WIND TOWARDS)

	Pasquill Stability Class							
Dir	A	B	C	D	E	F	G	Wind Freq
N	1.966	3.126	3.216	3.672	2.767	3.079	0.000	0.068
NNW	2.188	3.314	3.786	4.124	3.859	3.526	0.000	0.127
NW	2.174	3.389	3.615	4.734	4.122	3.186	0.000	0.199
WNW	1.964	2.245	2.669	3.700	4.148	3.623	0.000	0.118
W	1.737	2.191	2.430	3.932	4.330	3.504	0.000	0.059
WSW	1.742	2.016	3.110	4.476	4.341	3.726	0.000	0.040
SW	1.695	2.962	2.761	4.234	3.539	3.357	0.000	0.039
SSW	1.718	2.485	3.474	3.679	3.167	3.236	0.000	0.041
S	2.039	3.392	4.271	3.395	3.330	2.867	0.000	0.036
SSE	1.860	3.064	3.789	4.335	3.559	2.686	0.000	0.033
SE	1.602	2.590	3.286	3.322	2.538	2.713	0.000	0.031
ESE	1.693	2.691	2.805	3.337	2.378	1.852	0.000	0.025
E	1.833	2.871	3.623	6.061	4.547	3.239	0.000	0.040
ENE	1.945	3.049	3.971	5.098	3.064	0.000	0.000	0.052
NE	2.049	2.958	3.375	3.963	2.905	0.000	0.000	0.043
NNE	2.088	2.645	3.683	3.505	3.009	3.079	0.000	0.050

ARITHMETIC AVERAGE WIND SPEEDS (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	3.011	4.208	4.749	4.757	3.435	3.292	0.000
NNW	3.358	4.610	5.169	5.466	4.607	3.755	0.000
NW	3.405	4.761	5.218	5.803	4.719	3.523	0.000
WNW	2.978	3.784	4.007	4.859	4.603	3.995	0.000
W	2.738	3.521	3.805	5.083	5.107	3.931	0.000
WSW	2.868	3.496	4.583	6.124	5.500	3.944	0.000
SW	2.626	4.184	4.204	6.512	4.911	3.691	0.000
SSW	2.669	3.943	5.207	5.561	3.972	3.602	0.000
S	3.132	5.372	5.634	4.403	4.367	3.022	0.000
SSE	2.794	4.144	5.419	5.607	4.001	3.403	0.000
SE	2.518	3.450	4.350	5.011	3.223	3.254	0.000
ESE	2.608	3.434	3.920	4.927	3.475	2.272	0.000
E	2.687	3.768	5.121	7.878	6.104	3.472	0.000
ENE	2.993	4.314	5.498	6.618	4.452	0.000	0.000
NE	2.975	4.060	4.888	5.407	3.601	0.000	0.000
NNE	2.975	3.837	4.703	4.748	3.538	3.292	0.000

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FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	0.2141	0.1299	0.2424	0.2932	0.1138	0.0066	0.0000
NNW	0.1055	0.0730	0.1622	0.3889	0.2518	0.0186	0.0000
NW	0.0631	0.0463	0.0952	0.4068	0.3538	0.0349	0.0000
WNW	0.0669	0.0392	0.0604	0.2799	0.4981	0.0555	0.0000
W	0.1106	0.0427	0.0767	0.3761	0.3501	0.0437	0.0000
WSW	0.1259	0.0498	0.0945	0.3307	0.3307	0.0684	0.0000
SW	0.1454	0.0533	0.1066	0.3713	0.2573	0.0661	0.0000
SSW	0.1491	0.0649	0.1532	0.3784	0.1993	0.0551	0.0000
S	0.1765	0.1278	0.3668	0.2404	0.0783	0.0101	0.0000
SSE	0.2347	0.1379	0.2284	0.2843	0.1028	0.0118	0.0000
SE	0.2304	0.0953	0.2094	0.3192	0.1099	0.0359	0.0000
ESE	0.2619	0.1031	0.1966	0.3045	0.1268	0.0072	0.0000
E	0.2222	0.0853	0.1648	0.3950	0.1297	0.0030	0.0000
ENE	0.2218	0.1123	0.2097	0.4010	0.0551	0.0000	0.0000
NE	0.3013	0.1573	0.2102	0.2841	0.0471	0.0000	0.0000
NNE	0.2832	0.1561	0.2336	0.2515	0.0726	0.0030	0.0000
TOTAL	0.1468	0.0795	0.1520	0.3455	0.2475	0.0288	0.0000

ADDITIONAL WEATHER INFORMATION

Average Air Temperature:	17.5 degrees C
	290.63 K
Precipitation:	22.5 cm/y
Humidity:	8.0 g/cu m
Lid Height:	1000 meters
Surface Roughness Length:	0.010 meters
Height Of Wind Measurements:	10.0 meters
Average Wind Speed:	4.708 m/s
Vertical Temperature Gradients:	
STABILITY E	0.073 k/m
STABILITY F	0.109 k/m
STABILITY G	0.146 k/m

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C O N C E N T R A T I O N T A B L E S
Non-Radon Individual Assessment
May 15, 2014 11:54 am

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2013

Comments: CY 2013 WIPP Compliance Report
40 CFR Part 191, Subpart A

Dataset Name: 2013-191SubpartA
Dataset Date: 5/15/2014 10:56:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\WIPP2013.WND

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
N	350	Am-241	4.28E-09	7.71E-16	5.91E-17	8.30E-16
N	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Pu-238	3.47E-09	6.24E-16	4.73E-17	6.71E-16
N	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Pu-239	2.62E-09	4.71E-16	3.62E-17	5.07E-16
N	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Sr-90	2.48E-07	4.47E-14	3.40E-15	4.81E-14
N	350	Y-90	2.99E-10	5.38E-17	4.04E-18	5.79E-17
N	350	Cs-137	3.04E-06	5.47E-13	4.25E-14	5.89E-13
N	350	Ba-137m	2.57E-06	4.63E-13	3.60E-14	4.99E-13
N	350	U-233	5.56E-09	1.00E-15	7.30E-17	1.07E-15
N	350	U-238	6.14E-09	1.10E-15	8.06E-17	1.19E-15
N	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Am-241	7.14E-09	1.29E-15	8.80E-17	1.37E-15
NNW	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Pu-238	5.84E-09	1.05E-15	7.04E-17	1.12E-15
NNW	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Pu-239	4.38E-09	7.89E-16	5.39E-17	8.43E-16
NNW	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00

NNW	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
NNW	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Sr-90	4.17E-07	7.51E-14	5.06E-15	8.02E-14
NNW	350	Y-90	5.14E-10	9.24E-17	6.01E-18	9.84E-17
NNW	350	Cs-137	4.99E-06	8.99E-13	6.32E-14	9.62E-13
NNW	350	Ba-137m	4.23E-06	7.62E-13	5.36E-14	8.16E-13
NNW	350	U-233	9.56E-09	1.72E-15	1.09E-16	1.83E-15
NNW	350	U-238	1.06E-08	1.90E-15	1.20E-16	2.02E-15
NNW	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Am-241	9.94E-09	1.79E-15	1.25E-16	1.91E-15
NW	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Pu-238	8.16E-09	1.47E-15	9.99E-17	1.57E-15
NW	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Pu-239	6.10E-09	1.10E-15	7.66E-17	1.17E-15
NW	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Sr-90	5.83E-07	1.05E-13	7.19E-15	1.12E-13
NW	350	Y-90	7.22E-10	1.30E-16	8.54E-18	1.39E-16
NW	350	Cs-137	6.90E-06	1.24E-12	8.98E-14	1.33E-12
NW	350	Ba-137m	5.85E-06	1.05E-12	7.61E-14	1.13E-12
NW	350	U-233	1.35E-08	2.43E-15	1.54E-16	2.59E-15
NW	350	U-238	1.50E-08	2.69E-15	1.70E-16	2.86E-15
NW	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Am-241	5.68E-09	1.02E-15	8.37E-17	1.11E-15
WNW	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00

WNW	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
WNW	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Pu-238	4.67E-09	8.41E-16	6.70E-17	9.08E-16
WNW	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Pu-239	3.46E-09	6.23E-16	5.13E-17	6.74E-16
WNW	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Sr-90	3.33E-07	5.99E-14	4.82E-15	6.47E-14
WNW	350	Y-90	4.08E-10	7.34E-17	5.72E-18	7.91E-17
WNW	350	Cs-137	3.96E-06	7.13E-13	6.01E-14	7.73E-13
WNW	350	Ba-137m	3.36E-06	6.05E-13	5.10E-14	6.55E-13
WNW	350	U-233	7.82E-09	1.41E-15	1.03E-16	1.51E-15
WNW	350	U-238	8.63E-09	1.55E-15	1.14E-16	1.67E-15
WNW	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Am-241	3.36E-09	6.05E-16	4.45E-17	6.49E-16
W	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Pu-238	2.75E-09	4.95E-16	3.56E-17	5.31E-16
W	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Pu-239	2.06E-09	3.70E-16	2.73E-17	3.98E-16
W	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Sr-90	1.96E-07	3.54E-14	2.56E-15	3.79E-14
W	350	Y-90	2.42E-10	4.35E-17	3.04E-18	4.66E-17
W	350	Cs-137	2.34E-06	4.22E-13	3.20E-14	4.54E-13
W	350	Ba-137m	1.99E-06	3.58E-13	2.71E-14	3.85E-13

W	350	U-233	4.53E-09	8.15E-16	5.50E-17	8.70E-16

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
W	350	U-238	5.00E-09	9.01E-16	6.07E-17	9.61E-16
W	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Am-241	2.25E-09	4.04E-16	2.93E-17	4.34E-16
WSW	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Pu-238	1.84E-09	3.31E-16	2.34E-17	3.55E-16
WSW	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Pu-239	1.38E-09	2.49E-16	1.79E-17	2.67E-16
WSW	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Sr-90	1.32E-07	2.37E-14	1.69E-15	2.54E-14
WSW	350	Y-90	1.63E-10	2.94E-17	2.00E-18	3.14E-17
WSW	350	Cs-137	1.56E-06	2.81E-13	2.10E-14	3.02E-13
WSW	350	Ba-137m	1.32E-06	2.38E-13	1.78E-14	2.56E-13
WSW	350	U-233	3.02E-09	5.44E-16	3.62E-17	5.80E-16
WSW	350	U-238	3.34E-09	6.01E-16	3.99E-17	6.41E-16
WSW	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Am-241	2.39E-09	4.31E-16	3.15E-17	4.62E-16
SW	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Pu-238	1.96E-09	3.52E-16	2.52E-17	3.78E-16
SW	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00

SW	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
SW	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Pu-239	1.47E-09	2.65E-16	1.93E-17	2.84E-16
SW	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Sr-90	1.40E-07	2.52E-14	1.81E-15	2.70E-14
SW	350	Y-90	1.73E-10	3.12E-17	2.15E-18	3.33E-17
SW	350	Cs-137	1.67E-06	3.00E-13	2.26E-14	3.23E-13
SW	350	Ba-137m	1.41E-06	2.55E-13	1.92E-14	2.74E-13
SW	350	U-233	3.20E-09	5.76E-16	3.89E-17	6.15E-16
SW	350	U-238	3.54E-09	6.37E-16	4.30E-17	6.80E-16
SW	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Am-241	2.53E-09	4.56E-16	3.46E-17	4.91E-16
SSW	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Pu-238	2.07E-09	3.72E-16	2.77E-17	3.99E-16
SSW	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Pu-239	1.55E-09	2.79E-16	2.12E-17	3.01E-16
SSW	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Sr-90	1.48E-07	2.66E-14	1.99E-15	2.86E-14
SSW	350	Y-90	1.80E-10	3.25E-17	2.37E-18	3.48E-17
SSW	350	Cs-137	1.78E-06	3.20E-13	2.49E-14	3.45E-13
SSW	350	Ba-137m	1.51E-06	2.72E-13	2.11E-14	2.93E-13
SSW	350	U-233	3.36E-09	6.05E-16	4.28E-17	6.47E-16
SSW	350	U-238	3.71E-09	6.68E-16	4.73E-17	7.15E-16
SSW	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Am-241	2.13E-09	3.83E-16	2.73E-17	4.10E-16
S	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00

S	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
S	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Pu-238	1.72E-09	3.10E-16	2.18E-17	3.32E-16
S	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Pu-239	1.30E-09	2.35E-16	1.67E-17	2.51E-16
S	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Sr-90	1.24E-07	2.22E-14	1.57E-15	2.38E-14
S	350	Y-90	1.49E-10	2.69E-17	1.86E-18	2.88E-17
S	350	Cs-137	1.51E-06	2.71E-13	1.96E-14	2.91E-13
S	350	Ba-137m	1.28E-06	2.30E-13	1.66E-14	2.47E-13
S	350	U-233	2.76E-09	4.96E-16	3.37E-17	5.30E-16
S	350	U-238	3.04E-09	5.48E-16	3.72E-17	5.85E-16
S	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Am-241	2.00E-09	3.61E-16	2.72E-17	3.88E-16
SSE	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Pu-238	1.62E-09	2.92E-16	2.17E-17	3.14E-16
SSE	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Pu-239	1.23E-09	2.21E-16	1.67E-17	2.38E-16
SSE	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00

SSE	350	Sr-90	1.16E-07	2.10E-14	1.56E-15	2.25E-14

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
SSE	350	Y-90	1.41E-10	2.54E-17	1.86E-18	2.73E-17
SSE	350	Cs-137	1.42E-06	2.55E-13	1.95E-14	2.75E-13
SSE	350	Ba-137m	1.20E-06	2.16E-13	1.66E-14	2.33E-13
SSE	350	U-233	2.60E-09	4.67E-16	3.36E-17	5.01E-16
SSE	350	U-238	2.87E-09	5.16E-16	3.71E-17	5.53E-16
SSE	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Am-241	2.08E-09	3.75E-16	3.06E-17	4.05E-16
SE	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Pu-238	1.69E-09	3.04E-16	2.45E-17	3.28E-16
SE	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Pu-239	1.27E-09	2.29E-16	1.87E-17	2.48E-16
SE	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Sr-90	1.21E-07	2.17E-14	1.76E-15	2.35E-14
SE	350	Y-90	1.45E-10	2.62E-17	2.09E-18	2.83E-17
SE	350	Cs-137	1.48E-06	2.66E-13	2.20E-14	2.88E-13
SE	350	Ba-137m	1.25E-06	2.25E-13	1.86E-14	2.44E-13
SE	350	U-233	2.71E-09	4.87E-16	3.78E-17	5.25E-16
SE	350	U-238	2.99E-09	5.38E-16	4.17E-17	5.79E-16
SE	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Am-241	1.74E-09	3.13E-16	2.56E-17	3.38E-16
ESE	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00

ESE	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
ESE	350	Pu-238	1.41E-09	2.53E-16	2.05E-17	2.74E-16
ESE	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Pu-239	1.06E-09	1.91E-16	1.57E-17	2.06E-16
ESE	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Sr-90	1.01E-07	1.81E-14	1.47E-15	1.96E-14
ESE	350	Y-90	1.21E-10	2.18E-17	1.75E-18	2.35E-17
ESE	350	Cs-137	1.23E-06	2.22E-13	1.84E-14	2.40E-13
ESE	350	Ba-137m	1.05E-06	1.88E-13	1.56E-14	2.04E-13
ESE	350	U-233	2.26E-09	4.07E-16	3.16E-17	4.38E-16
ESE	350	U-238	2.49E-09	4.49E-16	3.49E-17	4.84E-16
ESE	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Am-241	2.36E-09	4.25E-16	2.89E-17	4.54E-16
E	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Pu-238	1.92E-09	3.46E-16	2.31E-17	3.69E-16
E	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Pu-239	1.46E-09	2.63E-16	1.77E-17	2.81E-16
E	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	350	Sr-90	1.38E-07	2.48E-14	1.66E-15	2.65E-14
E	350	Y-90	1.70E-10	3.07E-17	1.97E-18	3.26E-17
E	350	Cs-137	1.65E-06	2.98E-13	2.07E-14	3.18E-13
E	350	Ba-137m	1.40E-06	2.52E-13	1.76E-14	2.70E-13
E	350	U-233	3.09E-09	5.56E-16	3.57E-17	5.92E-16
E	350	U-238	3.42E-09	6.15E-16	3.94E-17	6.55E-16
E	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00

E	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
E	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Am-241	3.15E-09	5.67E-16	3.85E-17	6.06E-16
ENE	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Pu-238	2.56E-09	4.61E-16	3.08E-17	4.91E-16
ENE	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Pu-239	1.94E-09	3.50E-16	2.36E-17	3.73E-16
ENE	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Sr-90	1.83E-07	3.30E-14	2.22E-15	3.52E-14
ENE	350	Y-90	2.25E-10	4.05E-17	2.63E-18	4.31E-17
ENE	350	Cs-137	2.21E-06	3.99E-13	2.77E-14	4.26E-13
ENE	350	Ba-137m	1.88E-06	3.38E-13	2.35E-14	3.61E-13
ENE	350	U-233	4.09E-09	7.37E-16	4.76E-17	7.85E-16
ENE	350	U-238	4.53E-09	8.15E-16	5.26E-17	8.67E-16
ENE	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Am-241	2.74E-09	4.93E-16	3.70E-17	5.30E-16
NE	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Pu-238	2.22E-09	3.99E-16	2.96E-17	4.28E-16
NE	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Pu-239	1.68E-09	3.02E-16	2.27E-17	3.25E-16

NE	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00

May 15, 2014 11:54 am CONCEN
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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
NE	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Sr-90	1.59E-07	2.86E-14	2.13E-15	3.07E-14
NE	350	Y-90	1.92E-10	3.46E-17	2.53E-18	3.71E-17
NE	350	Cs-137	1.94E-06	3.49E-13	2.66E-14	3.76E-13
NE	350	Ba-137m	1.64E-06	2.96E-13	2.25E-14	3.19E-13
NE	350	U-233	3.52E-09	6.34E-16	4.57E-17	6.80E-16
NE	350	U-238	3.89E-09	7.01E-16	5.05E-17	7.51E-16
NE	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Am-241	3.14E-09	5.65E-16	4.39E-17	6.09E-16
NNE	350	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Pu-238	2.54E-09	4.57E-16	3.51E-17	4.92E-16
NNE	350	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Pu-239	1.92E-09	3.45E-16	2.69E-17	3.72E-16
NNE	350	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Sr-90	1.82E-07	3.27E-14	2.53E-15	3.53E-14
NNE	350	Y-90	2.19E-10	3.94E-17	3.00E-18	4.24E-17
NNE	350	Cs-137	2.23E-06	4.01E-13	3.16E-14	4.33E-13
NNE	350	Ba-137m	1.89E-06	3.40E-13	2.68E-14	3.67E-13
NNE	350	U-233	4.04E-09	7.27E-16	5.43E-17	7.82E-16
NNE	350	U-238	4.46E-09	8.03E-16	5.99E-17	8.63E-16
NNE	350	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	350	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00

C A P 8 8 - P C
Version 3.0

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K C O N V E R S I O N F A C T O R S
Non-Radon Individual Assessment
May 15, 2014 11:54 am

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2013

Comments: CY 2013 WIPP Compliance Report
40 CFR Part 191, Subpart A

Dataset Name: 2013-191SubpartA
Dataset Date: 5/15/2014 10:56:00 AM
Wind File: . C:\Program Files\CAP88-PC30\WndFiles\WIPP2013.WND

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DOSE AND RISK FACTOR UNITS

The units for each type of dose rate conversion factor are shown below, by pathway:

Pathway	Units
Ingestion	millirem/picoCurie
Inhalation	millirem/picoCurie
Immersion	millirem-cubic cm/microCurie-year
Surface	millirem-square cm/microCurie-year

Risks for internal exposures (inhalation and ingestion) are the lifetime risk of premature death in a birth cohort of 100,000 people for a 1 picoCurie/year intake rate, where the average lifetime is 70.7565 years.
This is simplified to lifetime risk per 100,000 picoCuries.

The units for each type of risk conversion factor are shown below, by pathway:

Pathway	Units
Ingestion	lifetime risk/100,000 picoCuries
Inhalation	lifetime risk/100,000 picoCuries
Immersion	lifetime risk-cubic cm/100,000 picoCurie-years
Surface	lifetime risk-square cm/100,000 picoCurie-years

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* NUCLIDE Am-241 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.831E-06	5.321E-04	5.289E+07	1.713E+04
B Surfac	1.670E-03	3.149E-01	3.344E+08	1.083E+05
Breasts	2.831E-06	5.321E-04	1.247E+08	4.101E+04
St Wall	3.065E-06	5.321E-04	6.466E+07	2.097E+04
ULI Wall	6.371E-06	5.332E-04	5.277E+07	1.841E+04
Kidneys	8.540E-06	1.613E-03	7.002E+07	2.225E+04
Lungs	2.831E-06	6.849E-03	7.852E+07	2.342E+04
Ovaries	3.237E-05	6.109E-03	4.380E+07	1.724E+04
R Marrow	5.676E-05	1.072E-02	6.070E+07	1.957E+04
Spleen	2.831E-06	5.321E-04	6.524E+07	2.109E+04
Thymus	2.831E-06	5.321E-04	7.596E+07	2.283E+04
Uterus	2.831E-06	5.321E-04	4.520E+07	1.666E+04
Bld Wall	2.831E-06	5.321E-04	6.023E+07	2.062E+04
Brain	2.831E-06	5.321E-04	7.258E+07	1.806E+04
Esophagu	2.831E-06	1.731E-03	4.357E+07	1.386E+04
SI Wall	3.415E-06	5.324E-04	4.765E+07	1.713E+04
LLI Wall	1.322E-05	5.346E-04	4.835E+07	1.782E+04
Liver	1.023E-04	1.932E-02	6.571E+07	2.109E+04
Muscle	2.831E-06	5.321E-04	8.516E+07	3.285E+04
Pancreas	2.831E-06	5.321E-04	4.485E+07	1.608E+04
Skin	2.831E-06	5.321E-04	1.491E+08	9.693E+04
Testes	3.209E-05	6.053E-03	9.996E+07	3.786E+04
Thyroid	2.831E-06	5.321E-04	9.122E+07	2.575E+04
EFFEC	7.548E-04	1.543E-01	7.887E+07	2.714E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.366E-08	6.808E-06	5.009E-02	1.596E-05
Stomach	1.310E-07	1.399E-05	2.610E-01	8.470E-05
Colon	2.727E-06	2.727E-05	5.254E-01	1.876E-04
Liver	2.701E-06	4.366E-04	9.961E-02	3.192E-05
LUNG	2.941E-07	1.373E-03	7.677E-01	2.295E-04
Bone	2.031E-06	3.415E-04	3.180E-02	1.029E-05
Skin	2.960E-09	4.218E-07	1.491E-02	9.669E-06
Breast	5.587E-08	7.844E-06	6.023E-01	1.980E-04
Ovary	5.920E-07	1.032E-04	6.233E-02	2.458E-05
Bladder	1.073E-07	1.628E-05	1.456E-01	4.986E-05
Kidneys	8.843E-08	1.365E-05	3.646E-02	1.158E-05
Thyroid	8.214E-09	1.154E-06	2.901E-02	8.202E-06
Leukemia	3.226E-07	4.958E-05	3.402E-01	1.099E-04
Residual	3.545E-07	4.736E-05	9.075E-01	3.274E-04
Total	9.472E-06	2.438E-03	3.879E+00	1.293E-03

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* NUCLIDE Np-237 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	1.313E-06	2.471E-04	7.724E+07	2.027E+04
B Surfac	1.005E-03	1.898E-01	3.728E+08	9.273E+04
Breasts	1.313E-06	2.471E-04	1.468E+08	4.206E+04
St Wall	1.517E-06	2.472E-04	8.912E+07	2.318E+04
ULI Wall	4.396E-06	2.479E-04	7.794E+07	2.132E+04
Kidneys	3.564E-06	6.741E-04	9.343E+07	2.470E+04
Lungs	1.313E-06	5.273E-03	1.051E+08	2.540E+04
Ovaries	1.335E-05	2.522E-03	6.792E+07	2.015E+04
R Marrow	3.833E-05	7.248E-03	8.959E+07	2.353E+04
Spleen	1.313E-06	2.471E-04	9.052E+07	2.330E+04
Thymus	1.313E-06	2.471E-04	1.005E+08	2.423E+04
Uterus	1.313E-06	2.471E-04	7.025E+07	2.015E+04
Bld Wall	1.313E-06	2.472E-04	8.423E+07	2.365E+04
Brain	1.313E-06	2.471E-04	1.017E+08	2.062E+04
Esophagu	1.313E-06	1.341E-03	7.048E+07	1.759E+04
SI Wall	1.822E-06	2.472E-04	7.246E+07	2.004E+04
LLI Wall	1.035E-05	2.493E-04	7.316E+07	2.085E+04
Liver	1.595E-05	3.018E-03	9.087E+07	2.330E+04
Muscle	1.313E-06	2.471E-04	1.085E+08	3.495E+04
Pancreas	1.313E-06	2.471E-04	7.037E+07	1.911E+04
Skin	1.313E-06	2.471E-04	1.794E+08	9.739E+04
Testes	1.358E-05	2.566E-03	1.212E+08	3.938E+04
Thyroid	1.313E-06	2.471E-04	1.158E+08	2.854E+04
EFFEC	3.959E-04	8.399E-02	1.037E+08	2.936E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.401E-08	3.667E-06	8.108E-02	2.027E-05
Stomach	8.917E-08	8.510E-06	3.600E-01	9.355E-05
Colon	2.405E-06	1.783E-05	7.829E-01	2.179E-04
Liver	4.588E-07	7.400E-05	1.375E-01	3.530E-05
LUNG	1.739E-07	1.088E-03	1.028E+00	2.481E-04
Bone	1.288E-06	2.183E-04	3.542E-02	8.807E-06
Skin	1.757E-09	2.431E-07	1.794E-02	9.716E-06
Breast	3.567E-08	4.810E-06	7.095E-01	2.027E-04
Ovary	2.849E-07	4.921E-05	9.658E-02	2.866E-05
Bladder	5.772E-08	8.584E-06	2.039E-01	5.720E-05
Kidneys	4.514E-08	6.771E-06	4.858E-02	1.281E-05
Thyroid	5.069E-09	6.808E-07	3.681E-02	9.087E-06
Leukemia	2.331E-07	3.678E-05	5.033E-01	1.316E-04
Residual	2.264E-07	2.941E-05	1.270E+00	3.693E-04
Total	5.328E-06	1.547E-03	5.312E+00	1.445E-03

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* NUCLIDE Pa-233 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	3.552E-13	3.425E-11	8.365E+08	1.876E+05
B Surfac	8.443E-12	8.547E-10	2.423E+09	4.264E+05
Breasts	3.552E-13	3.425E-11	1.223E+09	2.342E+05
St Wall	3.553E-13	3.425E-11	9.064E+08	2.004E+05
ULI Wall	3.829E-13	3.430E-11	8.318E+08	1.957E+05
Kidneys	5.439E-12	4.965E-10	9.180E+08	2.015E+05
Lungs	3.552E-13	1.238E-09	1.035E+09	2.132E+05
Ovaries	3.175E-12	2.614E-10	7.549E+08	2.015E+05
R Marrow	8.795E-13	8.791E-11	9.635E+08	2.120E+05
Spleen	3.552E-13	3.425E-11	9.250E+08	2.015E+05
Thymus	3.552E-13	3.425E-11	9.704E+08	1.992E+05
Uterus	3.552E-13	3.425E-11	7.736E+08	1.922E+05
Bld Wall	3.554E-13	3.429E-11	8.563E+08	2.027E+05
Brain	3.552E-13	3.425E-11	1.073E+09	1.969E+05
Esophagu	3.552E-13	4.521E-10	8.097E+08	1.759E+05
SI Wall	3.564E-13	3.426E-11	7.910E+08	1.911E+05
LLI Wall	5.417E-13	3.441E-11	8.015E+08	1.969E+05
Liver	1.078E-12	1.093E-10	9.215E+08	2.004E+05
Muscle	3.552E-13	3.425E-11	1.012E+09	2.330E+05
Pancreas	3.552E-13	3.425E-11	7.864E+08	1.829E+05
Skin	3.552E-13	3.425E-11	1.934E+09	3.146E+05
Testes	3.224E-12	2.654E-10	1.067E+09	2.388E+05
Thyroid	3.552E-13	3.425E-11	1.073E+09	2.190E+05
EFFEC	3.247E-06	1.232E-05	9.984E+08	2.167E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	1.069E-11	6.845E-10	9.320E-01	2.027E-04
Stomach	6.290E-09	2.601E-09	3.658E+00	8.085E-04
Colon	4.366E-07	8.991E-08	8.458E+00	2.027E-03
Liver	1.720E-10	1.424E-09	1.398E+00	3.041E-04
LUNG	2.494E-10	9.546E-07	1.011E+01	2.085E-03
Bone	4.181E-11	2.102E-09	2.307E-01	4.054E-05
Skin	4.440E-12	1.820E-11	1.934E-01	3.134E-05
Breast	8.214E-11	2.420E-09	5.907E+00	1.131E-03
Ovary	1.454E-09	7.289E-10	1.074E+00	2.866E-04
Bladder	8.880E-10	4.921E-10	2.074E+00	4.905E-04
Kidneys	8.621E-11	7.733E-10	4.777E-01	1.048E-04
Thyroid	1.761E-12	9.398E-11	3.413E-01	6.978E-05
Leukemia	1.273E-09	1.698E-08	5.406E+00	1.188E-03
Residual	1.913E-09	7.326E-09	1.305E+01	2.994E-03
Total	4.514E-07	1.080E-06	5.336E+01	1.177E-02

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* NUCLIDE U-233 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	5.254E-06	2.607E-05	1.212E+06	3.087E+02
B Surfac	1.551E-04	7.929E-04	4.800E+06	1.549E+03
Breasts	5.254E-06	2.607E-05	2.586E+06	1.491E+03
St Wall	5.461E-06	2.611E-05	1.351E+06	3.483E+02
ULI Wall	8.306E-06	2.681E-05	1.200E+06	3.122E+02
Kidneys	5.383E-05	2.680E-04	1.410E+06	3.891E+02
Lungs	5.254E-06	5.132E-03	1.573E+06	3.728E+02
Ovaries	5.280E-06	2.635E-05	1.078E+06	3.390E+02
R Marrow	1.553E-05	7.826E-05	1.445E+06	4.206E+02
Spleen	5.254E-06	2.607E-05	1.375E+06	3.379E+02
Thymus	5.254E-06	2.607E-05	1.503E+06	3.728E+02
Uterus	5.254E-06	2.607E-05	1.103E+06	2.982E+02
Bld Wall	5.272E-06	2.615E-05	1.282E+06	3.542E+02
Brain	5.254E-06	2.607E-05	1.561E+06	3.076E+02
Esophagu	5.254E-06	1.131E-03	1.132E+06	2.633E+02
SI Wall	5.757E-06	2.619E-05	1.132E+06	2.971E+02
LLI Wall	1.421E-05	2.825E-05	1.146E+06	3.099E+02
Liver	2.049E-05	1.029E-04	1.375E+06	3.448E+02
Muscle	5.254E-06	2.607E-05	1.794E+06	1.038E+03
Pancreas	5.254E-06	2.607E-05	1.115E+06	2.819E+02
Skin	5.254E-06	2.607E-05	5.324E+06	6.920E+03
Testes	5.280E-06	2.635E-05	1.969E+06	1.212E+03
Thyroid	5.254E-06	2.607E-05	1.806E+06	5.149E+02
EFFEC	1.897E-04	1.314E-02	1.654E+06	6.990E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	8.177E-08	3.604E-07	1.305E-03	3.029E-07
Stomach	2.309E-07	8.399E-07	5.452E-03	1.410E-06
Colon	2.523E-06	2.176E-06	1.212E-02	3.215E-06
Liver	5.698E-07	2.464E-06	2.085E-03	5.231E-07
LUNG	5.735E-07	1.080E-03	1.538E-02	3.646E-06
Bone	3.622E-07	1.613E-06	4.555E-04	1.468E-07
Skin	5.883E-09	2.409E-08	5.312E-04	6.908E-07
Breast	1.128E-07	4.736E-07	1.247E-02	7.200E-06
Ovary	9.435E-08	4.366E-07	1.538E-03	4.823E-07
Bladder	2.002E-07	8.510E-07	3.099E-03	8.563E-07
Kidneys	6.438E-07	2.779E-06	7.328E-04	2.027E-07
Thyroid	1.650E-08	6.734E-08	5.755E-04	1.643E-07
Leukemia	9.176E-08	4.033E-07	8.108E-03	2.365E-06
Residual	7.363E-07	2.897E-06	2.039E-02	8.085E-06
Total	6.253E-06	1.095E-03	8.435E-02	2.924E-05

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* NUCLIDE Th-229 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	1.395E-05	3.048E-04	3.076E+08	7.468E+04
B Surfac	4.170E-03	9.487E-02	1.340E+09	2.726E+05
Breasts	1.395E-05	3.048E-04	5.149E+08	1.052E+05
St Wall	1.415E-05	3.050E-04	3.483E+08	8.283E+04
ULI Wall	1.722E-05	3.097E-04	3.099E+08	7.922E+04
Kidneys	5.839E-05	1.389E-03	3.588E+08	8.353E+04
Lungs	1.395E-05	9.235E-02	4.078E+08	8.901E+04
Ovaries	3.512E-05	7.977E-04	2.761E+08	7.584E+04
R Marrow	1.994E-04	4.677E-03	3.530E+08	8.365E+04
Spleen	1.395E-05	3.049E-04	3.553E+08	8.411E+04
Thymus	1.395E-05	3.048E-04	3.868E+08	8.225E+04
Uterus	1.395E-05	3.048E-04	2.831E+08	7.642E+04
Bld Wall	1.396E-05	3.051E-04	3.285E+08	8.341E+04
Brain	1.395E-05	3.048E-04	4.019E+08	7.771E+04
Esophagu	1.395E-05	3.677E-02	2.866E+08	6.839E+04
SI Wall	1.447E-05	3.051E-04	2.912E+08	7.584E+04
LLI Wall	2.426E-05	3.298E-04	2.936E+08	7.864E+04
Liver	2.018E-04	4.651E-03	3.553E+08	8.318E+04
Muscle	1.395E-05	3.048E-04	4.031E+08	9.996E+04
Pancreas	1.395E-05	3.048E-04	2.854E+08	7.328E+04
Skin	1.395E-05	3.048E-04	6.303E+08	1.829E+05
Testes	3.559E-05	8.081E-04	4.392E+08	1.043E+05
Thyroid	1.395E-05	3.048E-04	4.310E+08	9.075E+04
EFFEC	1.850E-03	2.634E-01	3.926E+08	9.204E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.153E-07	3.589E-06	3.297E-01	7.864E-05
Stomach	5.328E-07	6.623E-06	1.410E+00	3.344E-04
Colon	3.574E-06	1.376E-05	3.122E+00	8.155E-04
Liver	4.847E-06	8.066E-05	5.382E-01	1.258E-04
LUNG	1.465E-06	1.624E-02	3.984E+00	8.703E-04
Bone	5.365E-06	9.805E-05	1.270E-01	2.586E-05
Skin	1.476E-08	2.105E-07	6.291E-02	1.829E-05
Breast	2.794E-07	3.774E-06	2.493E+00	5.079E-04
Ovary	6.919E-07	1.228E-05	3.926E-01	1.079E-04
Bladder	5.328E-07	8.695E-06	7.945E-01	2.015E-04
Kidneys	5.032E-07	8.621E-06	1.864E-01	4.345E-05
Thyroid	4.107E-08	5.624E-07	1.375E-01	2.889E-05
Leukemia	1.073E-06	1.846E-05	1.980E+00	4.695E-04
Residual	1.776E-06	2.209E-05	4.940E+00	1.235E-03
Total	2.090E-05	1.654E-02	2.050E+01	4.858E-03

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* NUCLIDE Ra-225 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.076E-06	1.183E-06	1.340E+07	7.072E+03
B Surfac	6.649E-04	4.159E-04	1.072E+08	5.499E+04
Breasts	2.076E-06	1.183E-06	4.940E+07	2.027E+04
St Wall	2.078E-06	1.196E-06	1.794E+07	9.355E+03
ULI Wall	2.873E-06	1.566E-06	1.282E+07	7.188E+03
Kidneys	6.834E-06	2.075E-05	2.202E+07	1.109E+04
Lungs	2.076E-06	9.561E-03	2.283E+07	1.095E+04
Ovaries	2.471E-06	2.892E-06	8.528E+06	4.858E+03
R Marrow	6.420E-05	3.700E-05	1.654E+07	7.852E+03
Spleen	2.090E-06	1.190E-06	1.759E+07	9.367E+03
Thymus	2.076E-06	1.183E-06	2.353E+07	1.065E+04
Uterus	2.076E-06	1.183E-06	9.425E+06	5.813E+03
Bld Wall	2.084E-06	1.204E-06	1.678E+07	9.273E+03
Brain	2.076E-06	1.183E-06	1.911E+07	6.978E+03
Esophagu	2.076E-06	5.754E-04	8.376E+06	4.078E+03
SI Wall	2.090E-06	1.201E-06	1.058E+07	6.151E+03
LLI Wall	7.282E-06	2.968E-06	1.067E+07	6.431E+03
Liver	3.582E-05	1.474E-05	1.817E+07	9.320E+03
Muscle	2.076E-06	1.183E-06	2.936E+07	1.561E+04
Pancreas	2.076E-06	1.183E-06	8.924E+06	5.219E+03
Skin	2.076E-06	1.183E-06	3.507E+08	3.786E+04
Testes	2.478E-06	2.922E-06	3.775E+07	1.899E+04
Thyroid	2.076E-06	1.183E-06	3.227E+07	1.340E+04
EFFEC	3.680E-04	2.317E-02	2.808E+07	1.247E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	6.808E-08	2.993E-08	9.635E-03	4.695E-06
Stomach	2.786E-07	1.066E-07	7.246E-02	3.775E-05
Colon	2.102E-06	6.734E-07	1.223E-01	7.083E-05
Liver	1.543E-06	4.773E-07	2.749E-02	1.410E-05
LUNG	7.178E-07	1.991E-03	2.237E-01	1.071E-04
Bone	3.611E-06	1.162E-06	1.018E-02	5.219E-06
Skin	7.104E-09	2.653E-09	3.495E-02	3.775E-06
Breast	1.754E-07	6.475E-08	2.388E-01	9.798E-05
Ovary	9.694E-08	8.695E-08	1.212E-02	6.908E-06
Bladder	1.487E-07	6.549E-08	4.054E-02	2.237E-05
Kidneys	1.088E-07	2.216E-07	1.145E-02	5.767E-06
Thyroid	2.431E-08	8.584E-09	1.028E-02	4.264E-06
Leukemia	8.473E-07	3.112E-07	9.285E-02	4.404E-05
Residual	1.099E-06	3.959E-07	2.563E-01	1.386E-04
Total	1.084E-05	1.994E-03	1.163E+00	5.639E-04

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* NUCLIDE Ac-225 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	1.616E-06	1.361E-06	5.907E+07	1.410E+04
B Surfac	7.929E-06	4.007E-04	2.412E+08	4.753E+04
Breasts	1.616E-06	1.361E-06	9.646E+07	1.946E+04
St Wall	2.524E-06	1.567E-06	6.640E+07	1.549E+04
ULI Wall	1.820E-05	4.784E-06	5.953E+07	1.491E+04
Kidneys	4.444E-05	3.811E-05	6.815E+07	1.561E+04
Lungs	1.616E-06	1.122E-02	7.736E+07	1.654E+04
Ovaries	1.716E-06	7.748E-06	5.336E+07	1.445E+04
R Marrow	2.012E-06	3.297E-05	6.792E+07	1.584E+04
Spleen	1.625E-06	1.389E-06	6.780E+07	1.573E+04
Thymus	1.616E-06	1.361E-06	7.316E+07	1.526E+04
Uterus	1.616E-06	1.361E-06	5.452E+07	1.445E+04
Bld Wall	1.964E-06	1.451E-06	6.268E+07	1.561E+04
Brain	1.616E-06	1.361E-06	7.712E+07	1.468E+04
Esophagu	1.616E-06	1.000E-03	5.557E+07	1.305E+04
SI Wall	2.855E-06	1.622E-06	5.592E+07	1.433E+04
LLI Wall	4.795E-05	1.091E-05	5.662E+07	1.491E+04
Liver	5.306E-06	1.771E-04	6.780E+07	1.549E+04
Muscle	1.616E-06	1.361E-06	7.619E+07	1.864E+04
Pancreas	1.616E-06	1.361E-06	5.510E+07	1.386E+04
Skin	1.616E-06	1.361E-06	1.095E+08	3.588E+04
Testes	1.715E-06	7.689E-06	8.248E+07	1.934E+04
Thyroid	1.616E-06	1.361E-06	8.143E+07	1.689E+04
EFFEC	1.425E-04	2.734E-02	7.433E+07	1.713E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.921E-08	3.885E-08	6.396E-02	1.503E-05
Stomach	3.112E-07	1.702E-07	2.679E-01	6.256E-05
Colon	1.273E-05	2.768E-06	6.011E-01	1.538E-04
Liver	1.987E-07	5.328E-06	1.028E-01	2.353E-05
LUNG	4.958E-07	2.327E-03	7.561E-01	1.619E-04
Bone	2.494E-08	1.073E-06	2.295E-02	4.509E-06
Skin	4.958E-09	3.630E-09	1.093E-02	3.577E-06
Breast	1.199E-07	9.213E-08	4.660E-01	9.402E-05
Ovary	6.142E-08	2.394E-07	7.596E-02	2.050E-05
Bladder	1.354E-07	8.880E-08	1.515E-01	3.775E-05
Kidneys	6.068E-07	4.662E-07	3.542E-02	8.120E-06
Thyroid	1.665E-08	1.217E-08	2.598E-02	5.382E-06
Leukemia	2.120E-08	3.448E-07	3.810E-01	8.889E-05
Residual	7.696E-07	5.550E-07	9.448E-01	2.307E-04
Total	1.554E-05	2.338E-03	3.903E+00	9.110E-04

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* NUCLIDE Fr-221 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	1.281E+08	2.912E+04
B Surfac	0.000E+00	0.000E+00	4.054E+08	6.827E+04
Breasts	0.000E+00	0.000E+00	1.911E+08	3.518E+04
St Wall	0.000E+00	0.000E+00	1.398E+08	3.111E+04
ULI Wall	0.000E+00	0.000E+00	1.281E+08	3.017E+04
Kidneys	0.000E+00	0.000E+00	1.421E+08	3.087E+04
Lungs	0.000E+00	0.000E+00	1.608E+08	3.274E+04
Ovaries	0.000E+00	0.000E+00	1.188E+08	2.994E+04
R Marrow	0.000E+00	0.000E+00	1.480E+08	3.250E+04
Spleen	0.000E+00	0.000E+00	1.433E+08	3.134E+04
Thymus	0.000E+00	0.000E+00	1.514E+08	2.994E+04
Uterus	0.000E+00	0.000E+00	1.200E+08	2.947E+04
Bld Wall	0.000E+00	0.000E+00	1.328E+08	3.076E+04
Brain	0.000E+00	0.000E+00	1.654E+08	3.017E+04
Esophagu	0.000E+00	0.000E+00	1.247E+08	2.680E+04
SI Wall	0.000E+00	0.000E+00	1.223E+08	2.924E+04
LLI Wall	0.000E+00	0.000E+00	1.235E+08	3.029E+04
Liver	0.000E+00	0.000E+00	1.433E+08	3.111E+04
Muscle	0.000E+00	0.000E+00	1.573E+08	3.530E+04
Pancreas	0.000E+00	0.000E+00	1.212E+08	2.831E+04
Skin	0.000E+00	0.000E+00	2.353E+08	4.276E+04
Testes	0.000E+00	0.000E+00	1.666E+08	3.588E+04
Thyroid	0.000E+00	0.000E+00	1.678E+08	3.285E+04
EFFEC	0.000E+00	0.000E+00	1.549E+08	3.309E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	1.433E-01	3.087E-05
Stomach	0.000E+00	0.000E+00	5.639E-01	1.258E-04
Colon	0.000E+00	0.000E+00	1.305E+00	3.122E-04
Liver	0.000E+00	0.000E+00	2.167E-01	4.718E-05
LUNG	0.000E+00	0.000E+00	1.573E+00	3.204E-04
Bone	0.000E+00	0.000E+00	3.844E-02	6.477E-06
Skin	0.000E+00	0.000E+00	2.353E-02	4.264E-06
Breast	0.000E+00	0.000E+00	9.227E-01	1.701E-04
Ovary	0.000E+00	0.000E+00	1.689E-01	4.264E-05
Bladder	0.000E+00	0.000E+00	3.215E-01	7.433E-05
Kidneys	0.000E+00	0.000E+00	7.398E-02	1.608E-05
Thyroid	0.000E+00	0.000E+00	5.347E-02	1.046E-05
Leukemia	0.000E+00	0.000E+00	8.306E-01	1.829E-04
Residual	0.000E+00	0.000E+00	2.015E+00	4.602E-04
Total	0.000E+00	0.000E+00	8.248E+00	1.806E-03

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* NUCLIDE At-217 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	1.375E+06	2.982E+02
B Surfac	0.000E+00	0.000E+00	3.111E+06	5.475E+02
Breasts	0.000E+00	0.000E+00	1.922E+06	3.553E+02
St Wall	0.000E+00	0.000E+00	1.480E+06	3.169E+02
ULI Wall	0.000E+00	0.000E+00	1.363E+06	3.145E+02
Kidneys	0.000E+00	0.000E+00	1.480E+06	3.192E+02
Lungs	0.000E+00	0.000E+00	1.666E+06	3.367E+02
Ovaries	0.000E+00	0.000E+00	1.258E+06	3.262E+02
R Marrow	0.000E+00	0.000E+00	1.596E+06	3.390E+02
Spleen	0.000E+00	0.000E+00	1.503E+06	3.192E+02
Thymus	0.000E+00	0.000E+00	1.549E+06	3.192E+02
Uterus	0.000E+00	0.000E+00	1.282E+06	3.076E+02
Bld Wall	0.000E+00	0.000E+00	1.375E+06	3.215E+02
Brain	0.000E+00	0.000E+00	1.759E+06	3.157E+02
Esophagu	0.000E+00	0.000E+00	1.363E+06	2.843E+02
SI Wall	0.000E+00	0.000E+00	1.305E+06	3.076E+02
LLI Wall	0.000E+00	0.000E+00	1.340E+06	3.192E+02
Liver	0.000E+00	0.000E+00	1.491E+06	3.180E+02
Muscle	0.000E+00	0.000E+00	1.631E+06	3.635E+02
Pancreas	0.000E+00	0.000E+00	1.293E+06	2.913E+02
Skin	0.000E+00	0.000E+00	2.167E+06	4.788E+02
Testes	0.000E+00	0.000E+00	1.689E+06	3.693E+02
Thyroid	0.000E+00	0.000E+00	1.713E+06	3.495E+02
EFFEC	0.000E+00	0.000E+00	1.596E+06	3.402E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	1.573E-03	3.274E-07
Stomach	0.000E+00	0.000E+00	5.976E-03	1.281E-06
Colon	0.000E+00	0.000E+00	1.398E-02	3.274E-06
Liver	0.000E+00	0.000E+00	2.260E-03	4.823E-07
LUNG	0.000E+00	0.000E+00	1.631E-02	3.297E-06
Bone	0.000E+00	0.000E+00	2.959E-04	5.196E-08
Skin	0.000E+00	0.000E+00	2.167E-04	4.776E-08
Breast	0.000E+00	0.000E+00	9.285E-03	1.713E-06
Ovary	0.000E+00	0.000E+00	1.794E-03	4.637E-07
Bladder	0.000E+00	0.000E+00	3.320E-03	7.771E-07
Kidneys	0.000E+00	0.000E+00	7.701E-04	1.666E-07
Thyroid	0.000E+00	0.000E+00	5.452E-04	1.113E-07
Leukemia	0.000E+00	0.000E+00	8.959E-03	1.899E-06
Residual	0.000E+00	0.000E+00	2.132E-02	4.730E-06
Total	0.000E+00	0.000E+00	8.656E-02	1.864E-05

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* NUCLIDE Bi-213 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	7.837E-10	2.876E-09	5.976E+08	1.293E+05
B Surfac	7.837E-10	2.876E-09	1.363E+09	2.400E+05
Breasts	7.837E-10	2.876E-09	8.341E+08	1.561E+05
St Wall	1.866E-07	3.082E-08	6.373E+08	1.375E+05
ULI Wall	4.666E-08	1.081E-08	5.895E+08	1.375E+05
Kidneys	1.109E-07	4.070E-07	6.419E+08	1.386E+05
Lungs	7.837E-10	3.185E-05	7.188E+08	1.468E+05
Ovaries	7.837E-10	2.876E-09	5.347E+08	1.456E+05
R Marrow	7.837E-10	2.876E-09	6.885E+08	1.480E+05
Spleen	7.837E-10	2.876E-09	6.489E+08	1.386E+05
Thymus	7.837E-10	2.876E-09	6.687E+08	1.410E+05
Uterus	7.837E-10	2.876E-09	5.499E+08	1.340E+05
Bld Wall	1.161E-09	4.259E-09	5.988E+08	1.410E+05
Brain	7.837E-10	2.876E-09	7.619E+08	1.375E+05
Esophagu	7.837E-10	6.745E-05	5.848E+08	1.235E+05
SI Wall	9.968E-08	1.775E-08	5.639E+08	1.340E+05
LLI Wall	6.671E-09	3.892E-09	5.743E+08	1.386E+05
Liver	7.837E-10	2.876E-09	6.454E+08	1.386E+05
Muscle	7.837E-10	2.876E-09	7.037E+08	1.596E+05
Pancreas	7.837E-10	2.876E-09	5.604E+08	1.270E+05
Skin	7.837E-10	2.876E-09	3.949E+09	4.928E+06
Testes	7.837E-10	2.876E-09	7.281E+08	1.619E+05
Thyroid	7.837E-10	2.876E-09	7.398E+08	1.526E+05
EFFEC	7.326E-07	1.104E-04	7.188E+08	1.957E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.483E-11	8.362E-11	6.734E-01	1.421E-04
Stomach	2.849E-08	4.440E-09	2.575E+00	5.545E-04
Colon	1.998E-08	4.181E-09	6.023E+00	1.421E-03
Liver	3.922E-11	1.114E-10	9.786E-01	2.097E-04
LUNG	2.620E-10	6.475E-06	7.025E+00	1.433E-03
Bone	2.202E-12	6.882E-12	1.293E-01	2.283E-05
Skin	2.553E-12	7.733E-12	3.938E-01	4.916E-04
Breast	6.549E-11	1.987E-10	4.031E+00	7.538E-04
Ovary	4.218E-11	1.014E-10	7.607E-01	2.074E-04
Bladder	9.620E-11	2.779E-10	1.445E+00	3.413E-04
Kidneys	1.521E-09	4.995E-09	3.344E-01	7.211E-05
Thyroid	8.288E-12	2.601E-11	2.353E-01	4.858E-05
Leukemia	2.309E-11	2.808E-11	3.868E+00	8.306E-04
Residual	4.884E-10	1.199E-09	9.238E+00	2.062E-03
Total	5.106E-08	6.475E-06	3.775E+01	8.598E-03

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* NUCLIDE Pu-238 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.386E-06	4.484E-04	7.106E+04	5.650E+01
B Surfac	1.369E-03	2.576E-01	1.083E+06	1.421E+03
Breasts	2.386E-06	4.484E-04	1.480E+06	2.248E+03
St Wall	2.620E-06	4.484E-04	1.069E+05	8.912E+01
ULI Wall	5.935E-06	4.495E-04	6.687E+04	3.355E+01
Kidneys	5.920E-06	1.116E-03	1.538E+05	1.782E+02
Lungs	2.386E-06	6.775E-03	1.235E+05	9.169E+01
Ovaries	1.796E-05	3.383E-03	5.056E+04	1.068E+02
R Marrow	6.767E-05	1.275E-02	1.957E+05	2.260E+02
Spleen	2.386E-06	4.484E-04	8.947E+04	5.242E+01
Thymus	2.386E-06	4.484E-04	1.689E+05	1.538E+02
Uterus	2.386E-06	4.484E-04	5.475E+04	2.516E+01
Bld Wall	2.386E-06	4.484E-04	1.059E+05	1.012E+02
Brain	2.386E-06	4.484E-04	8.912E+04	2.610E+01
Esophagu	2.386E-06	1.645E-03	5.242E+04	1.584E+01
SI Wall	2.971E-06	4.488E-04	5.825E+04	2.749E+01
LLI Wall	1.279E-05	4.510E-04	5.848E+04	3.262E+01
Liver	2.885E-04	5.432E-02	1.019E+05	7.759E+01
Muscle	2.386E-06	4.484E-04	6.209E+05	1.340E+03
Pancreas	2.386E-06	4.484E-04	5.173E+04	1.946E+01
Skin	2.386E-06	4.484E-04	4.765E+06	1.123E+04
Testes	1.829E-05	3.443E-03	7.642E+05	1.736E+03
Thyroid	2.386E-06	4.484E-04	4.672E+05	3.961E+02
EFFEC	8.436E-04	1.709E-01	4.089E+05	7.293E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.477E-08	6.919E-06	6.035E-05	1.817E-08
Stomach	1.606E-07	1.806E-05	4.322E-04	3.600E-07
Colon	2.742E-06	3.996E-05	6.536E-04	3.425E-07
Liver	6.549E-06	1.036E-03	1.549E-04	1.177E-07
LUNG	3.533E-07	1.380E-03	1.212E-03	8.970E-07
Bone	1.676E-06	2.816E-04	1.029E-04	1.351E-07
Skin	3.552E-09	4.921E-07	4.753E-04	1.121E-06
Breast	7.622E-08	1.029E-05	7.153E-03	1.086E-05
Ovary	3.448E-07	5.957E-05	7.188E-05	1.514E-07
Bladder	1.054E-07	1.598E-05	2.563E-04	2.446E-07
Kidneys	6.364E-08	9.620E-06	8.004E-05	9.273E-08
Thyroid	1.073E-08	1.428E-06	1.491E-04	1.258E-07
Leukemia	3.389E-07	5.365E-05	1.099E-03	1.270E-06
Residual	4.847E-07	6.327E-05	3.693E-03	7.025E-06
Total	1.295E-05	2.975E-03	1.561E-02	2.272E-05

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* NUCLIDE U-234 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	5.106E-06	2.526E-05	3.577E+05	1.235E+02
B Surfac	1.453E-04	7.211E-04	2.318E+06	1.421E+03
Breasts	5.106E-06	2.526E-05	1.678E+06	1.911E+03
St Wall	5.310E-06	2.531E-05	4.310E+05	1.526E+02
ULI Wall	8.125E-06	2.600E-05	3.565E+05	1.117E+02
Kidneys	5.306E-05	2.638E-04	4.765E+05	2.085E+02
Lungs	5.106E-06	5.036E-03	5.103E+05	1.631E+02
Ovaries	5.106E-06	2.526E-05	3.076E+05	1.666E+02
R Marrow	1.500E-05	7.448E-05	4.893E+05	2.575E+02
Spleen	5.106E-06	2.526E-05	4.264E+05	1.316E+02
Thymus	5.106E-06	2.526E-05	5.184E+05	1.934E+02
Uterus	5.106E-06	2.526E-05	3.157E+05	1.029E+02
Bld Wall	5.125E-06	2.534E-05	4.078E+05	1.596E+02
Brain	5.106E-06	2.526E-05	4.742E+05	1.069E+02
Esophagu	5.106E-06	1.117E-03	3.122E+05	8.574E+01
SI Wall	5.606E-06	2.539E-05	3.274E+05	1.033E+02
LLI Wall	1.395E-05	2.741E-05	3.320E+05	1.114E+02
Liver	1.989E-05	9.879E-05	4.357E+05	1.456E+02
Muscle	5.106E-06	2.526E-05	8.889E+05	1.200E+03
Pancreas	5.106E-06	2.526E-05	3.146E+05	9.541E+01
Skin	5.106E-06	2.526E-05	4.951E+06	1.059E+04
Testes	5.106E-06	2.526E-05	1.024E+06	1.456E+03
Thyroid	5.106E-06	2.526E-05	7.794E+05	3.740E+02
EFFEC	1.832E-04	1.287E-02	7.141E+05	6.827E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	7.955E-08	3.504E-07	3.588E-04	9.868E-08
Stomach	2.268E-07	8.214E-07	1.736E-03	6.163E-07
Colon	2.505E-06	2.135E-06	3.577E-03	1.152E-06
Liver	5.550E-07	2.379E-06	6.606E-04	2.202E-07
LUNG	5.624E-07	1.058E-03	4.986E-03	1.596E-06
Bone	3.456E-07	1.513E-06	2.202E-04	1.351E-07
Skin	5.735E-09	2.349E-08	4.940E-04	1.057E-06
Breast	1.106E-07	4.625E-07	8.108E-03	9.227E-06
Ovary	9.065E-08	4.181E-07	4.380E-04	2.365E-07
Bladder	1.950E-07	8.288E-07	9.856E-04	3.856E-07
Kidneys	6.364E-07	2.738E-06	2.481E-04	1.085E-07
Thyroid	1.617E-08	6.586E-08	2.481E-04	1.188E-07
Leukemia	8.917E-08	3.885E-07	2.749E-03	1.445E-06
Residual	7.215E-07	2.834E-06	7.747E-03	7.037E-06
Total	6.142E-06	1.073E-03	3.250E-02	2.342E-05

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* NUCLIDE Th-230 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.515E-06	5.602E-05	1.212E+06	3.320E+02
B Surfac	2.270E-03	5.158E-02	6.163E+06	1.922E+03
Breasts	2.515E-06	5.602E-05	2.773E+06	1.549E+03
St Wall	2.714E-06	5.609E-05	1.410E+06	3.786E+02
ULI Wall	5.535E-06	5.702E-05	1.212E+06	3.437E+02
Kidneys	3.424E-05	8.055E-04	1.480E+06	4.054E+02
Lungs	2.515E-06	1.417E-02	1.666E+06	4.101E+02
Ovaries	1.831E-05	4.203E-04	1.057E+06	3.751E+02
R Marrow	7.822E-05	1.856E-03	1.421E+06	4.357E+02
Spleen	2.515E-06	5.602E-05	1.433E+06	3.740E+02
Thymus	2.515E-06	5.602E-05	1.596E+06	4.101E+02
Uterus	2.515E-06	5.602E-05	1.089E+06	3.250E+02
Bld Wall	2.515E-06	5.602E-05	1.328E+06	3.798E+02
Brain	2.515E-06	5.602E-05	1.608E+06	3.355E+02
Esophagu	2.515E-06	6.564E-03	1.090E+06	2.808E+02
SI Wall	3.013E-06	5.620E-05	1.128E+06	3.262E+02
LLI Wall	1.137E-05	5.890E-05	1.142E+06	3.402E+02
Liver	2.943E-05	6.808E-04	1.433E+06	3.786E+02
Muscle	2.515E-06	5.602E-05	1.876E+06	1.096E+03
Pancreas	2.515E-06	5.602E-05	1.094E+06	3.134E+02
Skin	2.515E-06	5.602E-05	5.254E+06	8.353E+03
Testes	1.864E-05	4.277E-04	2.097E+06	1.223E+03
Thyroid	2.515E-06	5.602E-05	1.899E+06	5.196E+02
EFFEC	7.911E-04	5.173E-02	1.736E+06	7.421E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.292E-08	7.067E-07	1.258E-03	3.227E-07
Stomach	1.399E-07	1.473E-06	5.697E-03	1.526E-06
Colon	2.335E-06	3.334E-06	1.223E-02	3.530E-06
Liver	7.326E-07	1.206E-05	2.167E-03	5.743E-07
LUNG	3.163E-07	2.579E-03	1.631E-02	4.008E-06
Bone	2.745E-06	5.180E-05	5.848E-04	1.829E-07
Skin	3.201E-09	4.403E-08	5.242E-04	8.330E-07
Breast	6.512E-08	8.140E-07	1.340E-02	7.491E-06
Ovary	3.774E-07	6.697E-06	1.503E-03	5.336E-07
Bladder	1.036E-07	1.698E-06	3.215E-03	9.180E-07
Kidneys	3.041E-07	5.069E-06	7.701E-04	2.109E-07
Thyroid	9.324E-09	1.199E-07	6.046E-04	1.654E-07
Leukemia	4.181E-07	7.178E-06	7.980E-03	2.446E-06
Residual	4.144E-07	4.958E-06	2.074E-02	8.644E-06
Total	7.992E-06	2.675E-03	8.691E-02	3.134E-05

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* NUCLIDE Ra-226 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	7.267E-06	4.314E-06	2.714E+07	6.244E+03
B Surfac	2.302E-03	1.366E-03	9.262E+07	1.584E+04
Breasts	7.267E-06	4.314E-06	4.124E+07	7.596E+03
St Wall	7.474E-06	4.366E-06	2.982E+07	6.687E+03
ULI Wall	1.178E-05	5.809E-06	2.726E+07	6.477E+03
Kidneys	1.083E-05	6.394E-06	3.041E+07	6.652E+03
Lungs	7.267E-06	5.087E-03	3.437E+07	7.060E+03
Ovaries	7.267E-06	4.314E-06	2.516E+07	6.303E+03
R Marrow	1.601E-04	9.513E-05	3.146E+07	6.932E+03
Spleen	9.846E-06	5.831E-06	3.052E+07	6.745E+03
Thymus	7.267E-06	4.314E-06	3.262E+07	6.408E+03
Uterus	7.267E-06	4.314E-06	2.540E+07	6.314E+03
Bld Wall	7.274E-06	4.322E-06	2.819E+07	6.617E+03
Brain	7.267E-06	4.314E-06	3.507E+07	6.454E+03
Esophagu	7.267E-06	1.150E-03	2.621E+07	5.732E+03
SI Wall	7.729E-06	4.444E-06	2.586E+07	6.268E+03
LLI Wall	2.539E-05	1.035E-05	2.610E+07	6.477E+03
Liver	3.299E-05	1.959E-05	3.052E+07	6.675E+03
Muscle	7.267E-06	4.314E-06	3.367E+07	7.584E+03
Pancreas	7.267E-06	4.314E-06	2.575E+07	6.058E+03
Skin	7.267E-06	4.314E-06	5.580E+07	9.460E+03
Testes	7.267E-06	4.314E-06	3.588E+07	7.736E+03
Thyroid	7.267E-06	4.314E-06	3.600E+07	7.060E+03
EFFEC	1.035E-03	1.281E-02	3.309E+07	7.118E+03

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.135E-07	9.509E-08	3.017E-02	6.594E-06
Stomach	8.473E-07	3.101E-07	1.200E-01	2.703E-05
Colon	6.438E-06	1.935E-06	2.761E-01	6.687E-05
Liver	1.654E-06	6.956E-07	4.625E-02	1.011E-05
LUNG	1.954E-06	1.073E-03	3.355E-01	6.908E-05
Bone	8.917E-06	3.511E-06	8.796E-03	1.503E-06
Skin	1.998E-08	7.696E-09	5.569E-03	9.436E-07
Breast	4.736E-07	1.765E-07	1.992E-01	3.670E-05
Ovary	2.523E-07	1.158E-07	3.577E-02	8.970E-06
Bladder	4.736E-07	2.087E-07	6.815E-02	1.596E-05
Kidneys	1.832E-07	7.252E-08	1.584E-02	3.460E-06
Thyroid	6.401E-08	2.327E-08	1.146E-02	2.248E-06
Leukemia	1.820E-06	7.696E-07	1.771E-01	3.891E-05
Residual	1.206E-05	4.625E-06	4.299E-01	9.868E-05
Total	3.537E-05	1.084E-03	1.759E+00	3.868E-04

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* NUCLIDE Rn-222 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	1.806E+06	3.879E+02
B Surfac	0.000E+00	0.000E+00	3.856E+06	6.745E+02
Breasts	0.000E+00	0.000E+00	2.493E+06	4.637E+02
St Wall	0.000E+00	0.000E+00	1.922E+06	4.124E+02
ULI Wall	0.000E+00	0.000E+00	1.782E+06	4.101E+02
Kidneys	0.000E+00	0.000E+00	1.934E+06	4.159E+02
Lungs	0.000E+00	0.000E+00	2.167E+06	4.404E+02
Ovaries	0.000E+00	0.000E+00	1.619E+06	4.392E+02
R Marrow	0.000E+00	0.000E+00	2.085E+06	4.439E+02
Spleen	0.000E+00	0.000E+00	1.957E+06	4.147E+02
Thymus	0.000E+00	0.000E+00	2.004E+06	4.229E+02
Uterus	0.000E+00	0.000E+00	1.666E+06	4.019E+02
Bld Wall	0.000E+00	0.000E+00	1.806E+06	4.229E+02
Brain	0.000E+00	0.000E+00	2.307E+06	4.136E+02
Esophagu	0.000E+00	0.000E+00	1.771E+06	3.740E+02
SI Wall	0.000E+00	0.000E+00	1.713E+06	4.019E+02
LLI Wall	0.000E+00	0.000E+00	1.736E+06	4.171E+02
Liver	0.000E+00	0.000E+00	1.946E+06	4.147E+02
Muscle	0.000E+00	0.000E+00	2.109E+06	4.753E+02
Pancreas	0.000E+00	0.000E+00	1.689E+06	3.798E+02
Skin	0.000E+00	0.000E+00	2.656E+06	6.058E+02
Testes	0.000E+00	0.000E+00	2.179E+06	4.835E+02
Thyroid	0.000E+00	0.000E+00	2.214E+06	4.602E+02
EFFEC	0.000E+00	0.000E+00	2.074E+06	4.450E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	2.039E-03	4.299E-07
Stomach	0.000E+00	0.000E+00	7.759E-03	1.666E-06
Colon	0.000E+00	0.000E+00	1.817E-02	4.264E-06
Liver	0.000E+00	0.000E+00	2.947E-03	6.291E-07
LUNG	0.000E+00	0.000E+00	2.120E-02	4.310E-06
Bone	0.000E+00	0.000E+00	3.658E-04	6.407E-08
Skin	0.000E+00	0.000E+00	2.645E-04	6.046E-08
Breast	0.000E+00	0.000E+00	1.200E-02	2.237E-06
Ovary	0.000E+00	0.000E+00	2.307E-03	6.244E-07
Bladder	0.000E+00	0.000E+00	4.369E-03	1.023E-06
Kidneys	0.000E+00	0.000E+00	1.007E-03	2.167E-07
Thyroid	0.000E+00	0.000E+00	7.048E-04	1.468E-07
Leukemia	0.000E+00	0.000E+00	1.165E-02	2.493E-06
Residual	0.000E+00	0.000E+00	2.784E-02	6.163E-06
Total	0.000E+00	0.000E+00	1.127E-01	2.435E-05

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* NUCLIDE Pu-239 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.684E-06	5.051E-04	2.330E+05	6.978E+01
B Surfac	1.523E-03	2.870E-01	1.103E+06	6.769E+02
Breasts	2.684E-06	5.051E-04	8.796E+05	9.052E+02
St Wall	2.904E-06	5.051E-04	2.680E+05	8.679E+01
ULI Wall	6.013E-06	5.062E-04	2.307E+05	6.396E+01
Kidneys	6.253E-06	1.181E-03	2.901E+05	1.212E+02
Lungs	2.684E-06	6.168E-03	3.087E+05	9.169E+01
Ovaries	1.995E-05	3.763E-03	2.039E+05	9.134E+01
R Marrow	7.241E-05	1.367E-02	3.111E+05	1.398E+02
Spleen	2.684E-06	5.051E-04	2.656E+05	7.351E+01
Thymus	2.684E-06	5.051E-04	3.111E+05	1.115E+02
Uterus	2.684E-06	5.051E-04	2.097E+05	5.907E+01
Bld Wall	2.684E-06	5.051E-04	2.540E+05	9.180E+01
Brain	2.684E-06	5.051E-04	3.006E+05	6.093E+01
Esophagu	2.684E-06	1.654E-03	2.155E+05	5.091E+01
SI Wall	3.233E-06	5.054E-04	2.167E+05	5.976E+01
LLI Wall	1.244E-05	5.076E-04	2.190E+05	6.361E+01
Liver	3.194E-04	6.024E-02	2.703E+05	8.260E+01
Muscle	2.684E-06	5.051E-04	4.916E+05	5.650E+02
Pancreas	2.684E-06	5.051E-04	2.109E+05	5.452E+01
Skin	2.684E-06	5.051E-04	2.167E+06	4.276E+03
Testes	2.031E-05	3.829E-03	5.639E+05	7.153E+02
Thyroid	2.684E-06	5.051E-04	4.520E+05	2.074E+02
EFFEC	9.276E-04	1.855E-01	4.066E+05	3.309E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.810E-08	7.437E-06	2.481E-04	5.860E-08
Stomach	1.613E-07	1.850E-05	1.082E-03	3.507E-07
Colon	2.586E-06	4.033E-05	2.330E-03	6.594E-07
Liver	6.956E-06	1.103E-03	4.101E-04	1.247E-07
LUNG	3.693E-07	1.243E-03	3.017E-03	8.970E-07
Bone	1.798E-06	3.019E-04	1.047E-04	6.431E-08
Skin	3.689E-09	5.143E-07	2.167E-04	4.264E-07
Breast	7.733E-08	1.051E-05	4.252E-03	4.369E-06
Ovary	3.681E-07	6.364E-05	2.901E-04	1.305E-07
Bladder	1.147E-07	1.735E-05	6.140E-04	2.225E-07
Kidneys	6.401E-08	9.731E-06	1.514E-04	6.303E-08
Thyroid	1.103E-08	1.480E-06	1.445E-04	6.606E-08
Leukemia	3.500E-07	5.550E-05	1.747E-03	7.852E-07
Residual	4.884E-07	6.438E-05	4.637E-03	3.425E-06
Total	1.343E-05	2.938E-03	1.922E-02	1.164E-05

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* NUCLIDE U-235 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	4.717E-06	2.334E-05	6.198E+08	1.421E+05
B Surfac	1.366E-04	6.778E-04	2.144E+09	3.658E+05
Breasts	4.717E-06	2.334E-05	9.448E+08	1.759E+05
St Wall	4.906E-06	2.339E-05	6.815E+08	1.526E+05
ULI Wall	7.507E-06	2.402E-05	6.221E+08	1.480E+05
Kidneys	4.899E-05	2.437E-04	6.943E+08	1.514E+05
Lungs	4.717E-06	4.444E-03	7.864E+08	1.608E+05
Ovaries	4.717E-06	2.334E-05	5.743E+08	1.433E+05
R Marrow	1.386E-05	6.878E-05	7.165E+08	1.584E+05
Spleen	4.717E-06	2.334E-05	6.967E+08	1.538E+05
Thymus	4.717E-06	2.334E-05	7.444E+08	1.456E+05
Uterus	4.717E-06	2.334E-05	5.790E+08	1.445E+05
Bld Wall	4.736E-06	2.342E-05	6.454E+08	1.514E+05
Brain	4.717E-06	2.334E-05	8.004E+08	1.468E+05
Esophagu	4.717E-06	1.025E-03	5.988E+08	1.305E+05
SI Wall	5.180E-06	2.345E-05	5.907E+08	1.433E+05
LLI Wall	1.289E-05	2.533E-05	5.965E+08	1.480E+05
Liver	1.837E-05	9.128E-05	6.967E+08	1.526E+05
Muscle	4.717E-06	2.334E-05	7.689E+08	1.748E+05
Pancreas	4.717E-06	2.334E-05	5.872E+08	1.386E+05
Skin	4.717E-06	2.334E-05	1.007E+09	2.260E+05
Testes	4.717E-06	2.334E-05	8.213E+08	1.782E+05
Thyroid	4.717E-06	2.334E-05	8.213E+08	1.619E+05
EFFEC	1.728E-04	1.142E-02	7.549E+08	1.631E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	7.400E-08	3.275E-07	6.885E-01	1.503E-04
Stomach	2.124E-07	7.659E-07	2.749E+00	6.163E-04
Colon	2.608E-06	2.057E-06	6.314E+00	1.526E-03
Liver	5.143E-07	2.205E-06	1.055E+00	2.318E-04
LUNG	5.217E-07	9.398E-04	7.689E+00	1.573E-03
Bone	3.238E-07	1.417E-06	2.039E-01	3.472E-05
Skin	5.328E-09	2.183E-08	1.004E-01	2.260E-05
Breast	1.032E-07	4.366E-07	4.567E+00	8.493E-04
Ovary	8.621E-08	3.922E-07	8.167E-01	2.039E-04
Bladder	1.817E-07	7.696E-07	1.561E+00	3.658E-04
Kidneys	5.883E-07	2.535E-06	3.611E-01	7.875E-05
Thyroid	1.502E-08	6.142E-08	2.610E-01	5.161E-05
Leukemia	1.029E-07	4.514E-07	4.019E+00	8.889E-04
Residual	6.734E-07	2.657E-06	9.798E+00	2.260E-03
Total	5.994E-06	9.509E-04	4.019E+01	8.854E-03

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* NUCLIDE Th-231 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	9.176E-13	2.142E-11	3.658E+07	1.003E+04
B Surfac	4.122E-10	9.901E-09	1.899E+08	5.569E+04
Breasts	9.176E-13	2.142E-11	7.910E+07	3.204E+04
St Wall	9.180E-13	2.142E-11	4.287E+07	1.188E+04
ULI Wall	1.142E-12	2.466E-11	3.693E+07	1.051E+04
Kidneys	5.587E-12	1.405E-10	4.543E+07	1.340E+04
Lungs	9.176E-13	2.352E-09	5.068E+07	1.305E+04
Ovaries	3.529E-12	8.510E-11	3.180E+07	1.031E+04
R Marrow	1.518E-11	3.904E-10	4.310E+07	1.258E+04
Spleen	9.209E-13	2.150E-11	4.334E+07	1.177E+04
Thymus	9.176E-13	2.142E-11	4.893E+07	1.305E+04
Uterus	9.176E-13	2.142E-11	3.309E+07	9.716E+03
Bld Wall	9.187E-13	2.145E-11	4.043E+07	1.223E+04
Brain	9.176E-13	2.142E-11	4.835E+07	1.004E+04
Esophagu	9.176E-13	8.706E-10	3.297E+07	8.376E+03
SI Wall	9.231E-13	2.143E-11	3.425E+07	9.833E+03
LLI Wall	1.775E-12	3.058E-11	3.448E+07	1.019E+04
Liver	1.075E-11	2.742E-10	4.357E+07	1.188E+04
Muscle	9.176E-13	2.142E-11	5.534E+07	2.388E+04
Pancreas	9.176E-13	2.142E-11	3.297E+07	9.204E+03
Skin	9.176E-13	2.142E-11	2.936E+08	9.996E+04
Testes	3.582E-12	8.636E-11	6.279E+07	2.819E+04
Thyroid	9.176E-13	2.142E-11	5.825E+07	1.643E+04
EFFEC	1.243E-06	1.236E-06	5.347E+07	1.817E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.956E-13	4.366E-12	3.798E-02	9.635E-06
Stomach	4.255E-09	8.288E-10	1.736E-01	4.800E-05
Colon	1.750E-07	3.374E-08	3.705E-01	1.071E-04
Liver	9.250E-12	1.036E-11	6.606E-02	1.806E-05
LUNG	9.731E-12	8.473E-08	4.951E-01	1.282E-04
Bone	2.253E-12	1.040E-11	1.806E-02	5.289E-06
Skin	1.676E-13	1.025E-13	2.924E-02	9.972E-06
Breast	2.549E-12	1.513E-11	3.821E-01	1.549E-04
Ovary	1.365E-10	2.990E-11	4.520E-02	1.468E-05
Bladder	3.693E-11	7.881E-12	9.774E-02	2.959E-05
Kidneys	3.548E-12	1.928E-12	2.365E-02	6.967E-06
Thyroid	5.180E-14	4.144E-13	1.852E-02	5.231E-06
Leukemia	4.847E-11	1.965E-11	2.423E-01	7.060E-05
Residual	1.058E-10	6.290E-11	6.198E-01	2.144E-04
Total	1.798E-07	1.195E-07	2.621E+00	8.213E-04

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* NUCLIDE Pa-231 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	1.033E-05	1.951E-03	1.526E+08	3.472E+04
B Surfac	4.640E-03	8.776E-01	4.241E+08	8.341E+04
Breasts	1.033E-05	1.951E-03	2.318E+08	5.627E+04
St Wall	1.054E-05	1.951E-03	1.654E+08	3.740E+04
ULI Wall	1.493E-05	2.216E-03	1.514E+08	3.600E+04
Kidneys	6.290E-05	1.193E-02	1.678E+08	3.833E+04
Lungs	1.033E-05	7.437E-03	1.887E+08	3.973E+04
Ovaries	3.974E-05	7.518E-03	1.386E+08	3.740E+04
R Marrow	1.709E-04	3.245E-02	1.771E+08	4.008E+04
Spleen	1.036E-05	1.958E-03	1.689E+08	3.740E+04
Thymus	1.033E-05	1.951E-03	1.771E+08	3.775E+04
Uterus	1.033E-05	1.951E-03	1.410E+08	3.495E+04
Bld Wall	1.034E-05	1.954E-03	1.561E+08	3.763E+04
Brain	1.033E-05	1.951E-03	1.957E+08	3.600E+04
Esophagu	1.033E-05	3.155E-03	1.491E+08	3.180E+04
SI Wall	1.086E-05	1.951E-03	1.445E+08	3.483E+04
LLI Wall	2.365E-05	2.696E-03	1.468E+08	3.600E+04
Liver	1.210E-04	2.298E-02	1.678E+08	3.740E+04
Muscle	1.033E-05	1.951E-03	1.876E+08	5.079E+04
Pancreas	1.033E-05	1.951E-03	1.445E+08	3.320E+04
Skin	1.033E-05	1.951E-03	2.843E+08	1.247E+05
Testes	4.033E-05	7.629E-03	1.992E+08	5.417E+04
Thyroid	1.033E-05	1.951E-03	1.980E+08	4.299E+04
EFFEC	1.772E-03	3.458E-01	1.829E+08	4.404E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	1.469E-07	2.283E-05	1.713E-01	3.658E-05
Stomach	3.293E-07	4.218E-05	6.675E-01	1.514E-04
Colon	3.019E-06	9.250E-05	1.538E+00	3.716E-04
Liver	2.527E-06	3.885E-04	2.540E-01	5.662E-05
LUNG	9.509E-07	1.299E-03	1.841E+00	3.879E-04
Bone	5.254E-06	8.695E-04	4.031E-02	7.922E-06
Skin	9.287E-09	1.336E-06	2.831E-02	1.247E-05
Breast	1.661E-07	2.372E-05	1.120E+00	2.714E-04
Ovary	7.326E-07	1.221E-04	1.969E-01	5.324E-05
Bladder	3.700E-07	5.624E-05	3.775E-01	9.099E-05
Kidneys	5.069E-07	7.807E-05	8.726E-02	1.992E-05
Thyroid	2.542E-08	3.630E-06	6.303E-02	1.363E-05
Leukemia	8.140E-07	1.288E-04	9.937E-01	2.248E-04
Residual	1.029E-06	1.391E-04	2.400E+00	5.895E-04
Total	1.587E-05	3.267E-03	9.798E+00	2.283E-03

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* NUCLIDE Ac-227 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	8.725E-06	1.635E-03	4.613E+05	1.121E+02
B Surfac	1.730E-03	3.250E-01	1.957E+06	4.322E+02
Breasts	8.725E-06	1.635E-03	8.132E+05	2.470E+02
St Wall	8.728E-06	1.635E-03	5.208E+05	1.235E+02
ULI Wall	1.001E-05	1.845E-03	4.648E+05	1.177E+02
Kidneys	1.313E-05	2.511E-03	5.371E+05	1.270E+02
Lungs	8.725E-06	2.066E-02	6.081E+05	1.328E+02
Ovaries	3.455E-05	6.479E-03	4.171E+05	1.162E+02
R Marrow	9.080E-05	1.711E-02	5.347E+05	1.316E+02
Spleen	8.773E-06	1.643E-03	5.312E+05	1.247E+02
Thymus	8.725E-06	1.635E-03	5.778E+05	1.235E+02
Uterus	8.725E-06	1.635E-03	4.264E+05	1.136E+02
Bld Wall	8.739E-06	1.637E-03	4.928E+05	1.247E+02
Brain	8.725E-06	1.635E-03	6.023E+05	1.155E+02
Esophagu	8.725E-06	6.601E-03	4.334E+05	1.018E+02
SI Wall	8.739E-06	1.635E-03	4.369E+05	1.125E+02
LLI Wall	1.295E-05	2.226E-03	4.415E+05	1.165E+02
Liver	3.737E-04	7.008E-02	5.324E+05	1.235E+02
Muscle	8.725E-06	1.635E-03	6.186E+05	2.027E+02
Pancreas	8.725E-06	1.635E-03	4.299E+05	1.087E+02
Skin	8.725E-06	1.635E-03	1.282E+06	8.656E+02
Testes	3.431E-05	6.434E-03	6.734E+05	2.202E+02
Thyroid	8.725E-06	1.635E-03	6.524E+05	1.456E+02
EFFEC	1.194E-03	2.695E-01	5.976E+05	1.643E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	1.506E-07	2.394E-05	4.986E-04	1.177E-07
Stomach	4.107E-07	5.698E-05	2.097E-03	4.986E-07
Colon	1.391E-06	1.443E-04	4.695E-03	1.212E-06
Liver	1.066E-05	1.724E-03	8.073E-04	1.876E-07
LUNG	1.084E-06	4.218E-03	5.942E-03	1.293E-06
Bone	2.549E-06	4.218E-04	1.864E-04	4.101E-08
Skin	1.128E-08	1.624E-06	1.282E-04	8.633E-08
Breast	2.264E-07	3.193E-05	3.926E-03	1.188E-06
Ovary	7.067E-07	1.221E-04	5.930E-04	1.654E-07
Bladder	3.585E-07	5.550E-05	1.188E-03	3.017E-07
Kidneys	1.384E-07	2.168E-05	2.796E-04	6.606E-08
Thyroid	3.201E-08	4.477E-06	2.074E-04	4.637E-08
Leukemia	5.661E-07	8.769E-05	3.006E-03	7.386E-07
Residual	1.476E-06	1.991E-04	7.491E-03	2.097E-06
Total	1.976E-05	7.104E-03	3.111E-02	8.050E-06

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* NUCLIDE Sr-90 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.457E-06	1.273E-07	5.441E+05	1.957E+02
B Surfac	1.511E-03	6.997E-05	2.656E+06	9.681E+02
Breasts	2.457E-06	1.273E-07	1.106E+06	4.078E+02
St Wall	3.335E-06	8.447E-07	6.326E+05	2.318E+02
ULI Wall	2.165E-05	1.310E-05	5.429E+05	2.050E+02
Kidneys	2.457E-06	1.273E-07	6.745E+05	2.516E+02
Lungs	2.457E-06	4.773E-03	7.503E+05	2.551E+02
Ovaries	2.457E-06	1.273E-07	4.695E+05	1.864E+02
R Marrow	6.627E-04	3.127E-05	6.338E+05	2.248E+02
Spleen	2.457E-06	1.273E-07	6.396E+05	2.318E+02
Thymus	2.457E-06	1.273E-07	7.246E+05	2.458E+02
Uterus	2.457E-06	1.273E-07	4.835E+05	1.887E+02
Bld Wall	5.487E-06	3.260E-07	5.965E+05	2.330E+02
Brain	2.457E-06	1.273E-07	7.200E+05	2.004E+02
Esophagu	2.457E-06	1.611E-04	4.835E+05	1.608E+02
SI Wall	4.196E-06	1.986E-06	5.010E+05	1.911E+02
LLI Wall	8.103E-05	4.444E-05	5.068E+05	1.981E+02
Liver	2.457E-06	1.273E-07	6.442E+05	2.318E+02
Muscle	2.457E-06	1.274E-07	7.957E+05	3.390E+02
Pancreas	2.457E-06	1.273E-07	4.835E+05	1.782E+02
Skin	2.457E-06	1.273E-07	1.072E+09	1.631E+05
Testes	2.457E-06	1.273E-07	9.064E+05	3.879E+02
Thyroid	2.457E-06	1.273E-07	8.539E+05	2.901E+02
EFFEC	1.024E-04	5.805E-04	1.145E+07	1.911E+03

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.070E-09	1.387E-10	5.557E-04	1.852E-07
Stomach	2.190E-08	3.848E-09	2.551E-03	9.355E-07
Colon	8.251E-07	3.811E-07	5.441E-03	2.085E-06
Liver	5.624E-09	1.876E-10	9.763E-04	3.518E-07
LUNG	4.144E-08	3.959E-05	7.340E-03	2.493E-06
Bone	2.176E-07	6.697E-09	2.516E-04	9.192E-08
Skin	4.107E-10	1.151E-11	1.069E-01	1.631E-05
Breast	2.028E-08	5.291E-10	5.336E-03	1.969E-06
Ovary	4.736E-09	1.669E-10	6.675E-04	2.656E-07
Bladder	1.880E-08	7.585E-10	1.445E-03	5.639E-07
Kidneys	1.950E-09	6.438E-11	3.507E-04	1.305E-07
Thyroid	1.391E-09	3.533E-11	2.714E-04	9.238E-08
Leukemia	4.773E-06	1.606E-07	3.553E-03	1.258E-06
Residual	6.475E-08	1.665E-09	9.040E-03	3.542E-06
Total	5.994E-06	3.996E-05	1.445E-01	3.029E-05

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* NUCLIDE Y-90 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	4.769E-11	1.324E-08	1.631E+07	4.707E+03
B Surfac	1.379E-09	3.829E-07	5.173E+07	1.363E+04
Breasts	4.769E-11	1.324E-08	2.563E+07	6.664E+03
St Wall	3.948E-06	7.903E-07	1.794E+07	5.173E+03
ULI Wall	5.010E-05	1.003E-05	1.631E+07	4.940E+03
Kidneys	4.773E-11	1.324E-08	1.841E+07	5.312E+03
Lungs	4.769E-11	2.566E-05	2.062E+07	5.545E+03
Ovaries	5.280E-11	1.324E-08	1.491E+07	4.858E+03
R Marrow	1.379E-09	3.826E-07	1.887E+07	5.324E+03
Spleen	4.773E-11	1.324E-08	1.829E+07	5.208E+03
Thymus	4.769E-11	1.324E-08	1.946E+07	5.219E+03
Uterus	4.780E-11	1.324E-08	1.503E+07	4.753E+03
Bld Wall	2.242E-10	6.220E-08	1.689E+07	5.208E+03
Brain	4.769E-11	1.324E-08	2.109E+07	4.916E+03
Esophagu	4.769E-11	3.785E-06	1.561E+07	4.287E+03
SI Wall	9.457E-06	1.874E-06	1.538E+07	4.765E+03
LLI Wall	1.166E-04	2.332E-05	1.561E+07	4.940E+03
Liver	1.353E-09	3.756E-07	1.829E+07	5.184E+03
Muscle	4.788E-11	1.324E-08	2.050E+07	6.326E+03
Pancreas	4.777E-11	1.324E-08	1.514E+07	4.520E+03
Skin	4.773E-11	1.324E-08	7.270E+09	1.223E+07
Testes	4.769E-11	1.324E-08	2.202E+07	6.699E+03
Thyroid	4.769E-11	1.324E-08	2.179E+07	5.848E+03
EFFEC	9.942E-06	5.147E-06	9.238E+07	1.282E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	7.918E-14	1.846E-11	1.794E-02	4.928E-06
Stomach	2.316E-08	4.403E-09	7.246E-02	2.085E-05
Colon	1.443E-06	2.731E-07	1.654E-01	5.103E-05
Liver	2.986E-12	6.882E-10	2.773E-02	7.852E-06
LUNG	8.436E-13	2.675E-07	2.015E-01	5.417E-05
Bone	1.735E-13	4.181E-11	4.916E-03	1.293E-06
Skin	8.399E-15	1.732E-12	7.258E-01	1.223E-03
Breast	4.144E-13	8.658E-11	1.235E-01	3.215E-05
Ovary	1.058E-13	2.239E-11	2.120E-02	6.908E-06
Bladder	6.882E-13	1.695E-10	4.089E-02	1.258E-05
Kidneys	3.811E-14	8.547E-12	9.576E-03	2.761E-06
Thyroid	2.901E-14	5.772E-12	6.932E-03	1.864E-06
Leukemia	1.399E-11	2.942E-09	1.059E-01	2.994E-05
Residual	1.295E-12	2.631E-10	2.575E-01	7.712E-05
Total	1.465E-06	5.476E-07	1.782E+00	1.526E-03

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* NUCLIDE Cs-137 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	5.195E-05	1.763E-05	5.697E+05	2.004E+02
B Surfac	5.091E-05	1.729E-05	2.668E+06	9.495E+02
Breasts	4.148E-05	1.407E-05	1.127E+06	4.043E+02
St Wall	4.958E-05	1.652E-05	6.582E+05	2.353E+02
ULI Wall	5.343E-05	1.807E-05	5.697E+05	2.097E+02
Kidneys	4.991E-05	1.693E-05	6.990E+05	2.540E+02
Lungs	4.692E-05	1.602E-05	7.782E+05	2.586E+02
Ovaries	5.298E-05	1.797E-05	4.940E+05	1.934E+02
R Marrow	4.854E-05	1.649E-05	6.640E+05	2.295E+02
Spleen	4.995E-05	1.694E-05	6.664E+05	2.353E+02
Thymus	4.847E-05	1.648E-05	7.491E+05	2.481E+02
Uterus	5.347E-05	1.814E-05	5.091E+05	1.946E+02
Bld Wall	5.354E-05	1.816E-05	6.209E+05	2.365E+02
Brain	4.359E-05	1.482E-05	7.526E+05	2.050E+02
Esophagu	4.836E-05	2.747E-05	5.114E+05	1.666E+02
SI Wall	5.187E-05	1.759E-05	5.266E+05	1.957E+02
LLI Wall	6.186E-05	2.086E-05	5.336E+05	2.039E+02
Liver	5.025E-05	1.705E-05	6.710E+05	2.353E+02
Muscle	4.640E-05	1.577E-05	8.202E+05	3.390E+02
Pancreas	5.332E-05	1.808E-05	5.103E+05	1.829E+02
Skin	3.966E-05	1.346E-05	1.005E+09	3.204E+05
Testes	4.651E-05	1.578E-05	9.273E+05	3.856E+02
Thyroid	4.836E-05	1.644E-05	8.796E+05	2.924E+02
EFFEC	5.017E-05	1.729E-05	1.081E+07	3.483E+03

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	5.180E-08	1.746E-08	5.883E-04	1.922E-07
Stomach	1.850E-07	5.698E-08	2.656E-03	9.506E-07
Colon	5.143E-07	1.576E-07	5.720E-03	2.144E-06
Liver	7.659E-08	2.457E-08	1.017E-03	3.565E-07
LUNG	3.811E-07	1.254E-07	7.607E-03	2.528E-06
Bone	4.662E-09	1.536E-09	2.528E-04	9.017E-08
Skin	3.589E-09	1.140E-09	1.003E-01	3.192E-05
Breast	1.528E-07	5.143E-08	5.441E-03	1.957E-06
Ovary	6.327E-08	2.257E-08	7.025E-04	2.749E-07
Bladder	1.325E-07	4.292E-08	1.503E-03	5.720E-07
Kidneys	2.612E-08	8.362E-09	3.635E-04	1.316E-07
Thyroid	1.258E-08	4.070E-09	2.796E-04	9.308E-08
Leukemia	2.649E-07	8.658E-08	3.728E-03	1.293E-06
Residual	6.771E-07	2.098E-07	9.425E-03	3.588E-06
Total	2.546E-06	8.103E-07	1.398E-01	4.613E-05

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* NUCLIDE Ba-137m *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	2.738E+09	5.837E+05
B Surfac	0.000E+00	0.000E+00	5.394E+09	9.635E+05
Breasts	0.000E+00	0.000E+00	3.751E+09	6.874E+05
St Wall	0.000E+00	0.000E+00	2.912E+09	6.186E+05
ULI Wall	0.000E+00	0.000E+00	2.714E+09	6.140E+05
Kidneys	0.000E+00	0.000E+00	2.924E+09	6.244E+05
Lungs	0.000E+00	0.000E+00	3.262E+09	6.536E+05
Ovaries	0.000E+00	0.000E+00	2.563E+09	6.291E+05
R Marrow	0.000E+00	0.000E+00	3.180E+09	6.641E+05
Spleen	0.000E+00	0.000E+00	2.959E+09	6.233E+05
Thymus	0.000E+00	0.000E+00	3.029E+09	6.163E+05
Uterus	0.000E+00	0.000E+00	2.540E+09	6.023E+05
Bld Wall	0.000E+00	0.000E+00	2.703E+09	6.233E+05
Brain	0.000E+00	0.000E+00	3.507E+09	6.163E+05
Esophagu	0.000E+00	0.000E+00	2.726E+09	5.592E+05
SI Wall	0.000E+00	0.000E+00	2.610E+09	6.046E+05
LLI Wall	0.000E+00	0.000E+00	2.668E+09	6.291E+05
Liver	0.000E+00	0.000E+00	2.947E+09	6.198E+05
Muscle	0.000E+00	0.000E+00	3.192E+09	7.083E+05
Pancreas	0.000E+00	0.000E+00	2.586E+09	5.697E+05
Skin	0.000E+00	0.000E+00	4.345E+09	1.922E+06
Testes	0.000E+00	0.000E+00	3.285E+09	7.188E+05
Thyroid	0.000E+00	0.000E+00	3.355E+09	6.839E+05
EFFEC	0.000E+00	0.000E+00	3.134E+09	6.734E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	3.134E+00	6.431E-04
Stomach	0.000E+00	0.000E+00	1.177E+01	2.493E-03
Colon	0.000E+00	0.000E+00	2.784E+01	6.407E-03
Liver	0.000E+00	0.000E+00	4.462E+00	9.390E-04
LUNG	0.000E+00	0.000E+00	3.192E+01	6.396E-03
Bone	0.000E+00	0.000E+00	5.126E-01	9.145E-05
Skin	0.000E+00	0.000E+00	4.334E-01	1.922E-04
Breast	0.000E+00	0.000E+00	1.817E+01	3.320E-03
Ovary	0.000E+00	0.000E+00	3.646E+00	8.947E-04
Bladder	0.000E+00	0.000E+00	6.536E+00	1.503E-03
Kidneys	0.000E+00	0.000E+00	1.526E+00	3.250E-04
Thyroid	0.000E+00	0.000E+00	1.068E+00	2.179E-04
Leukemia	0.000E+00	0.000E+00	1.782E+01	3.728E-03
Residual	0.000E+00	0.000E+00	4.229E+01	9.238E-03
Total	0.000E+00	0.000E+00	1.713E+02	3.635E-02

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* NUCLIDE U-233 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	5.254E-06	3.237E-06	1.212E+06	3.087E+02
B Surfac	1.551E-04	1.477E-04	4.800E+06	1.549E+03
Breasts	5.254E-06	3.237E-06	2.586E+06	1.491E+03
St Wall	5.461E-06	3.303E-06	1.351E+06	3.483E+02
ULI Wall	8.306E-06	4.244E-06	1.200E+06	3.122E+02
Kidneys	5.383E-05	3.673E-05	1.410E+06	3.891E+02
Lungs	5.254E-06	1.473E-02	1.573E+06	3.728E+02
Ovaries	5.280E-06	3.570E-06	1.078E+06	3.390E+02
R Marrow	1.553E-05	1.261E-05	1.445E+06	4.206E+02
Spleen	5.254E-06	3.238E-06	1.375E+06	3.379E+02
Thymus	5.254E-06	3.237E-06	1.503E+06	3.728E+02
Uterus	5.254E-06	3.237E-06	1.103E+06	2.982E+02
Bld Wall	5.272E-06	3.249E-06	1.282E+06	3.542E+02
Brain	5.254E-06	3.237E-06	1.561E+06	3.076E+02
Esophagu	5.254E-06	6.712E-03	1.132E+06	2.633E+02
SI Wall	5.757E-06	3.403E-06	1.132E+06	2.971E+02
LLI Wall	1.421E-05	6.198E-06	1.146E+06	3.099E+02
Liver	2.049E-05	1.564E-05	1.375E+06	3.448E+02
Muscle	5.254E-06	3.237E-06	1.794E+06	1.038E+03
Pancreas	5.254E-06	3.237E-06	1.115E+06	2.819E+02
Skin	5.254E-06	3.237E-06	5.324E+06	6.920E+03
Testes	5.280E-06	3.575E-06	1.969E+06	1.212E+03
Thyroid	5.254E-06	3.237E-06	1.806E+06	5.149E+02
EFFEC	1.897E-04	3.549E-02	1.654E+06	6.990E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	8.177E-08	3.996E-08	1.305E-03	3.029E-07
Stomach	2.309E-07	8.843E-08	5.452E-03	1.410E-06
Colon	2.523E-06	7.289E-07	1.212E-02	3.215E-06
Liver	5.698E-07	3.060E-07	2.085E-03	5.231E-07
LUNG	5.735E-07	2.686E-03	1.538E-02	3.646E-06
Bone	3.622E-07	2.168E-07	4.555E-04	1.468E-07
Skin	5.883E-09	2.497E-09	5.312E-04	6.908E-07
Breast	1.128E-07	4.588E-08	1.247E-02	7.200E-06
Ovary	9.435E-08	5.217E-08	1.538E-03	4.823E-07
Bladder	2.002E-07	9.694E-08	3.099E-03	8.563E-07
Kidneys	6.438E-07	3.127E-07	7.328E-04	2.027E-07
Thyroid	1.650E-08	6.771E-09	5.755E-04	1.643E-07
Leukemia	9.176E-08	5.365E-08	8.108E-03	2.365E-06
Residual	7.363E-07	2.775E-07	2.039E-02	8.085E-06
Total	6.253E-06	2.690E-03	8.435E-02	2.924E-05

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* NUCLIDE U-238 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	4.492E-06	2.648E-06	6.850E+04	4.520E+01
B Surfac	1.301E-04	8.321E-05	8.621E+05	9.425E+02
Breasts	4.492E-06	2.648E-06	9.949E+05	1.503E+03
St Wall	4.669E-06	2.706E-06	9.623E+04	6.151E+01
ULI Wall	7.145E-06	3.522E-06	6.559E+04	3.134E+01
Kidneys	4.666E-05	3.119E-05	1.247E+05	1.075E+02
Lungs	4.492E-06	1.214E-02	1.160E+05	6.512E+01
Ovaries	4.492E-06	2.649E-06	5.079E+04	8.050E+01
R Marrow	1.320E-05	8.469E-06	1.445E+05	1.491E+02
Spleen	4.492E-06	2.648E-06	8.738E+04	4.310E+01
Thymus	4.492E-06	2.648E-06	1.375E+05	9.600E+01
Uterus	4.492E-06	2.648E-06	5.324E+04	2.645E+01
Bld Wall	4.507E-06	2.658E-06	9.227E+04	6.687E+01
Brain	4.492E-06	2.648E-06	9.262E+04	2.843E+01
Esophagu	4.492E-06	5.705E-03	4.905E+04	1.876E+01
SI Wall	4.928E-06	2.792E-06	5.685E+04	2.738E+01
LLI Wall	1.228E-05	5.213E-06	5.790E+04	3.146E+01
Liver	1.749E-05	1.127E-05	9.436E+04	5.557E+01
Muscle	4.492E-06	2.648E-06	4.299E+05	9.134E+02
Pancreas	4.492E-06	2.648E-06	5.091E+04	2.283E+01
Skin	4.492E-06	2.648E-06	3.390E+06	8.644E+03
Testes	4.492E-06	2.648E-06	5.114E+05	1.124E+03
Thyroid	4.492E-06	2.648E-06	3.169E+05	2.377E+02
EFFEC	1.648E-04	2.973E-02	2.924E+05	4.940E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	7.067E-08	3.574E-08	5.639E-05	2.155E-08
Stomach	2.013E-07	7.992E-08	3.879E-04	2.481E-07
Colon	2.283E-06	7.622E-07	6.431E-04	3.239E-07
Liver	4.921E-07	2.368E-07	1.433E-04	8.423E-08
LUNG	4.995E-07	2.246E-03	1.135E-03	6.373E-07
Bone	3.104E-07	1.480E-07	8.190E-05	8.947E-08
Skin	5.106E-09	2.135E-09	3.378E-04	8.621E-07
Breast	9.953E-08	4.588E-08	4.811E-03	7.258E-06
Ovary	8.103E-08	4.033E-08	7.223E-05	1.145E-07
Bladder	1.732E-07	8.103E-08	2.237E-04	1.619E-07
Kidneys	5.624E-07	2.708E-07	6.489E-05	5.592E-08
Thyroid	1.436E-08	5.883E-09	1.009E-04	7.572E-08
Leukemia	1.502E-07	9.139E-08	8.108E-04	8.365E-07
Residual	6.401E-07	2.512E-07	2.726E-03	4.870E-06
Total	5.587E-06	2.246E-03	1.159E-02	1.561E-05

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* NUCLIDE Th-234 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.006E-13	1.020E-12	2.540E+07	6.652E+03
B Surfac	4.684E-12	2.988E-11	1.305E+08	3.064E+04
Breasts	2.006E-13	1.020E-12	4.695E+07	1.066E+04
St Wall	2.007E-13	1.025E-12	2.959E+07	7.607E+03
ULI Wall	2.184E-13	1.101E-12	2.563E+07	7.153E+03
Kidneys	3.101E-12	1.321E-11	3.087E+07	7.747E+03
Lungs	2.006E-13	3.132E-09	3.507E+07	8.283E+03
Ovaries	1.803E-12	3.357E-12	2.225E+07	6.792E+03
R Marrow	4.939E-13	3.067E-12	2.901E+07	7.456E+03
Spleen	2.006E-13	1.020E-12	3.017E+07	7.736E+03
Thymus	2.006E-13	1.020E-12	3.344E+07	7.794E+03
Uterus	2.006E-13	1.020E-12	2.307E+07	6.792E+03
Bld Wall	2.007E-13	1.023E-12	2.784E+07	7.666E+03
Brain	2.006E-13	1.020E-12	3.378E+07	6.967E+03
Esophagu	2.006E-13	1.722E-09	2.283E+07	5.965E+03
SI Wall	2.014E-13	1.033E-12	2.377E+07	6.780E+03
LLI Wall	3.193E-13	1.275E-12	2.412E+07	7.060E+03
Liver	5.946E-13	3.992E-12	3.017E+07	7.666E+03
Muscle	2.006E-13	1.020E-12	3.530E+07	9.670E+03
Pancreas	2.006E-13	1.020E-12	2.307E+07	6.524E+03
Skin	2.006E-13	1.020E-12	8.737E+07	2.004E+04
Testes	1.831E-12	3.398E-12	3.938E+07	1.037E+04
Thyroid	2.006E-13	1.020E-12	3.786E+07	8.551E+03
EFFEC	1.259E-05	2.847E-05	3.437E+07	8.738E+03

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.514E-12	8.806E-11	2.633E-02	6.862E-06
Stomach	2.187E-08	4.958E-09	1.200E-01	3.076E-05
Colon	1.854E-06	3.959E-07	2.575E-01	7.340E-05
Liver	5.809E-11	1.332E-10	4.578E-02	1.162E-05
LUNG	6.179E-11	2.227E-06	3.425E-01	8.097E-05
Bone	2.338E-11	3.101E-11	1.235E-02	2.912E-06
Skin	8.917E-13	1.728E-12	8.714E-03	2.004E-06
Breast	2.535E-11	3.252E-10	2.272E-01	5.149E-05
Ovary	2.035E-10	6.623E-11	3.169E-02	9.658E-06
Bladder	1.169E-10	3.774E-11	6.734E-02	1.852E-05
Kidneys	4.403E-11	5.661E-11	1.608E-02	4.031E-06
Thyroid	1.284E-12	9.805E-12	1.200E-02	2.726E-06
Leukemia	1.110E-09	1.262E-09	1.631E-01	4.182E-05
Residual	2.756E-10	7.992E-10	4.159E-01	1.134E-04
Total	1.876E-06	2.631E-06	1.748E+00	4.497E-04

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* NUCLIDE Pa-234m *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	6.652E+07	1.480E+04
B Surfac	0.000E+00	0.000E+00	1.445E+08	2.936E+04
Breasts	0.000E+00	0.000E+00	9.378E+07	1.817E+04
St Wall	0.000E+00	0.000E+00	7.176E+07	1.584E+04
ULI Wall	0.000E+00	0.000E+00	6.699E+07	1.561E+04
Kidneys	0.000E+00	0.000E+00	7.258E+07	1.608E+04
Lungs	0.000E+00	0.000E+00	8.085E+07	1.666E+04
Ovaries	0.000E+00	0.000E+00	6.571E+07	1.503E+04
R Marrow	0.000E+00	0.000E+00	7.806E+07	1.678E+04
Spleen	0.000E+00	0.000E+00	7.305E+07	1.596E+04
Thymus	0.000E+00	0.000E+00	7.584E+07	1.549E+04
Uterus	0.000E+00	0.000E+00	6.291E+07	1.515E+04
Bld Wall	0.000E+00	0.000E+00	6.664E+07	1.596E+04
Brain	0.000E+00	0.000E+00	8.586E+07	1.549E+04
Esophagu	0.000E+00	0.000E+00	6.710E+07	1.398E+04
SI Wall	0.000E+00	0.000E+00	6.466E+07	1.538E+04
LLI Wall	0.000E+00	0.000E+00	6.594E+07	1.596E+04
Liver	0.000E+00	0.000E+00	7.281E+07	1.584E+04
Muscle	0.000E+00	0.000E+00	7.922E+07	1.841E+04
Pancreas	0.000E+00	0.000E+00	6.373E+07	1.445E+04
Skin	0.000E+00	0.000E+00	6.384E+09	1.094E+07
Testes	0.000E+00	0.000E+00	8.213E+07	1.876E+04
Thyroid	0.000E+00	0.000E+00	8.365E+07	1.713E+04
EFFEC	0.000E+00	0.000E+00	1.410E+08	1.258E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	7.724E-02	1.608E-05
Stomach	0.000E+00	0.000E+00	2.901E-01	6.396E-05
Colon	0.000E+00	0.000E+00	6.874E-01	1.631E-04
Liver	0.000E+00	0.000E+00	1.103E-01	2.400E-05
LUNG	0.000E+00	0.000E+00	7.910E-01	1.631E-04
Bone	0.000E+00	0.000E+00	1.375E-02	2.784E-06
Skin	0.000E+00	0.000E+00	6.373E-01	1.092E-03
Breast	0.000E+00	0.000E+00	4.532E-01	8.784E-05
Ovary	0.000E+00	0.000E+00	9.343E-02	2.144E-05
Bladder	0.000E+00	0.000E+00	1.608E-01	3.856E-05
Kidneys	0.000E+00	0.000E+00	3.775E-02	8.365E-06
Thyroid	0.000E+00	0.000E+00	2.668E-02	5.452E-06
Leukemia	0.000E+00	0.000E+00	4.380E-01	9.413E-05
Residual	0.000E+00	0.000E+00	1.039E+00	2.365E-04
Total	0.000E+00	0.000E+00	4.858E+00	2.015E-03

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* NUCLIDE Pa-234 *
****

DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	6.449E-15	1.119E-13	8.796E+09	1.841E+06
B Surfac	1.833E-13	2.994E-12	1.747E+10	3.122E+06
Breasts	6.449E-15	1.119E-13	1.212E+10	2.155E+06
St Wall	6.512E-15	1.120E-13	9.425E+09	1.957E+06
ULI Wall	1.341E-14	1.138E-13	8.842E+09	1.934E+06
Kidneys	7.012E-14	1.401E-12	9.506E+09	1.969E+06
Lungs	6.449E-15	1.553E-11	1.059E+10	2.050E+06
Ovaries	1.117E-14	4.651E-13	8.691E+09	1.887E+06
R Marrow	1.863E-14	3.053E-13	1.032E+10	2.085E+06
Spleen	6.449E-15	1.119E-13	9.611E+09	1.969E+06
Thymus	6.449E-15	1.119E-13	9.891E+09	1.899E+06
Uterus	6.449E-15	1.119E-13	8.318E+09	1.899E+06
Bld Wall	6.471E-15	1.122E-13	8.749E+09	1.957E+06
Brain	6.449E-15	1.119E-13	1.132E+10	1.934E+06
Esophagu	6.449E-15	3.517E-12	8.924E+09	1.759E+06
SI Wall	7.008E-15	1.121E-13	8.563E+09	1.911E+06
LLI Wall	3.227E-14	1.183E-13	8.726E+09	1.992E+06
Liver	2.422E-14	3.700E-13	9.565E+09	1.957E+06
Muscle	6.449E-15	1.119E-13	1.035E+10	2.225E+06
Pancreas	6.449E-15	1.119E-13	8.435E+09	1.806E+06
Skin	6.449E-15	1.119E-13	1.445E+10	4.532E+06
Testes	1.125E-14	4.714E-13	1.065E+10	2.248E+06
Thyroid	6.449E-15	1.119E-13	1.089E+10	2.097E+06
EFFEC	1.937E-06	1.444E-06	1.017E+10	2.097E+06

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	3.563E-11	1.528E-10	1.026E+01	2.027E-03
Stomach	1.650E-08	3.060E-09	3.810E+01	7.899E-03
Colon	1.850E-07	3.271E-08	9.075E+01	2.027E-02
Liver	4.551E-10	1.735E-10	1.445E+01	2.971E-03
LUNG	7.992E-10	6.364E-08	1.036E+02	2.004E-02
Bone	1.495E-11	1.839E-11	1.654E+00	2.959E-04
Skin	9.398E-12	4.810E-12	1.445E+00	4.520E-04
Breast	2.716E-10	4.440E-10	5.848E+01	1.042E-02
Ovary	2.087E-09	4.218E-10	1.235E+01	2.680E-03
Bladder	1.099E-09	2.290E-10	2.120E+01	4.730E-03
Kidneys	1.972E-10	5.920E-11	4.951E+00	1.024E-03
Thyroid	4.366E-12	2.068E-11	3.472E+00	6.675E-04
Leukemia	1.702E-09	7.030E-10	5.790E+01	1.165E-02
Residual	4.995E-09	1.850E-09	1.363E+02	2.912E-02
Total	2.135E-07	1.036E-07	5.557E+02	1.143E-01

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Clean Air Act Assessment Package - 1988

C H I / Q T A B L E S
Non-Radon Individual Assessment
May 15, 2014 11:54 am

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2013

Comments: CY 2013 WIPP Compliance Report
40 CFR Part 191, Subpart A

Dataset Name: 2013-191SubpartA
Dataset Date: 5/15/2014 10:56:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\WIPP2013.WND

May 15, 2014 11:54 am CHIQ
Page 1

GROUND-LEVEL CHI/Q VALUES FOR Am-241
SOLUBILITY: M
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	350
N	2.778E-06
NNW	4.636E-06
NW	6.448E-06
WNW	3.687E-06
W	2.179E-06
WSW	1.457E-06
SW	1.553E-06
SSW	1.644E-06
S	1.381E-06
SSE	1.301E-06
SE	1.351E-06
ESE	1.127E-06
E	1.534E-06
ENE	2.045E-06
NE	1.777E-06
NNE	2.036E-06

May 15, 2014 11:54 am CHIQ
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GROUND-LEVEL CHI/Q VALUES FOR Pu-238
SOLUBILITY: M
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	350
N	2.813E-06
NNW	4.737E-06
NW	6.621E-06
WNW	3.790E-06
W	2.231E-06
WSW	1.493E-06
SW	1.588E-06
SSW	1.675E-06
S	1.398E-06
SSE	1.317E-06
SE	1.368E-06
ESE	1.141E-06
E	1.560E-06
ENE	2.075E-06
NE	1.797E-06
NNE	2.057E-06

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Page 3

GROUND-LEVEL CHI/Q VALUES FOR Pu-239
SOLUBILITY: M
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	350
N	2.727E-06
NNW	4.570E-06
NW	6.359E-06
WNW	3.606E-06
W	2.145E-06
WSW	1.442E-06
SW	1.535E-06
SSW	1.618E-06
S	1.359E-06
SSE	1.282E-06
SE	1.326E-06
ESE	1.105E-06
E	1.522E-06
ENE	2.025E-06
NE	1.752E-06
NNE	2.001E-06

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GROUND-LEVEL CHI/Q VALUES FOR Sr-90
SOLUBILITY: S
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	350
N	2.799E-06
NNW	4.704E-06
NW	6.565E-06
WNW	3.749E-06
W	2.213E-06
WSW	1.482E-06
SW	1.578E-06
SSW	1.665E-06
S	1.392E-06
SSE	1.312E-06
SE	1.361E-06
ESE	1.135E-06
E	1.554E-06
ENE	2.068E-06
NE	1.791E-06
NNE	2.049E-06

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GROUND-LEVEL CHI/Q VALUES FOR Cs-137
SOLUBILITY: F
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	350
N	2.742E-06
NNW	4.510E-06
NW	6.234E-06
WNW	3.578E-06
W	2.118E-06
WSW	1.411E-06
SW	1.508E-06
SSW	1.608E-06
S	1.361E-06
SSE	1.280E-06
SE	1.333E-06
ESE	1.114E-06
E	1.494E-06
ENE	2.000E-06
NE	1.752E-06
NNE	2.012E-06

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GROUND-LEVEL CHI/Q VALUES FOR U-233
SOLUBILITY: S
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	350
N	2.919E-06
NNW	5.017E-06
NW	7.101E-06
WNW	4.106E-06
W	2.378E-06
WSW	1.586E-06
SW	1.681E-06
SSW	1.764E-06
S	1.447E-06
SSE	1.363E-06
SE	1.421E-06
ESE	1.186E-06
E	1.622E-06
ENE	2.150E-06
NE	1.850E-06
NNE	2.121E-06

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GROUND-LEVEL CHI/Q VALUES FOR U-238
SOLUBILITY: S
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	350
N	2.918E-06
NNW	5.022E-06
NW	7.109E-06
WNW	4.105E-06
W	2.380E-06
WSW	1.589E-06
SW	1.683E-06
SSW	1.765E-06
S	1.448E-06
SSE	1.364E-06
SE	1.420E-06
ESE	1.185E-06
E	1.626E-06
ENE	2.153E-06
NE	1.851E-06
NNE	2.121E-06

CY 2013 CAP88-PC Output Data for the Maximum Exposed Individual Near the DOE Land Withdrawal Area (7,500 meters)

C A P 8 8 - P C

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Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
May 15, 2014 01:02 pm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2013

Comments: CY 2013 WIPP Compliance Report
40 CFR Part 191, Subpart A MEOSI

Effective Dose Equivalent (mrem/year)
7.39E-06

At This Location: 7500 Meters West Northwest

Dataset Name: 2013_191SubpartA
Dataset Date: 5/15/2014 11:57:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\WIPP201

May 15, 2014 01:02 pm SYNOPSIS
Page 1

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 7500 Meters West Northwest
Lifetime Fatal Cancer Risk: 3.69E-12

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
Adrenals	6.32E-06
B Surfac	1.81E-05
Breasts	5.08E-06
St Wall	6.04E-06
ULI Wall	6.64E-06
Kidneys	6.08E-06
Lungs	6.05E-06
Ovaries	6.46E-06
R Marrow	1.08E-05
Spleen	6.08E-06
Thymus	5.90E-06
Uterus	6.50E-06
Bld Wall	6.53E-06
Brain	5.32E-06
Esophagu	5.92E-06
SI Wall	6.32E-06
LLI Wall	8.09E-06
Liver	6.22E-06
Muscle	5.67E-06
Pancreas	6.48E-06
Skin	5.19E-06
Testes	5.69E-06
Thyroid	5.90E-06
EFFEC	7.39E-06

RADIONUCLIDE EMISSIONS DURING THE YEAR 2013

Nuclide	Type	Size	Source #1 Ci/y	Source #2 Ci/y	Source #3 Ci/y	TOTAL Ci/y
Am-241	M	1	3.6E-08	1.5E-09	1.1E-08	4.9E-08
Pu-238	M	1	3.0E-08	1.7E-09	6.8E-09	3.9E-08
Pu-239	M	1	2.5E-08	4.7E-10	5.0E-09	3.0E-08
Sr-90	S	1	2.2E-06	9.1E-08	5.0E-07	2.8E-06
Cs-137	F	1	2.3E-05	1.2E-06	1.1E-05	3.5E-05
U-233	S	1	4.8E-08	6.8E-09	5.4E-09	6.0E-08
U-238	S	1	5.4E-08	7.1E-09	5.2E-09	6.6E-08

SITE INFORMATION

Temperature:	18 degrees C
Precipitation:	23 cm/y
Humidity:	8 g/cu m
Mixing Height:	1000 m

User specified location of max exposed individual.
(ILOC, JLOC): 4, 1

SOURCE INFORMATION

Source Number:	1	2	3
Stack Height (m):	7.70	6.70	20.00
Diameter (m):	5.20	1.80	2.60
Plume Rise Momentum (m/s): (Exit Velocity)	6.70	10.80	3.30

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	1.000	1.000	1.000
Fraction From Assessment Area:	0.000	0.000	0.000
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

7500

C A P 8 8 - P C
Version 3.0

Clean Air Act Assessment Package - 1988

G E N E R A L D A T A
Non-Radon Individual Assessment
May 15, 2014 01:02 pm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2013

Comments: CY 2013 WIPP Compliance Report
40 CFR Part 191, Subpart A MEOSI

Dataset Name: 2013_191SubpartA
Dataset Date: 5/15/2014 11:57:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\WIPP2013.WND

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VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

Nuclide	Clearance Type	Particle Size (microns)	Scavenging Coefficient (per second)	Dry Deposition Velocity (m/s)
Am-241	M	1	2.25E-06	1.80E-03
Np-237	M	1	2.25E-06	1.80E-03
Pa-233	M	1	2.25E-06	1.80E-03
U-233	M	1	2.25E-06	1.80E-03
Th-229	S	1	2.25E-06	1.80E-03
Ra-225	M	1	2.25E-06	1.80E-03
Ac-225	M	1	2.25E-06	1.80E-03
Fr-221	M	1	2.25E-06	1.80E-03
At-217	M	1	2.25E-06	1.80E-03
Bi-213	M	1	2.25E-06	1.80E-03
Pu-238	M	1	2.25E-06	1.80E-03
U-234	M	1	2.25E-06	1.80E-03
Th-230	S	1	2.25E-06	1.80E-03
Ra-226	M	1	2.25E-06	1.80E-03
Rn-222	G	0	0.00E+00	0.00E+00
Pu-239	M	1	2.25E-06	1.80E-03
U-235	M	1	2.25E-06	1.80E-03
Th-231	S	1	2.25E-06	1.80E-03
Pa-231	M	1	2.25E-06	1.80E-03
Ac-227	M	1	2.25E-06	1.80E-03
Sr-90	S	1	2.25E-06	1.80E-03
Y-90	M	1	2.25E-06	1.80E-03
Cs-137	F	1	2.25E-06	1.80E-03
Ba-137m	M	1	2.25E-06	1.80E-03
U-233	S	1	2.25E-06	1.80E-03
U-238	S	1	2.25E-06	1.80E-03
Th-234	S	1	2.25E-06	1.80E-03
Pa-234m	M	1	2.25E-06	1.80E-03
Pa-234	M	1	2.25E-06	1.80E-03

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VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

	DECAY CONSTANT (PER DAY)		TRANSFER COEFFICIENT		
Nuclide	Radio-active (1)	Surface	Water	Milk (2)	Meat (3)
Am-241	4.39E-06	5.48E-05	0.00E+00	2.00E-06	5.00E-05
Np-237	8.87E-10	5.48E-05	0.00E+00	1.00E-05	1.00E-03
Pa-233	2.57E-02	5.48E-05	0.00E+00	5.00E-06	5.00E-06
U-233	1.20E-08	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-229	2.58E-07	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Ra-225	4.68E-02	5.48E-05	0.00E+00	1.00E-03	2.00E-03
Ac-225	6.93E-02	5.48E-05	0.00E+00	2.00E-06	2.00E-05
Fr-221	2.08E+02	5.48E-05	0.00E+00	8.00E-03	3.00E-02
At-217	1.85E+06	5.48E-05	0.00E+00	1.00E-02	1.00E-02
Bi-213	2.19E+01	5.48E-05	0.00E+00	1.00E-03	2.00E-03
Pu-238	2.16E-05	5.48E-05	0.00E+00	1.00E-06	1.00E-04
U-234	7.76E-09	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-230	2.46E-08	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Ra-226	1.19E-06	5.48E-05	0.00E+00	1.00E-03	2.00E-03
Rn-222	1.81E-01	5.48E-05	0.00E+00	0.00E+00	0.00E+00
Pu-239	7.88E-08	5.48E-05	0.00E+00	1.00E-06	1.00E-04
U-235	2.70E-12	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-231	6.52E-01	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Pa-231	5.79E-08	5.48E-05	0.00E+00	5.00E-06	5.00E-06
Ac-227	8.71E-05	5.48E-05	0.00E+00	2.00E-06	2.00E-05
Sr-90	6.52E-05	5.48E-05	0.00E+00	2.00E-03	1.00E-02
Y-90	2.60E-01	5.48E-05	0.00E+00	6.00E-05	2.00E-03
Cs-137	6.32E-05	5.48E-05	0.00E+00	1.00E-02	5.00E-02
Ba-137m	3.91E+02	5.48E-05	0.00E+00	5.00E-04	2.00E-04
U-233	1.20E-08	5.48E-05	0.00E+00	4.00E-04	8.00E-04
U-238	4.25E-13	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-234	2.88E-02	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Pa-234m	8.53E+02	5.48E-05	0.00E+00	5.00E-06	5.00E-06
Pa-234	2.48E+00	5.48E-05	0.00E+00	5.00E-06	5.00E-06

FOOTNOTES:

(1) Fraction of animal's daily intake of nuclide which appears in each L of milk (days/L)
(2) Fraction of animal's daily intake of nuclide which appears in each kg of meat (days/kg)

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VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

	CONCENTRATION UPTAKE FACTOR		GI UPTAKE FRACTION	
Nuclide	Forage (1)	Edible (2)	Inhalation	Ingestion
Am-241	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Np-237	1.00E-01	2.00E-02	5.00E-04	5.00E-04
Pa-233	1.00E-01	1.00E-02	5.00E-04	5.00E-04
U-233	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-229	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Ra-225	2.00E-01	4.00E-02	2.00E-01	2.00E-01
Ac-225	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Fr-221	1.00E-01	3.00E-02	1.00E+00	1.00E+00
At-217	9.00E-01	2.00E-01	1.00E+00	1.00E+00
Bi-213	5.00E-01	1.00E-01	5.00E-02	5.00E-02
Pu-238	1.00E-01	1.00E-03	5.00E-04	5.00E-04
U-234	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-230	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Ra-226	2.00E-01	4.00E-02	2.00E-01	2.00E-01
Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pu-239	1.00E-01	1.00E-03	5.00E-04	5.00E-04
U-235	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-231	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Pa-231	1.00E-01	1.00E-02	5.00E-04	5.00E-04
Ac-227	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Sr-90	4.00E+00	3.00E-01	3.00E-01	3.00E-01
Y-90	1.00E-01	2.00E-03	1.00E-04	1.00E-04
Cs-137	1.00E+00	2.00E-01	1.00E+00	1.00E+00
Ba-137m	1.00E-01	1.00E-02	2.00E-01	2.00E-01
U-233	1.00E-01	2.00E-03	2.00E-02	2.00E-02
U-238	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-234	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Pa-234m	1.00E-01	1.00E-02	5.00E-04	5.00E-04
Pa-234	1.00E-01	1.00E-02	5.00E-04	5.00E-04

FOOTNOTES: (1) Concentration factor for uptake of nuclide from soil for pasture and forage (in pCi/kg dry weight per pCi/kg dry soil)
(2) Concentration factor for uptake of nuclide from soil by edible parts of crops (in pCi/kg wet weight per pCi/kg dry soil)

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DECAY CHAIN ACTIVITIES

Nuclide	Stack	Activity at 500. seconds	Activity at 100.00 years
Am-241	1	3.6200E-08	0.0000E+00
Am-241	2	1.5000E-09	0.0000E+00
Am-241	3	1.0900E-08	0.0000E+00
Np-237	1	0.0000E+00	0.0000E+00
Np-237	2	0.0000E+00	0.0000E+00
Np-237	3	0.0000E+00	0.0000E+00
Pa-233	1	0.0000E+00	0.0000E+00
Pa-233	2	0.0000E+00	0.0000E+00
Pa-233	3	0.0000E+00	0.0000E+00
U-233	1	0.0000E+00	0.0000E+00
U-233	2	0.0000E+00	0.0000E+00
U-233	3	0.0000E+00	0.0000E+00
Th-229	1	0.0000E+00	0.0000E+00
Th-229	2	0.0000E+00	0.0000E+00
Th-229	3	0.0000E+00	0.0000E+00
Ra-225	1	0.0000E+00	0.0000E+00
Ra-225	2	0.0000E+00	0.0000E+00
Ra-225	3	0.0000E+00	0.0000E+00
Ac-225	1	0.0000E+00	0.0000E+00
Ac-225	2	0.0000E+00	0.0000E+00
Ac-225	3	0.0000E+00	0.0000E+00
Fr-221	1	0.0000E+00	0.0000E+00
Fr-221	2	0.0000E+00	0.0000E+00
Fr-221	3	0.0000E+00	0.0000E+00
At-217	1	0.0000E+00	0.0000E+00
At-217	2	0.0000E+00	0.0000E+00
At-217	3	0.0000E+00	0.0000E+00
Bi-213	1	0.0000E+00	0.0000E+00
Bi-213	2	0.0000E+00	0.0000E+00
Bi-213	3	0.0000E+00	0.0000E+00
Pu-238	1	3.0400E-08	0.0000E+00
Pu-238	2	1.7100E-09	0.0000E+00
Pu-238	3	6.7700E-09	0.0000E+00
U-234	1	0.0000E+00	0.0000E+00
U-234	2	0.0000E+00	0.0000E+00
U-234	3	0.0000E+00	0.0000E+00
Th-230	1	0.0000E+00	0.0000E+00
Th-230	2	0.0000E+00	0.0000E+00
Th-230	3	0.0000E+00	0.0000E+00
Ra-226	1	0.0000E+00	0.0000E+00
Ra-226	2	0.0000E+00	0.0000E+00
Ra-226	3	0.0000E+00	0.0000E+00
Rn-222	1	0.0000E+00	0.0000E+00
Rn-222	2	0.0000E+00	0.0000E+00
Rn-222	3	0.0000E+00	0.0000E+00
Pu-239	1	2.4800E-08	0.0000E+00
Pu-239	2	0.0000E+00	0.0000E+00
Pu-239	3	4.9800E-09	0.0000E+00
U-235	1	0.0000E+00	0.0000E+00
U-235	2	0.0000E+00	0.0000E+00

U-235	3	0.0000E+00	0.0000E+00
Th-231	1	0.0000E+00	0.0000E+00
Th-231	2	0.0000E+00	0.0000E+00
Th-231	3	0.0000E+00	0.0000E+00
Pa-231	1	0.0000E+00	0.0000E+00
Pa-231	2	0.0000E+00	0.0000E+00
Pa-231	3	0.0000E+00	0.0000E+00
Ac-227	1	0.0000E+00	0.0000E+00
Ac-227	2	0.0000E+00	0.0000E+00
Ac-227	3	0.0000E+00	0.0000E+00
Sr-90	1	2.2100E-06	1.0120E-06
Sr-90	2	9.0500E-08	0.0000E+00
Sr-90	3	4.9800E-07	2.2800E-07
Y-90	1	3.3210E-09	9.9150E-07
Y-90	2	0.0000E+00	0.0000E+00
Y-90	3	0.0000E+00	2.2000E-07
Cs-137	1	2.2500E-05	1.0300E-05
Cs-137	2	1.2200E-06	5.5860E-07
Cs-137	3	1.1200E-05	5.1280E-06

Ba-137m	1	1.9070E-05	9.7450E-06
Ba-137m	2	1.0340E-06	5.2840E-07
Ba-137m	3	9.4930E-06	4.8510E-06
U-233	1	4.7900E-08	0.0000E+00
U-233	2	6.7700E-09	0.0000E+00
U-233	3	5.4000E-09	0.0000E+00
U-238	1	5.4000E-08	0.0000E+00
U-238	2	7.1400E-09	0.0000E+00
U-238	3	5.1800E-09	0.0000E+00
Th-234	1	0.0000E+00	0.0000E+00
Th-234	2	0.0000E+00	0.0000E+00
Th-234	3	0.0000E+00	0.0000E+00
Pa-234m	1	0.0000E+00	0.0000E+00
Pa-234m	2	0.0000E+00	0.0000E+00
Pa-234m	3	0.0000E+00	0.0000E+00
Pa-234	1	0.0000E+00	0.0000E+00
Pa-234	2	0.0000E+00	0.0000E+00
Pa-234	3	0.0000E+00	0.0000E+00

VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS

HUMAN INHALATION RATE	
Cubic centimeters/hr	9.17E+05
SOIL PARAMETERS	
Effective surface density (kg/sq m, dry weight) (Assumes 15 cm plow layer)	2.15E+02
BUILDUP TIMES	
For activity in soil (years)	1.00E+02
For radionuclides deposited on ground/water (days)	3.65E+04
DELAY TIMES	
Ingestion of pasture grass by animals (hr)	0.00E+00
Ingestion of stored feed by animals (hr)	2.16E+03
Ingestion of leafy vegetables by man (hr)	3.36E+02
Ingestion of produce by man (hr)	3.36E+02
Transport time from animal feed-milk-man (day)	2.00E+00
Time from slaughter to consumption (day)	2.00E+01
WEATHERING	
Removal rate constant for physical loss (per hr)	2.90E-03
CROP EXPOSURE DURATION	
Pasture grass (hr)	7.20E+02
Crops/leafy vegetables (hr)	1.44E+03
AGRICULTURAL PRODUCTIVITY	
Grass-cow-milk-man pathway (kg/sq m)	2.80E-01
Produce/leafy veg for human consumption (kg/sq m)	7.16E-01
FALLOUT INTERCEPTION FRACTIONS	
Vegetables	2.00E-01
Pasture	5.70E-01
GRAZING PARAMETERS	
Fraction of year animals graze on pasture	4.00E-01
Fraction of daily feed that is pasture grass when animal grazes on pasture	4.30E-01

VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS

ANIMAL FEED CONSUMPTION FACTORS	
Contaminated feed/forage (kg/day, dry weight)	1.56E+01
DAIRY PRODUCTIVITY	
Milk production of cow (L/day)	1.10E+01
MEAT ANIMAL SLAUGHTER PARAMETERS	
Muscle mass of animal at slaughter (kg)	2.00E+02
Fraction of herd slaughtered (per day)	3.81E-03
DECONTAMINATION	
Fraction of radioactivity retained after washing for leafy vegetables and produce	5.00E-01
FRACTIONS GROWN IN GARDEN OF INTEREST	
Produce ingested	1.00E+00
Leafy vegetables ingested	1.00E+00
INGESTION RATIOS:	
IMMEDIATE SURROUNDING AREA/TOTAL WITHIN AREA	
Vegetables	1.00E+00
Meat	1.00E+00
Milk	1.00E+00
MINIMUM INGESTION FRACTIONS FROM OUTSIDE AREA (Minimum fractions of food types from outside area listed below are actual fixed values.)	
Vegetables	0.00E+00
Meat	0.00E+00
Milk	0.00E+00
HUMAN FOOD UTILIZATION FACTORS	
Produce ingestion (kg/y)	1.76E+02
Milk ingestion (L/y)	1.12E+02
Meat ingestion (kg/y)	8.50E+01
Leafy vegetable ingestion (kg/y)	1.80E+01
SWIMMING PARAMETERS	
Fraction of time spent swimming	0.00E+00
Dilution factor for water (cm)	1.00E+00

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Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S
Non-Radon Individual Assessment
May 15, 2014 01:02 pm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2013

Comments: CY 2013 WIPP Compliance Report
40 CFR Part 191, Subpart A MEOSI

Dataset Name: 2013_191SubpartA
Dataset Date: 5/15/2014 11:57:00 AM
Wind File: . C:\Program Files\CAP88-PC30\WndFiles\WIPP2013.WND

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
Adrenals	6.32E-06
B Surfac	1.81E-05
Breasts	5.08E-06
St Wall	6.04E-06
ULI Wall	6.64E-06
Kidneys	6.08E-06
Lungs	6.05E-06
Ovaries	6.46E-06
R Marrow	1.08E-05
Spleen	6.08E-06
Thymus	5.90E-06
Uterus	6.50E-06
Bld Wall	6.53E-06
Brain	5.32E-06
Esophagu	5.92E-06
SI Wall	6.32E-06
LLI Wall	8.09E-06
Liver	6.22E-06
Muscle	5.67E-06
Pancreas	6.48E-06
Skin	5.19E-06
Testes	5.69E-06
Thyroid	5.90E-06
EFFEC	7.39E-06

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	6.75E-06
INHALATION	5.45E-07
AIR IMMERSION	2.43E-10
GROUND SURFACE	8.86E-08
INTERNAL	7.30E-06
EXTERNAL	8.89E-08
TOTAL	7.39E-06

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NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
Am-241	1.57E-07
Np-237	0.00E+00
Pa-233	0.00E+00
U-233	0.00E+00
Th-229	0.00E+00
Ra-225	0.00E+00
Ac-225	0.00E+00
Fr-221	0.00E+00
At-217	0.00E+00
Bi-213	0.00E+00
Pu-238	1.39E-07
U-234	0.00E+00
Th-230	0.00E+00
Ra-226	0.00E+00
Rn-222	0.00E+00
Pu-239	1.16E-07
U-235	0.00E+00
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Sr-90	7.90E-07
Y-90	1.32E-09
Cs-137	6.01E-06
Ba-137m	8.70E-08
U-233	4.48E-08
U-238	4.14E-08
Th-234	0.00E+00
Pa-234m	0.00E+00
Pa-234	0.00E+00
TOTAL	7.39E-06

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
Esophagu	6.33E-14
Stomach	2.27E-13
Colon	6.86E-13
Liver	1.13E-13
LUNG	5.89E-13
Bone	2.94E-14
Skin	4.76E-15
Breast	1.89E-13
Ovary	7.92E-14
Bladder	1.62E-13
Kidneys	3.21E-14
Thyroid	1.55E-14
Leukemia	6.76E-13
Residual	8.29E-13
Total	3.69E-12
TOTAL	7.39E-12

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	3.48E-12
INHALATION	1.62E-13
AIR IMMERSION	1.32E-16
GROUND SURFACE	4.71E-14
INTERNAL	3.65E-12
EXTERNAL	4.72E-14
TOTAL	3.69E-12

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NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
Am-241	2.48E-14
Np-237	0.00E+00
Pa-233	0.00E+00
U-233	0.00E+00
Th-229	0.00E+00
Ra-225	0.00E+00
Ac-225	0.00E+00
Fr-221	0.00E+00
At-217	0.00E+00
Bi-213	0.00E+00
Pu-238	2.42E-14
U-234	0.00E+00
Th-230	0.00E+00
Ra-226	0.00E+00
Rn-222	0.00E+00
Pu-239	1.83E-14
U-235	0.00E+00
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Sr-90	4.66E-13
Y-90	1.58E-16
Cs-137	3.05E-12
Ba-137m	4.70E-14
U-233	3.39E-14
U-238	3.13E-14
Th-234	0.00E+00
Pa-234m	0.00E+00
Pa-234	0.00E+00
TOTAL	3.69E-12

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INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)
Direction	7500
N	2.9E-06
NNW	6.1E-06
NW	1.0E-05
WNW	7.4E-06
W	3.3E-06
WSW	2.2E-06
SW	2.2E-06
SSW	2.3E-06
S	1.3E-06
SSE	1.3E-06
SE	1.6E-06
ESE	1.3E-06
E	1.4E-06
ENE	1.7E-06
NE	1.5E-06
NNE	1.9E-06

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INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)
Direction	7500
N	1.5E-12
NNW	3.1E-12
NW	5.2E-12
WNW	3.7E-12
W	1.7E-12
WSW	1.1E-12
SW	1.1E-12
SSW	1.2E-12
S	6.5E-13
SSE	6.3E-13
SE	8.1E-13
ESE	6.4E-13
E	6.8E-13
ENE	8.7E-13
NE	7.5E-13
NNE	9.3E-13

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W E A T H E R D A T A
Non-Radon Individual Assessment
May 15, 2014 01:02 pm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2013

Comments: CY 2013 WIPP Compliance Report
40 CFR Part 191, Subpart A MEOSI

Dataset Name: 2013_191SubpartA
Dataset Date: 5/15/2014 11:57:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\WIPP2013.WND

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HARMONIC AVERAGE WIND SPEEDS (WIND TOWARDS)

	Pasquill Stability Class							
Dir	A	B	C	D	E	F	G	Wind Freq
N	1.966	3.126	3.216	3.672	2.767	3.079	0.000	0.068
NNW	2.188	3.314	3.786	4.124	3.859	3.526	0.000	0.127
NW	2.174	3.389	3.615	4.734	4.122	3.186	0.000	0.199
WNW	1.964	2.245	2.669	3.700	4.148	3.623	0.000	0.118
W	1.737	2.191	2.430	3.932	4.330	3.504	0.000	0.059
WSW	1.742	2.016	3.110	4.476	4.341	3.726	0.000	0.040
SW	1.695	2.962	2.761	4.234	3.539	3.357	0.000	0.039
SSW	1.718	2.485	3.474	3.679	3.167	3.236	0.000	0.041
S	2.039	3.392	4.271	3.395	3.330	2.867	0.000	0.036
SSE	1.860	3.064	3.789	4.335	3.559	2.686	0.000	0.033
SE	1.602	2.590	3.286	3.322	2.538	2.713	0.000	0.031
ESE	1.693	2.691	2.805	3.337	2.378	1.852	0.000	0.025
E	1.833	2.871	3.623	6.061	4.547	3.239	0.000	0.040
ENE	1.945	3.049	3.971	5.098	3.064	0.000	0.000	0.052
NE	2.049	2.958	3.375	3.963	2.905	0.000	0.000	0.043
NNE	2.088	2.645	3.683	3.505	3.009	3.079	0.000	0.050

ARITHMETIC AVERAGE WIND SPEEDS (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	3.011	4.208	4.749	4.757	3.435	3.292	0.000
NNW	3.358	4.610	5.169	5.466	4.607	3.755	0.000
NW	3.405	4.761	5.218	5.803	4.719	3.523	0.000
WNW	2.978	3.784	4.007	4.859	4.603	3.995	0.000
W	2.738	3.521	3.805	5.083	5.107	3.931	0.000
WSW	2.868	3.496	4.583	6.124	5.500	3.944	0.000
SW	2.626	4.184	4.204	6.512	4.911	3.691	0.000
SSW	2.669	3.943	5.207	5.561	3.972	3.602	0.000
S	3.132	5.372	5.634	4.403	4.367	3.022	0.000
SSE	2.794	4.144	5.419	5.607	4.001	3.403	0.000
SE	2.518	3.450	4.350	5.011	3.223	3.254	0.000
ESE	2.608	3.434	3.920	4.927	3.475	2.272	0.000
E	2.687	3.768	5.121	7.878	6.104	3.472	0.000
ENE	2.993	4.314	5.498	6.618	4.452	0.000	0.000
NE	2.975	4.060	4.888	5.407	3.601	0.000	0.000
NNE	2.975	3.837	4.703	4.748	3.538	3.292	0.000

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FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	0.2141	0.1299	0.2424	0.2932	0.1138	0.0066	0.0000
NNW	0.1055	0.0730	0.1622	0.3889	0.2518	0.0186	0.0000
NW	0.0631	0.0463	0.0952	0.4068	0.3538	0.0349	0.0000
WNW	0.0669	0.0392	0.0604	0.2799	0.4981	0.0555	0.0000
W	0.1106	0.0427	0.0767	0.3761	0.3501	0.0437	0.0000
WSW	0.1259	0.0498	0.0945	0.3307	0.3307	0.0684	0.0000
SW	0.1454	0.0533	0.1066	0.3713	0.2573	0.0661	0.0000
SSW	0.1491	0.0649	0.1532	0.3784	0.1993	0.0551	0.0000
S	0.1765	0.1278	0.3668	0.2404	0.0783	0.0101	0.0000
SSE	0.2347	0.1379	0.2284	0.2843	0.1028	0.0118	0.0000
SE	0.2304	0.0953	0.2094	0.3192	0.1099	0.0359	0.0000
ESE	0.2619	0.1031	0.1966	0.3045	0.1268	0.0072	0.0000
E	0.2222	0.0853	0.1648	0.3950	0.1297	0.0030	0.0000
ENE	0.2218	0.1123	0.2097	0.4010	0.0551	0.0000	0.0000
NE	0.3013	0.1573	0.2102	0.2841	0.0471	0.0000	0.0000
NNE	0.2832	0.1561	0.2336	0.2515	0.0726	0.0030	0.0000
TOTAL	0.1468	0.0795	0.1520	0.3455	0.2475	0.0288	0.0000

ADDITIONAL WEATHER INFORMATION

Average Air Temperature: 17.5 degrees C
290.63 K
Precipitation: 22.5 cm/y
Humidity: 8.0 g/cu m
Lid Height: 1000 meters
Surface Roughness Length: 0.010 meters
Height Of Wind Measurements: 10.0 meters
Average Wind Speed: 4.708 m/s
Vertical Temperature Gradients:
STABILITY E 0.073 k/m
STABILITY F 0.109 k/m
STABILITY G 0.146 k/m

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C O N C E N T R A T I O N T A B L E S
Non-Radon Individual Assessment
May 15, 2014 01:02 pm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2013

Comments: CY 2013 WIPP Compliance Report
40 CFR Part 191, Subpart A MEOSI

Dataset Name: 2013_191SubpartA
Dataset Date: 5/15/2014 11:57:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\WIPP2013.WND

May 15, 2014 01:02 pm CONCEN
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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
N	7500	Am-241	4.40E-11	7.93E-18	2.67E-18	1.06E-17
N	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Pu-238	3.52E-11	6.34E-18	2.14E-18	8.48E-18
N	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Pu-239	2.70E-11	4.86E-18	1.64E-18	6.49E-18
N	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Sr-90	2.54E-09	4.57E-16	1.54E-16	6.10E-16
N	7500	Y-90	3.01E-12	5.42E-19	1.82E-19	7.24E-19
N	7500	Cs-137	3.16E-08	5.70E-15	1.92E-15	7.61E-15
N	7500	Ba-137m	2.68E-08	4.83E-15	1.63E-15	6.45E-15
N	7500	U-233	5.45E-11	9.81E-18	3.30E-18	1.31E-17
N	7500	U-238	6.02E-11	1.08E-17	3.64E-18	1.45E-17
N	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Am-241	1.00E-10	1.80E-17	3.96E-18	2.20E-17
NNW	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Pu-238	8.00E-11	1.44E-17	3.17E-18	1.76E-17
NNW	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Pu-239	6.13E-11	1.10E-17	2.43E-18	1.35E-17
NNW	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00

NNW	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
NNW	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Sr-90	5.76E-09	1.04E-15	2.28E-16	1.26E-15
NNW	7500	Y-90	6.84E-12	1.23E-18	2.71E-19	1.50E-18
NNW	7500	Cs-137	7.18E-08	1.29E-14	2.85E-15	1.58E-14
NNW	7500	Ba-137m	6.08E-08	1.10E-14	2.41E-15	1.34E-14
NNW	7500	U-233	1.24E-10	2.23E-17	4.90E-18	2.72E-17
NNW	7500	U-238	1.37E-10	2.46E-17	5.41E-18	3.00E-17
NNW	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNW	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Am-241	1.77E-10	3.19E-17	5.62E-18	3.75E-17
NW	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Pu-238	1.42E-10	2.55E-17	4.49E-18	3.00E-17
NW	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Pu-239	1.09E-10	1.95E-17	3.44E-18	2.30E-17
NW	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Sr-90	1.02E-08	1.84E-15	3.23E-16	2.16E-15
NW	7500	Y-90	1.21E-11	2.18E-18	3.84E-19	2.57E-18
NW	7500	Cs-137	1.27E-07	2.29E-14	4.04E-15	2.69E-14
NW	7500	Ba-137m	1.08E-07	1.94E-14	3.42E-15	2.28E-14
NW	7500	U-233	2.19E-10	3.95E-17	6.94E-18	4.64E-17
NW	7500	U-238	2.42E-10	4.36E-17	7.66E-18	5.13E-17
NW	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NW	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Am-241	1.27E-10	2.28E-17	3.74E-18	2.65E-17
WNW	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00

WNW	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
WNW	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Pu-238	1.01E-10	1.83E-17	2.99E-18	2.12E-17
WNW	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Pu-239	7.76E-11	1.40E-17	2.29E-18	1.63E-17
WNW	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Sr-90	7.30E-09	1.31E-15	2.15E-16	1.53E-15
WNW	7500	Y-90	8.67E-12	1.56E-18	2.56E-19	1.82E-18
WNW	7500	Cs-137	9.09E-08	1.64E-14	2.69E-15	1.91E-14
WNW	7500	Ba-137m	7.70E-08	1.39E-14	2.28E-15	1.61E-14
WNW	7500	U-233	1.57E-10	2.83E-17	4.62E-18	3.29E-17
WNW	7500	U-238	1.73E-10	3.12E-17	5.10E-18	3.63E-17
WNW	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WNW	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Am-241	5.50E-11	9.91E-18	2.00E-18	1.19E-17
W	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Pu-238	4.41E-11	7.93E-18	1.60E-18	9.53E-18
W	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Pu-239	3.37E-11	6.07E-18	1.22E-18	7.30E-18
W	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Sr-90	3.17E-09	5.71E-16	1.15E-16	6.86E-16
W	7500	Y-90	3.77E-12	6.79E-19	1.36E-19	8.15E-19
W	7500	Cs-137	3.95E-08	7.11E-15	1.44E-15	8.55E-15
W	7500	Ba-137m	3.35E-08	6.03E-15	1.22E-15	7.24E-15

W	7500	U-233	6.82E-11	1.23E-17	2.47E-18	1.47E-17

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
W	7500	U-238	7.53E-11	1.36E-17	2.72E-18	1.63E-17
W	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Am-241	3.58E-11	6.44E-18	1.32E-18	7.75E-18
WSW	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Pu-238	2.86E-11	5.15E-18	1.05E-18	6.21E-18
WSW	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Pu-239	2.19E-11	3.95E-18	8.07E-19	4.75E-18
WSW	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Sr-90	2.06E-09	3.71E-16	7.59E-17	4.47E-16
WSW	7500	Y-90	2.45E-12	4.41E-19	9.00E-20	5.31E-19
WSW	7500	Cs-137	2.57E-08	4.62E-15	9.47E-16	5.57E-15
WSW	7500	Ba-137m	2.18E-08	3.92E-15	8.03E-16	4.72E-15
WSW	7500	U-233	4.44E-11	7.98E-18	1.63E-18	9.61E-18
WSW	7500	U-238	4.90E-11	8.82E-18	1.80E-18	1.06E-17
WSW	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSW	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Am-241	3.70E-11	6.66E-18	1.41E-18	8.08E-18
SW	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Pu-238	2.96E-11	5.33E-18	1.13E-18	6.47E-18
SW	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00

SW	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
SW	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Pu-239	2.27E-11	4.08E-18	8.67E-19	4.95E-18
SW	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Sr-90	2.13E-09	3.84E-16	8.15E-17	4.65E-16
SW	7500	Y-90	2.53E-12	4.56E-19	9.67E-20	5.53E-19
SW	7500	Cs-137	2.66E-08	4.78E-15	1.02E-15	5.80E-15
SW	7500	Ba-137m	2.25E-08	4.05E-15	8.62E-16	4.92E-15
SW	7500	U-233	4.59E-11	8.26E-18	1.75E-18	1.00E-17
SW	7500	U-238	5.07E-11	9.12E-18	1.93E-18	1.10E-17
SW	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Am-241	3.77E-11	6.79E-18	1.55E-18	8.34E-18
SSW	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Pu-238	3.02E-11	5.43E-18	1.24E-18	6.68E-18
SSW	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Pu-239	2.31E-11	4.16E-18	9.52E-19	5.11E-18
SSW	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Sr-90	2.17E-09	3.91E-16	8.95E-17	4.81E-16
SSW	7500	Y-90	2.58E-12	4.64E-19	1.06E-19	5.71E-19
SSW	7500	Cs-137	2.71E-08	4.88E-15	1.12E-15	5.99E-15
SSW	7500	Ba-137m	2.30E-08	4.13E-15	9.47E-16	5.08E-15
SSW	7500	U-233	4.67E-11	8.41E-18	1.92E-18	1.03E-17
SSW	7500	U-238	5.16E-11	9.29E-18	2.12E-18	1.14E-17
SSW	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSW	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Am-241	1.91E-11	3.45E-18	1.24E-18	4.68E-18
S	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00

S	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
S	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Pu-238	1.53E-11	2.76E-18	9.89E-19	3.75E-18
S	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Pu-239	1.17E-11	2.11E-18	7.57E-19	2.87E-18
S	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Sr-90	1.10E-09	1.98E-16	7.12E-17	2.70E-16
S	7500	Y-90	1.31E-12	2.36E-19	8.44E-20	3.20E-19
S	7500	Cs-137	1.38E-08	2.48E-15	8.88E-16	3.36E-15
S	7500	Ba-137m	1.17E-08	2.10E-15	7.53E-16	2.85E-15
S	7500	U-233	2.37E-11	4.26E-18	1.53E-18	5.79E-18
S	7500	U-238	2.62E-11	4.71E-18	1.69E-18	6.39E-18
S	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Am-241	1.84E-11	3.31E-18	1.23E-18	4.54E-18
SSE	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Pu-238	1.47E-11	2.65E-18	9.87E-19	3.63E-18
SSE	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Pu-239	1.13E-11	2.03E-18	7.56E-19	2.78E-18
SSE	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00

SSE	7500	Sr-90	1.06E-09	1.91E-16	7.10E-17	2.62E-16

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
SSE	7500	Y-90	1.26E-12	2.26E-19	8.43E-20	3.11E-19
SSE	7500	Cs-137	1.32E-08	2.38E-15	8.86E-16	3.26E-15
SSE	7500	Ba-137m	1.12E-08	2.01E-15	7.51E-16	2.77E-15
SSE	7500	U-233	2.28E-11	4.10E-18	1.52E-18	5.62E-18
SSE	7500	U-238	2.51E-11	4.52E-18	1.68E-18	6.20E-18
SSE	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SSE	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Am-241	2.50E-11	4.49E-18	1.37E-18	5.87E-18
SE	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Pu-238	2.00E-11	3.60E-18	1.10E-18	4.70E-18
SE	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Pu-239	1.53E-11	2.75E-18	8.43E-19	3.59E-18
SE	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Sr-90	1.44E-09	2.59E-16	7.92E-17	3.38E-16
SE	7500	Y-90	1.71E-12	3.07E-19	9.39E-20	4.01E-19
SE	7500	Cs-137	1.79E-08	3.23E-15	9.88E-16	4.22E-15
SE	7500	Ba-137m	1.52E-08	2.74E-15	8.37E-16	3.57E-15
SE	7500	U-233	3.09E-11	5.56E-18	1.70E-18	7.26E-18
SE	7500	U-238	3.41E-11	6.14E-18	1.88E-18	8.02E-18
SE	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Am-241	1.92E-11	3.46E-18	1.15E-18	4.61E-18
ESE	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00

ESE	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
ESE	7500	Pu-238	1.54E-11	2.77E-18	9.19E-19	3.69E-18
ESE	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Pu-239	1.18E-11	2.12E-18	7.04E-19	2.82E-18
ESE	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Sr-90	1.11E-09	1.99E-16	6.62E-17	2.65E-16
ESE	7500	Y-90	1.31E-12	2.36E-19	7.85E-20	3.15E-19
ESE	7500	Cs-137	1.38E-08	2.49E-15	8.26E-16	3.31E-15
ESE	7500	Ba-137m	1.17E-08	2.11E-15	7.00E-16	2.81E-15
ESE	7500	U-233	2.38E-11	4.28E-18	1.42E-18	5.70E-18
ESE	7500	U-238	2.62E-11	4.72E-18	1.57E-18	6.29E-18
ESE	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ESE	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Am-241	2.01E-11	3.62E-18	1.31E-18	4.94E-18
E	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Pu-238	1.61E-11	2.90E-18	1.05E-18	3.95E-18
E	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Pu-239	1.23E-11	2.22E-18	8.05E-19	3.02E-18
E	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E	7500	Sr-90	1.16E-09	2.09E-16	7.56E-17	2.84E-16
E	7500	Y-90	1.38E-12	2.48E-19	8.97E-20	3.38E-19
E	7500	Cs-137	1.44E-08	2.60E-15	9.44E-16	3.54E-15
E	7500	Ba-137m	1.22E-08	2.20E-15	8.00E-16	3.00E-15
E	7500	U-233	2.49E-11	4.48E-18	1.62E-18	6.11E-18
E	7500	U-238	2.75E-11	4.95E-18	1.79E-18	6.74E-18
E	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00

E	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ESTIMATED RADIONUCLIDE CONCENTRATIONS
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AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
E	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Am-241	2.52E-11	4.54E-18	1.75E-18	6.29E-18
ENE	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Pu-238	2.02E-11	3.63E-18	1.40E-18	5.03E-18
ENE	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Pu-239	1.54E-11	2.78E-18	1.07E-18	3.85E-18
ENE	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Sr-90	1.45E-09	2.61E-16	1.01E-16	3.62E-16
ENE	7500	Y-90	1.72E-12	3.10E-19	1.20E-19	4.30E-19
ENE	7500	Cs-137	1.81E-08	3.26E-15	1.26E-15	4.52E-15
ENE	7500	Ba-137m	1.53E-08	2.76E-15	1.07E-15	3.83E-15
ENE	7500	U-233	3.12E-11	5.61E-18	2.16E-18	7.78E-18
ENE	7500	U-238	3.44E-11	6.20E-18	2.39E-18	8.59E-18
ENE	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ENE	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Am-241	2.07E-11	3.72E-18	1.68E-18	5.40E-18
NE	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Pu-238	1.65E-11	2.97E-18	1.35E-18	4.32E-18
NE	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Pu-239	1.27E-11	2.28E-18	1.03E-18	3.31E-18

NE	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00

May 15, 2014 01:02 pm CONCEN
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ESTIMATED RADIONUCLIDE CONCENTRATIONS
AT VARIOUS LOCATIONS IN THE ENVIRONMENT
AT TIME T = 500. SECONDS

Wind Toward	Distance (meters)	Nuclide	Air Conc (pCi/m3)	Dry Depo Rate (pCi/cm2/s)	Wet Depo Rate (pCi/cm2/s)	Ground Depo Rate (pCi/cm2/s)
NE	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Sr-90	1.19E-09	2.14E-16	9.69E-17	3.11E-16
NE	7500	Y-90	1.41E-12	2.54E-19	1.15E-19	3.69E-19
NE	7500	Cs-137	1.48E-08	2.67E-15	1.21E-15	3.88E-15
NE	7500	Ba-137m	1.26E-08	2.26E-15	1.02E-15	3.29E-15
NE	7500	U-233	2.55E-11	4.60E-18	2.08E-18	6.68E-18
NE	7500	U-238	2.82E-11	5.08E-18	2.29E-18	7.37E-18
NE	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NE	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Am-241	2.65E-11	4.77E-18	1.99E-18	6.76E-18
NNE	7500	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Pa-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	U-233	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Ra-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Ac-225	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Fr-221	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	At-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Bi-213	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Pu-238	2.12E-11	3.82E-18	1.59E-18	5.41E-18
NNE	7500	U-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Ra-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Pu-239	1.62E-11	2.92E-18	1.22E-18	4.14E-18
NNE	7500	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Th-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Pa-231	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Ac-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Sr-90	1.53E-09	2.75E-16	1.15E-16	3.90E-16
NNE	7500	Y-90	1.81E-12	3.26E-19	1.36E-19	4.62E-19
NNE	7500	Cs-137	1.90E-08	3.43E-15	1.43E-15	4.86E-15
NNE	7500	Ba-137m	1.61E-08	2.90E-15	1.21E-15	4.12E-15
NNE	7500	U-233	3.28E-11	5.90E-18	2.46E-18	8.36E-18
NNE	7500	U-238	3.62E-11	6.52E-18	2.72E-18	9.23E-18
NNE	7500	Th-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Pa-234m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NNE	7500	Pa-234	0.00E+00	0.00E+00	0.00E+00	0.00E+00

C A P 8 8 - P C
Version 3.0

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K C O N V E R S I O N F A C T O R S
Non-Radon Individual Assessment
May 15, 2014 01:02 pm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2013

Comments: CY 2013 WIPP Compliance Report
40 CFR Part 191, Subpart A MEOSI

Dataset Name: 2013_191SubpartA
Dataset Date: 5/15/2014 11:57:00 AM
Wind File: . C:\Program Files\CAP88-PC30\WndFiles\WIPP2013.WND

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DOSE AND RISK FACTOR UNITS

The units for each type of dose rate conversion factor are shown below, by pathway:

Pathway	Units
Ingestion	millirem/picoCurie
Inhalation	millirem/picoCurie
Immersion	millirem-cubic cm/microCurie-year
Surface	millirem-square cm/microCurie-year

Risks for internal exposures (inhalation and ingestion) are the lifetime risk of premature death in a birth cohort of 100,000 people for a 1 picoCurie/year intake rate, where the average lifetime is 70.7565 years.
This is simplified to lifetime risk per 100,000 picoCuries.

The units for each type of risk conversion factor are shown below, by pathway:

Pathway	Units
Ingestion	lifetime risk/100,000 picoCuries
Inhalation	lifetime risk/100,000 picoCuries
Immersion	lifetime risk-cubic cm/100,000 picoCurie-years
Surface	lifetime risk-square cm/100,000 picoCurie-years

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* NUCLIDE Am-241 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.831E-06	5.321E-04	5.289E+07	1.713E+04
B Surfac	1.670E-03	3.149E-01	3.344E+08	1.083E+05
Breasts	2.831E-06	5.321E-04	1.247E+08	4.101E+04
St Wall	3.065E-06	5.321E-04	6.466E+07	2.097E+04
ULI Wall	6.371E-06	5.332E-04	5.277E+07	1.841E+04
Kidneys	8.540E-06	1.613E-03	7.002E+07	2.225E+04
Lungs	2.831E-06	6.849E-03	7.852E+07	2.342E+04
Ovaries	3.237E-05	6.109E-03	4.380E+07	1.724E+04
R Marrow	5.676E-05	1.072E-02	6.070E+07	1.957E+04
Spleen	2.831E-06	5.321E-04	6.524E+07	2.109E+04
Thymus	2.831E-06	5.321E-04	7.596E+07	2.283E+04
Uterus	2.831E-06	5.321E-04	4.520E+07	1.666E+04
Bld Wall	2.831E-06	5.321E-04	6.023E+07	2.062E+04
Brain	2.831E-06	5.321E-04	7.258E+07	1.806E+04
Esophagu	2.831E-06	1.731E-03	4.357E+07	1.386E+04
SI Wall	3.415E-06	5.324E-04	4.765E+07	1.713E+04
LLI Wall	1.322E-05	5.346E-04	4.835E+07	1.782E+04
Liver	1.023E-04	1.932E-02	6.571E+07	2.109E+04
Muscle	2.831E-06	5.321E-04	8.516E+07	3.285E+04
Pancreas	2.831E-06	5.321E-04	4.485E+07	1.608E+04
Skin	2.831E-06	5.321E-04	1.491E+08	9.693E+04
Testes	3.209E-05	6.053E-03	9.996E+07	3.786E+04
Thyroid	2.831E-06	5.321E-04	9.122E+07	2.575E+04
EFFEC	7.548E-04	1.543E-01	7.887E+07	2.714E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.366E-08	6.808E-06	5.009E-02	1.596E-05
Stomach	1.310E-07	1.399E-05	2.610E-01	8.470E-05
Colon	2.727E-06	2.727E-05	5.254E-01	1.876E-04
Liver	2.701E-06	4.366E-04	9.961E-02	3.192E-05
LUNG	2.941E-07	1.373E-03	7.677E-01	2.295E-04
Bone	2.031E-06	3.415E-04	3.180E-02	1.029E-05
Skin	2.960E-09	4.218E-07	1.491E-02	9.669E-06
Breast	5.587E-08	7.844E-06	6.023E-01	1.980E-04
Ovary	5.920E-07	1.032E-04	6.233E-02	2.458E-05
Bladder	1.073E-07	1.628E-05	1.456E-01	4.986E-05
Kidneys	8.843E-08	1.365E-05	3.646E-02	1.158E-05
Thyroid	8.214E-09	1.154E-06	2.901E-02	8.202E-06
Leukemia	3.226E-07	4.958E-05	3.402E-01	1.099E-04
Residual	3.545E-07	4.736E-05	9.075E-01	3.274E-04
Total	9.472E-06	2.438E-03	3.879E+00	1.293E-03

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* NUCLIDE Np-237 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	1.313E-06	2.471E-04	7.724E+07	2.027E+04
B Surfac	1.005E-03	1.898E-01	3.728E+08	9.273E+04
Breasts	1.313E-06	2.471E-04	1.468E+08	4.206E+04
St Wall	1.517E-06	2.472E-04	8.912E+07	2.318E+04
ULI Wall	4.396E-06	2.479E-04	7.794E+07	2.132E+04
Kidneys	3.564E-06	6.741E-04	9.343E+07	2.470E+04
Lungs	1.313E-06	5.273E-03	1.051E+08	2.540E+04
Ovaries	1.335E-05	2.522E-03	6.792E+07	2.015E+04
R Marrow	3.833E-05	7.248E-03	8.959E+07	2.353E+04
Spleen	1.313E-06	2.471E-04	9.052E+07	2.330E+04
Thymus	1.313E-06	2.471E-04	1.005E+08	2.423E+04
Uterus	1.313E-06	2.471E-04	7.025E+07	2.015E+04
Bld Wall	1.313E-06	2.472E-04	8.423E+07	2.365E+04
Brain	1.313E-06	2.471E-04	1.017E+08	2.062E+04
Esophagu	1.313E-06	1.341E-03	7.048E+07	1.759E+04
SI Wall	1.822E-06	2.472E-04	7.246E+07	2.004E+04
LLI Wall	1.035E-05	2.493E-04	7.316E+07	2.085E+04
Liver	1.595E-05	3.018E-03	9.087E+07	2.330E+04
Muscle	1.313E-06	2.471E-04	1.085E+08	3.495E+04
Pancreas	1.313E-06	2.471E-04	7.037E+07	1.911E+04
Skin	1.313E-06	2.471E-04	1.794E+08	9.739E+04
Testes	1.358E-05	2.566E-03	1.212E+08	3.938E+04
Thyroid	1.313E-06	2.471E-04	1.158E+08	2.854E+04
EFFEC	3.959E-04	8.399E-02	1.037E+08	2.936E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.401E-08	3.667E-06	8.108E-02	2.027E-05
Stomach	8.917E-08	8.510E-06	3.600E-01	9.355E-05
Colon	2.405E-06	1.783E-05	7.829E-01	2.179E-04
Liver	4.588E-07	7.400E-05	1.375E-01	3.530E-05
LUNG	1.739E-07	1.088E-03	1.028E+00	2.481E-04
Bone	1.288E-06	2.183E-04	3.542E-02	8.807E-06
Skin	1.757E-09	2.431E-07	1.794E-02	9.716E-06
Breast	3.567E-08	4.810E-06	7.095E-01	2.027E-04
Ovary	2.849E-07	4.921E-05	9.658E-02	2.866E-05
Bladder	5.772E-08	8.584E-06	2.039E-01	5.720E-05
Kidneys	4.514E-08	6.771E-06	4.858E-02	1.281E-05
Thyroid	5.069E-09	6.808E-07	3.681E-02	9.087E-06
Leukemia	2.331E-07	3.678E-05	5.033E-01	1.316E-04
Residual	2.264E-07	2.941E-05	1.270E+00	3.693E-04
Total	5.328E-06	1.547E-03	5.312E+00	1.445E-03

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* NUCLIDE Pa-233 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	3.552E-13	3.425E-11	8.365E+08	1.876E+05
B Surfac	8.443E-12	8.547E-10	2.423E+09	4.264E+05
Breasts	3.552E-13	3.425E-11	1.223E+09	2.342E+05
St Wall	3.553E-13	3.425E-11	9.064E+08	2.004E+05
ULI Wall	3.829E-13	3.430E-11	8.318E+08	1.957E+05
Kidneys	5.439E-12	4.965E-10	9.180E+08	2.015E+05
Lungs	3.552E-13	1.238E-09	1.035E+09	2.132E+05
Ovaries	3.175E-12	2.614E-10	7.549E+08	2.015E+05
R Marrow	8.795E-13	8.791E-11	9.635E+08	2.120E+05
Spleen	3.552E-13	3.425E-11	9.250E+08	2.015E+05
Thymus	3.552E-13	3.425E-11	9.704E+08	1.992E+05
Uterus	3.552E-13	3.425E-11	7.736E+08	1.922E+05
Bld Wall	3.554E-13	3.429E-11	8.563E+08	2.027E+05
Brain	3.552E-13	3.425E-11	1.073E+09	1.969E+05
Esophagu	3.552E-13	4.521E-10	8.097E+08	1.759E+05
SI Wall	3.564E-13	3.426E-11	7.910E+08	1.911E+05
LLI Wall	5.417E-13	3.441E-11	8.015E+08	1.969E+05
Liver	1.078E-12	1.093E-10	9.215E+08	2.004E+05
Muscle	3.552E-13	3.425E-11	1.012E+09	2.330E+05
Pancreas	3.552E-13	3.425E-11	7.864E+08	1.829E+05
Skin	3.552E-13	3.425E-11	1.934E+09	3.146E+05
Testes	3.224E-12	2.654E-10	1.067E+09	2.388E+05
Thyroid	3.552E-13	3.425E-11	1.073E+09	2.190E+05
EFFEC	3.247E-06	1.232E-05	9.984E+08	2.167E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	1.069E-11	6.845E-10	9.320E-01	2.027E-04
Stomach	6.290E-09	2.601E-09	3.658E+00	8.085E-04
Colon	4.366E-07	8.991E-08	8.458E+00	2.027E-03
Liver	1.720E-10	1.424E-09	1.398E+00	3.041E-04
LUNG	2.494E-10	9.546E-07	1.011E+01	2.085E-03
Bone	4.181E-11	2.102E-09	2.307E-01	4.054E-05
Skin	4.440E-12	1.820E-11	1.934E-01	3.134E-05
Breast	8.214E-11	2.420E-09	5.907E+00	1.131E-03
Ovary	1.454E-09	7.289E-10	1.074E+00	2.866E-04
Bladder	8.880E-10	4.921E-10	2.074E+00	4.905E-04
Kidneys	8.621E-11	7.733E-10	4.777E-01	1.048E-04
Thyroid	1.761E-12	9.398E-11	3.413E-01	6.978E-05
Leukemia	1.273E-09	1.698E-08	5.406E+00	1.188E-03
Residual	1.913E-09	7.326E-09	1.305E+01	2.994E-03
Total	4.514E-07	1.080E-06	5.336E+01	1.177E-02

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* NUCLIDE U-233 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	5.254E-06	2.607E-05	1.212E+06	3.087E+02
B Surfac	1.551E-04	7.929E-04	4.800E+06	1.549E+03
Breasts	5.254E-06	2.607E-05	2.586E+06	1.491E+03
St Wall	5.461E-06	2.611E-05	1.351E+06	3.483E+02
ULI Wall	8.306E-06	2.681E-05	1.200E+06	3.122E+02
Kidneys	5.383E-05	2.680E-04	1.410E+06	3.891E+02
Lungs	5.254E-06	5.132E-03	1.573E+06	3.728E+02
Ovaries	5.280E-06	2.635E-05	1.078E+06	3.390E+02
R Marrow	1.553E-05	7.826E-05	1.445E+06	4.206E+02
Spleen	5.254E-06	2.607E-05	1.375E+06	3.379E+02
Thymus	5.254E-06	2.607E-05	1.503E+06	3.728E+02
Uterus	5.254E-06	2.607E-05	1.103E+06	2.982E+02
Bld Wall	5.272E-06	2.615E-05	1.282E+06	3.542E+02
Brain	5.254E-06	2.607E-05	1.561E+06	3.076E+02
Esophagu	5.254E-06	1.131E-03	1.132E+06	2.633E+02
SI Wall	5.757E-06	2.619E-05	1.132E+06	2.971E+02
LLI Wall	1.421E-05	2.825E-05	1.146E+06	3.099E+02
Liver	2.049E-05	1.029E-04	1.375E+06	3.448E+02
Muscle	5.254E-06	2.607E-05	1.794E+06	1.038E+03
Pancreas	5.254E-06	2.607E-05	1.115E+06	2.819E+02
Skin	5.254E-06	2.607E-05	5.324E+06	6.920E+03
Testes	5.280E-06	2.635E-05	1.969E+06	1.212E+03
Thyroid	5.254E-06	2.607E-05	1.806E+06	5.149E+02
EFFEC	1.897E-04	1.314E-02	1.654E+06	6.990E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	8.177E-08	3.604E-07	1.305E-03	3.029E-07
Stomach	2.309E-07	8.399E-07	5.452E-03	1.410E-06
Colon	2.523E-06	2.176E-06	1.212E-02	3.215E-06
Liver	5.698E-07	2.464E-06	2.085E-03	5.231E-07
LUNG	5.735E-07	1.080E-03	1.538E-02	3.646E-06
Bone	3.622E-07	1.613E-06	4.555E-04	1.468E-07
Skin	5.883E-09	2.409E-08	5.312E-04	6.908E-07
Breast	1.128E-07	4.736E-07	1.247E-02	7.200E-06
Ovary	9.435E-08	4.366E-07	1.538E-03	4.823E-07
Bladder	2.002E-07	8.510E-07	3.099E-03	8.563E-07
Kidneys	6.438E-07	2.779E-06	7.328E-04	2.027E-07
Thyroid	1.650E-08	6.734E-08	5.755E-04	1.643E-07
Leukemia	9.176E-08	4.033E-07	8.108E-03	2.365E-06
Residual	7.363E-07	2.897E-06	2.039E-02	8.085E-06
Total	6.253E-06	1.095E-03	8.435E-02	2.924E-05

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* NUCLIDE Th-229 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	1.395E-05	3.048E-04	3.076E+08	7.468E+04
B Surfac	4.170E-03	9.487E-02	1.340E+09	2.726E+05
Breasts	1.395E-05	3.048E-04	5.149E+08	1.052E+05
St Wall	1.415E-05	3.050E-04	3.483E+08	8.283E+04
ULI Wall	1.722E-05	3.097E-04	3.099E+08	7.922E+04
Kidneys	5.839E-05	1.389E-03	3.588E+08	8.353E+04
Lungs	1.395E-05	9.235E-02	4.078E+08	8.901E+04
Ovaries	3.512E-05	7.977E-04	2.761E+08	7.584E+04
R Marrow	1.994E-04	4.677E-03	3.530E+08	8.365E+04
Spleen	1.395E-05	3.049E-04	3.553E+08	8.411E+04
Thymus	1.395E-05	3.048E-04	3.868E+08	8.225E+04
Uterus	1.395E-05	3.048E-04	2.831E+08	7.642E+04
Bld Wall	1.396E-05	3.051E-04	3.285E+08	8.341E+04
Brain	1.395E-05	3.048E-04	4.019E+08	7.771E+04
Esophagu	1.395E-05	3.677E-02	2.866E+08	6.839E+04
SI Wall	1.447E-05	3.051E-04	2.912E+08	7.584E+04
LLI Wall	2.426E-05	3.298E-04	2.936E+08	7.864E+04
Liver	2.018E-04	4.651E-03	3.553E+08	8.318E+04
Muscle	1.395E-05	3.048E-04	4.031E+08	9.996E+04
Pancreas	1.395E-05	3.048E-04	2.854E+08	7.328E+04
Skin	1.395E-05	3.048E-04	6.303E+08	1.829E+05
Testes	3.559E-05	8.081E-04	4.392E+08	1.043E+05
Thyroid	1.395E-05	3.048E-04	4.310E+08	9.075E+04
EFFEC	1.850E-03	2.634E-01	3.926E+08	9.204E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.153E-07	3.589E-06	3.297E-01	7.864E-05
Stomach	5.328E-07	6.623E-06	1.410E+00	3.344E-04
Colon	3.574E-06	1.376E-05	3.122E+00	8.155E-04
Liver	4.847E-06	8.066E-05	5.382E-01	1.258E-04
LUNG	1.465E-06	1.624E-02	3.984E+00	8.703E-04
Bone	5.365E-06	9.805E-05	1.270E-01	2.586E-05
Skin	1.476E-08	2.105E-07	6.291E-02	1.829E-05
Breast	2.794E-07	3.774E-06	2.493E+00	5.079E-04
Ovary	6.919E-07	1.228E-05	3.926E-01	1.079E-04
Bladder	5.328E-07	8.695E-06	7.945E-01	2.015E-04
Kidneys	5.032E-07	8.621E-06	1.864E-01	4.345E-05
Thyroid	4.107E-08	5.624E-07	1.375E-01	2.889E-05
Leukemia	1.073E-06	1.846E-05	1.980E+00	4.695E-04
Residual	1.776E-06	2.209E-05	4.940E+00	1.235E-03
Total	2.090E-05	1.654E-02	2.050E+01	4.858E-03

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* NUCLIDE Ra-225 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.076E-06	1.183E-06	1.340E+07	7.072E+03
B Surfac	6.649E-04	4.159E-04	1.072E+08	5.499E+04
Breasts	2.076E-06	1.183E-06	4.940E+07	2.027E+04
St Wall	2.078E-06	1.196E-06	1.794E+07	9.355E+03
ULI Wall	2.873E-06	1.566E-06	1.282E+07	7.188E+03
Kidneys	6.834E-06	2.075E-05	2.202E+07	1.109E+04
Lungs	2.076E-06	9.561E-03	2.283E+07	1.095E+04
Ovaries	2.471E-06	2.892E-06	8.528E+06	4.858E+03
R Marrow	6.420E-05	3.700E-05	1.654E+07	7.852E+03
Spleen	2.090E-06	1.190E-06	1.759E+07	9.367E+03
Thymus	2.076E-06	1.183E-06	2.353E+07	1.065E+04
Uterus	2.076E-06	1.183E-06	9.425E+06	5.813E+03
Bld Wall	2.084E-06	1.204E-06	1.678E+07	9.273E+03
Brain	2.076E-06	1.183E-06	1.911E+07	6.978E+03
Esophagu	2.076E-06	5.754E-04	8.376E+06	4.078E+03
SI Wall	2.090E-06	1.201E-06	1.058E+07	6.151E+03
LLI Wall	7.282E-06	2.968E-06	1.067E+07	6.431E+03
Liver	3.582E-05	1.474E-05	1.817E+07	9.320E+03
Muscle	2.076E-06	1.183E-06	2.936E+07	1.561E+04
Pancreas	2.076E-06	1.183E-06	8.924E+06	5.219E+03
Skin	2.076E-06	1.183E-06	3.507E+08	3.786E+04
Testes	2.478E-06	2.922E-06	3.775E+07	1.899E+04
Thyroid	2.076E-06	1.183E-06	3.227E+07	1.340E+04
EFFEC	3.680E-04	2.317E-02	2.808E+07	1.247E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	6.808E-08	2.993E-08	9.635E-03	4.695E-06
Stomach	2.786E-07	1.066E-07	7.246E-02	3.775E-05
Colon	2.102E-06	6.734E-07	1.223E-01	7.083E-05
Liver	1.543E-06	4.773E-07	2.749E-02	1.410E-05
LUNG	7.178E-07	1.991E-03	2.237E-01	1.071E-04
Bone	3.611E-06	1.162E-06	1.018E-02	5.219E-06
Skin	7.104E-09	2.653E-09	3.495E-02	3.775E-06
Breast	1.754E-07	6.475E-08	2.388E-01	9.798E-05
Ovary	9.694E-08	8.695E-08	1.212E-02	6.908E-06
Bladder	1.487E-07	6.549E-08	4.054E-02	2.237E-05
Kidneys	1.088E-07	2.216E-07	1.145E-02	5.767E-06
Thyroid	2.431E-08	8.584E-09	1.028E-02	4.264E-06
Leukemia	8.473E-07	3.112E-07	9.285E-02	4.404E-05
Residual	1.099E-06	3.959E-07	2.563E-01	1.386E-04
Total	1.084E-05	1.994E-03	1.163E+00	5.639E-04

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* NUCLIDE Ac-225 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	1.616E-06	1.361E-06	5.907E+07	1.410E+04
B Surfac	7.929E-06	4.007E-04	2.412E+08	4.753E+04
Breasts	1.616E-06	1.361E-06	9.646E+07	1.946E+04
St Wall	2.524E-06	1.567E-06	6.640E+07	1.549E+04
ULI Wall	1.820E-05	4.784E-06	5.953E+07	1.491E+04
Kidneys	4.444E-05	3.811E-05	6.815E+07	1.561E+04
Lungs	1.616E-06	1.122E-02	7.736E+07	1.654E+04
Ovaries	1.716E-06	7.748E-06	5.336E+07	1.445E+04
R Marrow	2.012E-06	3.297E-05	6.792E+07	1.584E+04
Spleen	1.625E-06	1.389E-06	6.780E+07	1.573E+04
Thymus	1.616E-06	1.361E-06	7.316E+07	1.526E+04
Uterus	1.616E-06	1.361E-06	5.452E+07	1.445E+04
Bld Wall	1.964E-06	1.451E-06	6.268E+07	1.561E+04
Brain	1.616E-06	1.361E-06	7.712E+07	1.468E+04
Esophagu	1.616E-06	1.000E-03	5.557E+07	1.305E+04
SI Wall	2.855E-06	1.622E-06	5.592E+07	1.433E+04
LLI Wall	4.795E-05	1.091E-05	5.662E+07	1.491E+04
Liver	5.306E-06	1.771E-04	6.780E+07	1.549E+04
Muscle	1.616E-06	1.361E-06	7.619E+07	1.864E+04
Pancreas	1.616E-06	1.361E-06	5.510E+07	1.386E+04
Skin	1.616E-06	1.361E-06	1.095E+08	3.588E+04
Testes	1.715E-06	7.689E-06	8.248E+07	1.934E+04
Thyroid	1.616E-06	1.361E-06	8.143E+07	1.689E+04
EFFEC	1.425E-04	2.734E-02	7.433E+07	1.713E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.921E-08	3.885E-08	6.396E-02	1.503E-05
Stomach	3.112E-07	1.702E-07	2.679E-01	6.256E-05
Colon	1.273E-05	2.768E-06	6.011E-01	1.538E-04
Liver	1.987E-07	5.328E-06	1.028E-01	2.353E-05
LUNG	4.958E-07	2.327E-03	7.561E-01	1.619E-04
Bone	2.494E-08	1.073E-06	2.295E-02	4.509E-06
Skin	4.958E-09	3.630E-09	1.093E-02	3.577E-06
Breast	1.199E-07	9.213E-08	4.660E-01	9.402E-05
Ovary	6.142E-08	2.394E-07	7.596E-02	2.050E-05
Bladder	1.354E-07	8.880E-08	1.515E-01	3.775E-05
Kidneys	6.068E-07	4.662E-07	3.542E-02	8.120E-06
Thyroid	1.665E-08	1.217E-08	2.598E-02	5.382E-06
Leukemia	2.120E-08	3.448E-07	3.810E-01	8.889E-05
Residual	7.696E-07	5.550E-07	9.448E-01	2.307E-04
Total	1.554E-05	2.338E-03	3.903E+00	9.110E-04

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* NUCLIDE Fr-221 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	1.281E+08	2.912E+04
B Surfac	0.000E+00	0.000E+00	4.054E+08	6.827E+04
Breasts	0.000E+00	0.000E+00	1.911E+08	3.518E+04
St Wall	0.000E+00	0.000E+00	1.398E+08	3.111E+04
ULI Wall	0.000E+00	0.000E+00	1.281E+08	3.017E+04
Kidneys	0.000E+00	0.000E+00	1.421E+08	3.087E+04
Lungs	0.000E+00	0.000E+00	1.608E+08	3.274E+04
Ovaries	0.000E+00	0.000E+00	1.188E+08	2.994E+04
R Marrow	0.000E+00	0.000E+00	1.480E+08	3.250E+04
Spleen	0.000E+00	0.000E+00	1.433E+08	3.134E+04
Thymus	0.000E+00	0.000E+00	1.514E+08	2.994E+04
Uterus	0.000E+00	0.000E+00	1.200E+08	2.947E+04
Bld Wall	0.000E+00	0.000E+00	1.328E+08	3.076E+04
Brain	0.000E+00	0.000E+00	1.654E+08	3.017E+04
Esophagu	0.000E+00	0.000E+00	1.247E+08	2.680E+04
SI Wall	0.000E+00	0.000E+00	1.223E+08	2.924E+04
LLI Wall	0.000E+00	0.000E+00	1.235E+08	3.029E+04
Liver	0.000E+00	0.000E+00	1.433E+08	3.111E+04
Muscle	0.000E+00	0.000E+00	1.573E+08	3.530E+04
Pancreas	0.000E+00	0.000E+00	1.212E+08	2.831E+04
Skin	0.000E+00	0.000E+00	2.353E+08	4.276E+04
Testes	0.000E+00	0.000E+00	1.666E+08	3.588E+04
Thyroid	0.000E+00	0.000E+00	1.678E+08	3.285E+04
EFFEC	0.000E+00	0.000E+00	1.549E+08	3.309E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	1.433E-01	3.087E-05
Stomach	0.000E+00	0.000E+00	5.639E-01	1.258E-04
Colon	0.000E+00	0.000E+00	1.305E+00	3.122E-04
Liver	0.000E+00	0.000E+00	2.167E-01	4.718E-05
LUNG	0.000E+00	0.000E+00	1.573E+00	3.204E-04
Bone	0.000E+00	0.000E+00	3.844E-02	6.477E-06
Skin	0.000E+00	0.000E+00	2.353E-02	4.264E-06
Breast	0.000E+00	0.000E+00	9.227E-01	1.701E-04
Ovary	0.000E+00	0.000E+00	1.689E-01	4.264E-05
Bladder	0.000E+00	0.000E+00	3.215E-01	7.433E-05
Kidneys	0.000E+00	0.000E+00	7.398E-02	1.608E-05
Thyroid	0.000E+00	0.000E+00	5.347E-02	1.046E-05
Leukemia	0.000E+00	0.000E+00	8.306E-01	1.829E-04
Residual	0.000E+00	0.000E+00	2.015E+00	4.602E-04
Total	0.000E+00	0.000E+00	8.248E+00	1.806E-03

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* NUCLIDE At-217 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	1.375E+06	2.982E+02
B Surfac	0.000E+00	0.000E+00	3.111E+06	5.475E+02
Breasts	0.000E+00	0.000E+00	1.922E+06	3.553E+02
St Wall	0.000E+00	0.000E+00	1.480E+06	3.169E+02
ULI Wall	0.000E+00	0.000E+00	1.363E+06	3.145E+02
Kidneys	0.000E+00	0.000E+00	1.480E+06	3.192E+02
Lungs	0.000E+00	0.000E+00	1.666E+06	3.367E+02
Ovaries	0.000E+00	0.000E+00	1.258E+06	3.262E+02
R Marrow	0.000E+00	0.000E+00	1.596E+06	3.390E+02
Spleen	0.000E+00	0.000E+00	1.503E+06	3.192E+02
Thymus	0.000E+00	0.000E+00	1.549E+06	3.192E+02
Uterus	0.000E+00	0.000E+00	1.282E+06	3.076E+02
Bld Wall	0.000E+00	0.000E+00	1.375E+06	3.215E+02
Brain	0.000E+00	0.000E+00	1.759E+06	3.157E+02
Esophagu	0.000E+00	0.000E+00	1.363E+06	2.843E+02
SI Wall	0.000E+00	0.000E+00	1.305E+06	3.076E+02
LLI Wall	0.000E+00	0.000E+00	1.340E+06	3.192E+02
Liver	0.000E+00	0.000E+00	1.491E+06	3.180E+02
Muscle	0.000E+00	0.000E+00	1.631E+06	3.635E+02
Pancreas	0.000E+00	0.000E+00	1.293E+06	2.913E+02
Skin	0.000E+00	0.000E+00	2.167E+06	4.788E+02
Testes	0.000E+00	0.000E+00	1.689E+06	3.693E+02
Thyroid	0.000E+00	0.000E+00	1.713E+06	3.495E+02
EFFEC	0.000E+00	0.000E+00	1.596E+06	3.402E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	1.573E-03	3.274E-07
Stomach	0.000E+00	0.000E+00	5.976E-03	1.281E-06
Colon	0.000E+00	0.000E+00	1.398E-02	3.274E-06
Liver	0.000E+00	0.000E+00	2.260E-03	4.823E-07
LUNG	0.000E+00	0.000E+00	1.631E-02	3.297E-06
Bone	0.000E+00	0.000E+00	2.959E-04	5.196E-08
Skin	0.000E+00	0.000E+00	2.167E-04	4.776E-08
Breast	0.000E+00	0.000E+00	9.285E-03	1.713E-06
Ovary	0.000E+00	0.000E+00	1.794E-03	4.637E-07
Bladder	0.000E+00	0.000E+00	3.320E-03	7.771E-07
Kidneys	0.000E+00	0.000E+00	7.701E-04	1.666E-07
Thyroid	0.000E+00	0.000E+00	5.452E-04	1.113E-07
Leukemia	0.000E+00	0.000E+00	8.959E-03	1.899E-06
Residual	0.000E+00	0.000E+00	2.132E-02	4.730E-06
Total	0.000E+00	0.000E+00	8.656E-02	1.864E-05

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* NUCLIDE Bi-213 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	7.837E-10	2.876E-09	5.976E+08	1.293E+05
B Surfac	7.837E-10	2.876E-09	1.363E+09	2.400E+05
Breasts	7.837E-10	2.876E-09	8.341E+08	1.561E+05
St Wall	1.866E-07	3.082E-08	6.373E+08	1.375E+05
ULI Wall	4.666E-08	1.081E-08	5.895E+08	1.375E+05
Kidneys	1.109E-07	4.070E-07	6.419E+08	1.386E+05
Lungs	7.837E-10	3.185E-05	7.188E+08	1.468E+05
Ovaries	7.837E-10	2.876E-09	5.347E+08	1.456E+05
R Marrow	7.837E-10	2.876E-09	6.885E+08	1.480E+05
Spleen	7.837E-10	2.876E-09	6.489E+08	1.386E+05
Thymus	7.837E-10	2.876E-09	6.687E+08	1.410E+05
Uterus	7.837E-10	2.876E-09	5.499E+08	1.340E+05
Bld Wall	1.161E-09	4.259E-09	5.988E+08	1.410E+05
Brain	7.837E-10	2.876E-09	7.619E+08	1.375E+05
Esophagu	7.837E-10	6.745E-05	5.848E+08	1.235E+05
SI Wall	9.968E-08	1.775E-08	5.639E+08	1.340E+05
LLI Wall	6.671E-09	3.892E-09	5.743E+08	1.386E+05
Liver	7.837E-10	2.876E-09	6.454E+08	1.386E+05
Muscle	7.837E-10	2.876E-09	7.037E+08	1.596E+05
Pancreas	7.837E-10	2.876E-09	5.604E+08	1.270E+05
Skin	7.837E-10	2.876E-09	3.949E+09	4.928E+06
Testes	7.837E-10	2.876E-09	7.281E+08	1.619E+05
Thyroid	7.837E-10	2.876E-09	7.398E+08	1.526E+05
EFFEC	7.326E-07	1.104E-04	7.188E+08	1.957E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.483E-11	8.362E-11	6.734E-01	1.421E-04
Stomach	2.849E-08	4.440E-09	2.575E+00	5.545E-04
Colon	1.998E-08	4.181E-09	6.023E+00	1.421E-03
Liver	3.922E-11	1.114E-10	9.786E-01	2.097E-04
LUNG	2.620E-10	6.475E-06	7.025E+00	1.433E-03
Bone	2.202E-12	6.882E-12	1.293E-01	2.283E-05
Skin	2.553E-12	7.733E-12	3.938E-01	4.916E-04
Breast	6.549E-11	1.987E-10	4.031E+00	7.538E-04
Ovary	4.218E-11	1.014E-10	7.607E-01	2.074E-04
Bladder	9.620E-11	2.779E-10	1.445E+00	3.413E-04
Kidneys	1.521E-09	4.995E-09	3.344E-01	7.211E-05
Thyroid	8.288E-12	2.601E-11	2.353E-01	4.858E-05
Leukemia	2.309E-11	2.808E-11	3.868E+00	8.306E-04
Residual	4.884E-10	1.199E-09	9.238E+00	2.062E-03
Total	5.106E-08	6.475E-06	3.775E+01	8.598E-03

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* NUCLIDE Pu-238 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.386E-06	4.484E-04	7.106E+04	5.650E+01
B Surfac	1.369E-03	2.576E-01	1.083E+06	1.421E+03
Breasts	2.386E-06	4.484E-04	1.480E+06	2.248E+03
St Wall	2.620E-06	4.484E-04	1.069E+05	8.912E+01
ULI Wall	5.935E-06	4.495E-04	6.687E+04	3.355E+01
Kidneys	5.920E-06	1.116E-03	1.538E+05	1.782E+02
Lungs	2.386E-06	6.775E-03	1.235E+05	9.169E+01
Ovaries	1.796E-05	3.383E-03	5.056E+04	1.068E+02
R Marrow	6.767E-05	1.275E-02	1.957E+05	2.260E+02
Spleen	2.386E-06	4.484E-04	8.947E+04	5.242E+01
Thymus	2.386E-06	4.484E-04	1.689E+05	1.538E+02
Uterus	2.386E-06	4.484E-04	5.475E+04	2.516E+01
Bld Wall	2.386E-06	4.484E-04	1.059E+05	1.012E+02
Brain	2.386E-06	4.484E-04	8.912E+04	2.610E+01
Esophagu	2.386E-06	1.645E-03	5.242E+04	1.584E+01
SI Wall	2.971E-06	4.488E-04	5.825E+04	2.749E+01
LLI Wall	1.279E-05	4.510E-04	5.848E+04	3.262E+01
Liver	2.885E-04	5.432E-02	1.019E+05	7.759E+01
Muscle	2.386E-06	4.484E-04	6.209E+05	1.340E+03
Pancreas	2.386E-06	4.484E-04	5.173E+04	1.946E+01
Skin	2.386E-06	4.484E-04	4.765E+06	1.123E+04
Testes	1.829E-05	3.443E-03	7.642E+05	1.736E+03
Thyroid	2.386E-06	4.484E-04	4.672E+05	3.961E+02
EFFEC	8.436E-04	1.709E-01	4.089E+05	7.293E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.477E-08	6.919E-06	6.035E-05	1.817E-08
Stomach	1.606E-07	1.806E-05	4.322E-04	3.600E-07
Colon	2.742E-06	3.996E-05	6.536E-04	3.425E-07
Liver	6.549E-06	1.036E-03	1.549E-04	1.177E-07
LUNG	3.533E-07	1.380E-03	1.212E-03	8.970E-07
Bone	1.676E-06	2.816E-04	1.029E-04	1.351E-07
Skin	3.552E-09	4.921E-07	4.753E-04	1.121E-06
Breast	7.622E-08	1.029E-05	7.153E-03	1.086E-05
Ovary	3.448E-07	5.957E-05	7.188E-05	1.514E-07
Bladder	1.054E-07	1.598E-05	2.563E-04	2.446E-07
Kidneys	6.364E-08	9.620E-06	8.004E-05	9.273E-08
Thyroid	1.073E-08	1.428E-06	1.491E-04	1.258E-07
Leukemia	3.389E-07	5.365E-05	1.099E-03	1.270E-06
Residual	4.847E-07	6.327E-05	3.693E-03	7.025E-06
Total	1.295E-05	2.975E-03	1.561E-02	2.272E-05

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* NUCLIDE U-234 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	5.106E-06	2.526E-05	3.577E+05	1.235E+02
B Surfac	1.453E-04	7.211E-04	2.318E+06	1.421E+03
Breasts	5.106E-06	2.526E-05	1.678E+06	1.911E+03
St Wall	5.310E-06	2.531E-05	4.310E+05	1.526E+02
ULI Wall	8.125E-06	2.600E-05	3.565E+05	1.117E+02
Kidneys	5.306E-05	2.638E-04	4.765E+05	2.085E+02
Lungs	5.106E-06	5.036E-03	5.103E+05	1.631E+02
Ovaries	5.106E-06	2.526E-05	3.076E+05	1.666E+02
R Marrow	1.500E-05	7.448E-05	4.893E+05	2.575E+02
Spleen	5.106E-06	2.526E-05	4.264E+05	1.316E+02
Thymus	5.106E-06	2.526E-05	5.184E+05	1.934E+02
Uterus	5.106E-06	2.526E-05	3.157E+05	1.029E+02
Bld Wall	5.125E-06	2.534E-05	4.078E+05	1.596E+02
Brain	5.106E-06	2.526E-05	4.742E+05	1.069E+02
Esophagu	5.106E-06	1.117E-03	3.122E+05	8.574E+01
SI Wall	5.606E-06	2.539E-05	3.274E+05	1.033E+02
LLI Wall	1.395E-05	2.741E-05	3.320E+05	1.114E+02
Liver	1.989E-05	9.879E-05	4.357E+05	1.456E+02
Muscle	5.106E-06	2.526E-05	8.889E+05	1.200E+03
Pancreas	5.106E-06	2.526E-05	3.146E+05	9.541E+01
Skin	5.106E-06	2.526E-05	4.951E+06	1.059E+04
Testes	5.106E-06	2.526E-05	1.024E+06	1.456E+03
Thyroid	5.106E-06	2.526E-05	7.794E+05	3.740E+02
EFFEC	1.832E-04	1.287E-02	7.141E+05	6.827E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	7.955E-08	3.504E-07	3.588E-04	9.868E-08
Stomach	2.268E-07	8.214E-07	1.736E-03	6.163E-07
Colon	2.505E-06	2.135E-06	3.577E-03	1.152E-06
Liver	5.550E-07	2.379E-06	6.606E-04	2.202E-07
LUNG	5.624E-07	1.058E-03	4.986E-03	1.596E-06
Bone	3.456E-07	1.513E-06	2.202E-04	1.351E-07
Skin	5.735E-09	2.349E-08	4.940E-04	1.057E-06
Breast	1.106E-07	4.625E-07	8.108E-03	9.227E-06
Ovary	9.065E-08	4.181E-07	4.380E-04	2.365E-07
Bladder	1.950E-07	8.288E-07	9.856E-04	3.856E-07
Kidneys	6.364E-07	2.738E-06	2.481E-04	1.085E-07
Thyroid	1.617E-08	6.586E-08	2.481E-04	1.188E-07
Leukemia	8.917E-08	3.885E-07	2.749E-03	1.445E-06
Residual	7.215E-07	2.834E-06	7.747E-03	7.037E-06
Total	6.142E-06	1.073E-03	3.250E-02	2.342E-05

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* NUCLIDE Th-230 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.515E-06	5.602E-05	1.212E+06	3.320E+02
B Surfac	2.270E-03	5.158E-02	6.163E+06	1.922E+03
Breasts	2.515E-06	5.602E-05	2.773E+06	1.549E+03
St Wall	2.714E-06	5.609E-05	1.410E+06	3.786E+02
ULI Wall	5.535E-06	5.702E-05	1.212E+06	3.437E+02
Kidneys	3.424E-05	8.055E-04	1.480E+06	4.054E+02
Lungs	2.515E-06	1.417E-02	1.666E+06	4.101E+02
Ovaries	1.831E-05	4.203E-04	1.057E+06	3.751E+02
R Marrow	7.822E-05	1.856E-03	1.421E+06	4.357E+02
Spleen	2.515E-06	5.602E-05	1.433E+06	3.740E+02
Thymus	2.515E-06	5.602E-05	1.596E+06	4.101E+02
Uterus	2.515E-06	5.602E-05	1.089E+06	3.250E+02
Bld Wall	2.515E-06	5.602E-05	1.328E+06	3.798E+02
Brain	2.515E-06	5.602E-05	1.608E+06	3.355E+02
Esophagu	2.515E-06	6.564E-03	1.090E+06	2.808E+02
SI Wall	3.013E-06	5.620E-05	1.128E+06	3.262E+02
LLI Wall	1.137E-05	5.890E-05	1.142E+06	3.402E+02
Liver	2.943E-05	6.808E-04	1.433E+06	3.786E+02
Muscle	2.515E-06	5.602E-05	1.876E+06	1.096E+03
Pancreas	2.515E-06	5.602E-05	1.094E+06	3.134E+02
Skin	2.515E-06	5.602E-05	5.254E+06	8.353E+03
Testes	1.864E-05	4.277E-04	2.097E+06	1.223E+03
Thyroid	2.515E-06	5.602E-05	1.899E+06	5.196E+02
EFFEC	7.911E-04	5.173E-02	1.736E+06	7.421E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.292E-08	7.067E-07	1.258E-03	3.227E-07
Stomach	1.399E-07	1.473E-06	5.697E-03	1.526E-06
Colon	2.335E-06	3.334E-06	1.223E-02	3.530E-06
Liver	7.326E-07	1.206E-05	2.167E-03	5.743E-07
LUNG	3.163E-07	2.579E-03	1.631E-02	4.008E-06
Bone	2.745E-06	5.180E-05	5.848E-04	1.829E-07
Skin	3.201E-09	4.403E-08	5.242E-04	8.330E-07
Breast	6.512E-08	8.140E-07	1.340E-02	7.491E-06
Ovary	3.774E-07	6.697E-06	1.503E-03	5.336E-07
Bladder	1.036E-07	1.698E-06	3.215E-03	9.180E-07
Kidneys	3.041E-07	5.069E-06	7.701E-04	2.109E-07
Thyroid	9.324E-09	1.199E-07	6.046E-04	1.654E-07
Leukemia	4.181E-07	7.178E-06	7.980E-03	2.446E-06
Residual	4.144E-07	4.958E-06	2.074E-02	8.644E-06
Total	7.992E-06	2.675E-03	8.691E-02	3.134E-05

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* NUCLIDE Ra-226 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	7.267E-06	4.314E-06	2.714E+07	6.244E+03
B Surfac	2.302E-03	1.366E-03	9.262E+07	1.584E+04
Breasts	7.267E-06	4.314E-06	4.124E+07	7.596E+03
St Wall	7.474E-06	4.366E-06	2.982E+07	6.687E+03
ULI Wall	1.178E-05	5.809E-06	2.726E+07	6.477E+03
Kidneys	1.083E-05	6.394E-06	3.041E+07	6.652E+03
Lungs	7.267E-06	5.087E-03	3.437E+07	7.060E+03
Ovaries	7.267E-06	4.314E-06	2.516E+07	6.303E+03
R Marrow	1.601E-04	9.513E-05	3.146E+07	6.932E+03
Spleen	9.846E-06	5.831E-06	3.052E+07	6.745E+03
Thymus	7.267E-06	4.314E-06	3.262E+07	6.408E+03
Uterus	7.267E-06	4.314E-06	2.540E+07	6.314E+03
Bld Wall	7.274E-06	4.322E-06	2.819E+07	6.617E+03
Brain	7.267E-06	4.314E-06	3.507E+07	6.454E+03
Esophagu	7.267E-06	1.150E-03	2.621E+07	5.732E+03
SI Wall	7.729E-06	4.444E-06	2.586E+07	6.268E+03
LLI Wall	2.539E-05	1.035E-05	2.610E+07	6.477E+03
Liver	3.299E-05	1.959E-05	3.052E+07	6.675E+03
Muscle	7.267E-06	4.314E-06	3.367E+07	7.584E+03
Pancreas	7.267E-06	4.314E-06	2.575E+07	6.058E+03
Skin	7.267E-06	4.314E-06	5.580E+07	9.460E+03
Testes	7.267E-06	4.314E-06	3.588E+07	7.736E+03
Thyroid	7.267E-06	4.314E-06	3.600E+07	7.060E+03
EFFEC	1.035E-03	1.281E-02	3.309E+07	7.118E+03

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.135E-07	9.509E-08	3.017E-02	6.594E-06
Stomach	8.473E-07	3.101E-07	1.200E-01	2.703E-05
Colon	6.438E-06	1.935E-06	2.761E-01	6.687E-05
Liver	1.654E-06	6.956E-07	4.625E-02	1.011E-05
LUNG	1.954E-06	1.073E-03	3.355E-01	6.908E-05
Bone	8.917E-06	3.511E-06	8.796E-03	1.503E-06
Skin	1.998E-08	7.696E-09	5.569E-03	9.436E-07
Breast	4.736E-07	1.765E-07	1.992E-01	3.670E-05
Ovary	2.523E-07	1.158E-07	3.577E-02	8.970E-06
Bladder	4.736E-07	2.087E-07	6.815E-02	1.596E-05
Kidneys	1.832E-07	7.252E-08	1.584E-02	3.460E-06
Thyroid	6.401E-08	2.327E-08	1.146E-02	2.248E-06
Leukemia	1.820E-06	7.696E-07	1.771E-01	3.891E-05
Residual	1.206E-05	4.625E-06	4.299E-01	9.868E-05
Total	3.537E-05	1.084E-03	1.759E+00	3.868E-04

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* NUCLIDE Rn-222 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	1.806E+06	3.879E+02
B Surfac	0.000E+00	0.000E+00	3.856E+06	6.745E+02
Breasts	0.000E+00	0.000E+00	2.493E+06	4.637E+02
St Wall	0.000E+00	0.000E+00	1.922E+06	4.124E+02
ULI Wall	0.000E+00	0.000E+00	1.782E+06	4.101E+02
Kidneys	0.000E+00	0.000E+00	1.934E+06	4.159E+02
Lungs	0.000E+00	0.000E+00	2.167E+06	4.404E+02
Ovaries	0.000E+00	0.000E+00	1.619E+06	4.392E+02
R Marrow	0.000E+00	0.000E+00	2.085E+06	4.439E+02
Spleen	0.000E+00	0.000E+00	1.957E+06	4.147E+02
Thymus	0.000E+00	0.000E+00	2.004E+06	4.229E+02
Uterus	0.000E+00	0.000E+00	1.666E+06	4.019E+02
Bld Wall	0.000E+00	0.000E+00	1.806E+06	4.229E+02
Brain	0.000E+00	0.000E+00	2.307E+06	4.136E+02
Esophagu	0.000E+00	0.000E+00	1.771E+06	3.740E+02
SI Wall	0.000E+00	0.000E+00	1.713E+06	4.019E+02
LLI Wall	0.000E+00	0.000E+00	1.736E+06	4.171E+02
Liver	0.000E+00	0.000E+00	1.946E+06	4.147E+02
Muscle	0.000E+00	0.000E+00	2.109E+06	4.753E+02
Pancreas	0.000E+00	0.000E+00	1.689E+06	3.798E+02
Skin	0.000E+00	0.000E+00	2.656E+06	6.058E+02
Testes	0.000E+00	0.000E+00	2.179E+06	4.835E+02
Thyroid	0.000E+00	0.000E+00	2.214E+06	4.602E+02
EFFEC	0.000E+00	0.000E+00	2.074E+06	4.450E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	2.039E-03	4.299E-07
Stomach	0.000E+00	0.000E+00	7.759E-03	1.666E-06
Colon	0.000E+00	0.000E+00	1.817E-02	4.264E-06
Liver	0.000E+00	0.000E+00	2.947E-03	6.291E-07
LUNG	0.000E+00	0.000E+00	2.120E-02	4.310E-06
Bone	0.000E+00	0.000E+00	3.658E-04	6.407E-08
Skin	0.000E+00	0.000E+00	2.645E-04	6.046E-08
Breast	0.000E+00	0.000E+00	1.200E-02	2.237E-06
Ovary	0.000E+00	0.000E+00	2.307E-03	6.244E-07
Bladder	0.000E+00	0.000E+00	4.369E-03	1.023E-06
Kidneys	0.000E+00	0.000E+00	1.007E-03	2.167E-07
Thyroid	0.000E+00	0.000E+00	7.048E-04	1.468E-07
Leukemia	0.000E+00	0.000E+00	1.165E-02	2.493E-06
Residual	0.000E+00	0.000E+00	2.784E-02	6.163E-06
Total	0.000E+00	0.000E+00	1.127E-01	2.435E-05

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* NUCLIDE Pu-239 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.684E-06	5.051E-04	2.330E+05	6.978E+01
B Surfac	1.523E-03	2.870E-01	1.103E+06	6.769E+02
Breasts	2.684E-06	5.051E-04	8.796E+05	9.052E+02
St Wall	2.904E-06	5.051E-04	2.680E+05	8.679E+01
ULI Wall	6.013E-06	5.062E-04	2.307E+05	6.396E+01
Kidneys	6.253E-06	1.181E-03	2.901E+05	1.212E+02
Lungs	2.684E-06	6.168E-03	3.087E+05	9.169E+01
Ovaries	1.995E-05	3.763E-03	2.039E+05	9.134E+01
R Marrow	7.241E-05	1.367E-02	3.111E+05	1.398E+02
Spleen	2.684E-06	5.051E-04	2.656E+05	7.351E+01
Thymus	2.684E-06	5.051E-04	3.111E+05	1.115E+02
Uterus	2.684E-06	5.051E-04	2.097E+05	5.907E+01
Bld Wall	2.684E-06	5.051E-04	2.540E+05	9.180E+01
Brain	2.684E-06	5.051E-04	3.006E+05	6.093E+01
Esophagu	2.684E-06	1.654E-03	2.155E+05	5.091E+01
SI Wall	3.233E-06	5.054E-04	2.167E+05	5.976E+01
LLI Wall	1.244E-05	5.076E-04	2.190E+05	6.361E+01
Liver	3.194E-04	6.024E-02	2.703E+05	8.260E+01
Muscle	2.684E-06	5.051E-04	4.916E+05	5.650E+02
Pancreas	2.684E-06	5.051E-04	2.109E+05	5.452E+01
Skin	2.684E-06	5.051E-04	2.167E+06	4.276E+03
Testes	2.031E-05	3.829E-03	5.639E+05	7.153E+02
Thyroid	2.684E-06	5.051E-04	4.520E+05	2.074E+02
EFFEC	9.276E-04	1.855E-01	4.066E+05	3.309E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.810E-08	7.437E-06	2.481E-04	5.860E-08
Stomach	1.613E-07	1.850E-05	1.082E-03	3.507E-07
Colon	2.586E-06	4.033E-05	2.330E-03	6.594E-07
Liver	6.956E-06	1.103E-03	4.101E-04	1.247E-07
LUNG	3.693E-07	1.243E-03	3.017E-03	8.970E-07
Bone	1.798E-06	3.019E-04	1.047E-04	6.431E-08
Skin	3.689E-09	5.143E-07	2.167E-04	4.264E-07
Breast	7.733E-08	1.051E-05	4.252E-03	4.369E-06
Ovary	3.681E-07	6.364E-05	2.901E-04	1.305E-07
Bladder	1.147E-07	1.735E-05	6.140E-04	2.225E-07
Kidneys	6.401E-08	9.731E-06	1.514E-04	6.303E-08
Thyroid	1.103E-08	1.480E-06	1.445E-04	6.606E-08
Leukemia	3.500E-07	5.550E-05	1.747E-03	7.852E-07
Residual	4.884E-07	6.438E-05	4.637E-03	3.425E-06
Total	1.343E-05	2.938E-03	1.922E-02	1.164E-05

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* NUCLIDE U-235 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	4.717E-06	2.334E-05	6.198E+08	1.421E+05
B Surfac	1.366E-04	6.778E-04	2.144E+09	3.658E+05
Breasts	4.717E-06	2.334E-05	9.448E+08	1.759E+05
St Wall	4.906E-06	2.339E-05	6.815E+08	1.526E+05
ULI Wall	7.507E-06	2.402E-05	6.221E+08	1.480E+05
Kidneys	4.899E-05	2.437E-04	6.943E+08	1.514E+05
Lungs	4.717E-06	4.444E-03	7.864E+08	1.608E+05
Ovaries	4.717E-06	2.334E-05	5.743E+08	1.433E+05
R Marrow	1.386E-05	6.878E-05	7.165E+08	1.584E+05
Spleen	4.717E-06	2.334E-05	6.967E+08	1.538E+05
Thymus	4.717E-06	2.334E-05	7.444E+08	1.456E+05
Uterus	4.717E-06	2.334E-05	5.790E+08	1.445E+05
Bld Wall	4.736E-06	2.342E-05	6.454E+08	1.514E+05
Brain	4.717E-06	2.334E-05	8.004E+08	1.468E+05
Esophagu	4.717E-06	1.025E-03	5.988E+08	1.305E+05
SI Wall	5.180E-06	2.345E-05	5.907E+08	1.433E+05
LLI Wall	1.289E-05	2.533E-05	5.965E+08	1.480E+05
Liver	1.837E-05	9.128E-05	6.967E+08	1.526E+05
Muscle	4.717E-06	2.334E-05	7.689E+08	1.748E+05
Pancreas	4.717E-06	2.334E-05	5.872E+08	1.386E+05
Skin	4.717E-06	2.334E-05	1.007E+09	2.260E+05
Testes	4.717E-06	2.334E-05	8.213E+08	1.782E+05
Thyroid	4.717E-06	2.334E-05	8.213E+08	1.619E+05
EFFEC	1.728E-04	1.142E-02	7.549E+08	1.631E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	7.400E-08	3.275E-07	6.885E-01	1.503E-04
Stomach	2.124E-07	7.659E-07	2.749E+00	6.163E-04
Colon	2.608E-06	2.057E-06	6.314E+00	1.526E-03
Liver	5.143E-07	2.205E-06	1.055E+00	2.318E-04
LUNG	5.217E-07	9.398E-04	7.689E+00	1.573E-03
Bone	3.238E-07	1.417E-06	2.039E-01	3.472E-05
Skin	5.328E-09	2.183E-08	1.004E-01	2.260E-05
Breast	1.032E-07	4.366E-07	4.567E+00	8.493E-04
Ovary	8.621E-08	3.922E-07	8.167E-01	2.039E-04
Bladder	1.817E-07	7.696E-07	1.561E+00	3.658E-04
Kidneys	5.883E-07	2.535E-06	3.611E-01	7.875E-05
Thyroid	1.502E-08	6.142E-08	2.610E-01	5.161E-05
Leukemia	1.029E-07	4.514E-07	4.019E+00	8.889E-04
Residual	6.734E-07	2.657E-06	9.798E+00	2.260E-03
Total	5.994E-06	9.509E-04	4.019E+01	8.854E-03

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* NUCLIDE Th-231 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	9.176E-13	2.142E-11	3.658E+07	1.003E+04
B Surfac	4.122E-10	9.901E-09	1.899E+08	5.569E+04
Breasts	9.176E-13	2.142E-11	7.910E+07	3.204E+04
St Wall	9.180E-13	2.142E-11	4.287E+07	1.188E+04
ULI Wall	1.142E-12	2.466E-11	3.693E+07	1.051E+04
Kidneys	5.587E-12	1.405E-10	4.543E+07	1.340E+04
Lungs	9.176E-13	2.352E-09	5.068E+07	1.305E+04
Ovaries	3.529E-12	8.510E-11	3.180E+07	1.031E+04
R Marrow	1.518E-11	3.904E-10	4.310E+07	1.258E+04
Spleen	9.209E-13	2.150E-11	4.334E+07	1.177E+04
Thymus	9.176E-13	2.142E-11	4.893E+07	1.305E+04
Uterus	9.176E-13	2.142E-11	3.309E+07	9.716E+03
Bld Wall	9.187E-13	2.145E-11	4.043E+07	1.223E+04
Brain	9.176E-13	2.142E-11	4.835E+07	1.004E+04
Esophagu	9.176E-13	8.706E-10	3.297E+07	8.376E+03
SI Wall	9.231E-13	2.143E-11	3.425E+07	9.833E+03
LLI Wall	1.775E-12	3.058E-11	3.448E+07	1.019E+04
Liver	1.075E-11	2.742E-10	4.357E+07	1.188E+04
Muscle	9.176E-13	2.142E-11	5.534E+07	2.388E+04
Pancreas	9.176E-13	2.142E-11	3.297E+07	9.204E+03
Skin	9.176E-13	2.142E-11	2.936E+08	9.996E+04
Testes	3.582E-12	8.636E-11	6.279E+07	2.819E+04
Thyroid	9.176E-13	2.142E-11	5.825E+07	1.643E+04
EFFEC	1.243E-06	1.236E-06	5.347E+07	1.817E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	2.956E-13	4.366E-12	3.798E-02	9.635E-06
Stomach	4.255E-09	8.288E-10	1.736E-01	4.800E-05
Colon	1.750E-07	3.374E-08	3.705E-01	1.071E-04
Liver	9.250E-12	1.036E-11	6.606E-02	1.806E-05
LUNG	9.731E-12	8.473E-08	4.951E-01	1.282E-04
Bone	2.253E-12	1.040E-11	1.806E-02	5.289E-06
Skin	1.676E-13	1.025E-13	2.924E-02	9.972E-06
Breast	2.549E-12	1.513E-11	3.821E-01	1.549E-04
Ovary	1.365E-10	2.990E-11	4.520E-02	1.468E-05
Bladder	3.693E-11	7.881E-12	9.774E-02	2.959E-05
Kidneys	3.548E-12	1.928E-12	2.365E-02	6.967E-06
Thyroid	5.180E-14	4.144E-13	1.852E-02	5.231E-06
Leukemia	4.847E-11	1.965E-11	2.423E-01	7.060E-05
Residual	1.058E-10	6.290E-11	6.198E-01	2.144E-04
Total	1.798E-07	1.195E-07	2.621E+00	8.213E-04

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* NUCLIDE Pa-231 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	1.033E-05	1.951E-03	1.526E+08	3.472E+04
B Surfac	4.640E-03	8.776E-01	4.241E+08	8.341E+04
Breasts	1.033E-05	1.951E-03	2.318E+08	5.627E+04
St Wall	1.054E-05	1.951E-03	1.654E+08	3.740E+04
ULI Wall	1.493E-05	2.216E-03	1.514E+08	3.600E+04
Kidneys	6.290E-05	1.193E-02	1.678E+08	3.833E+04
Lungs	1.033E-05	7.437E-03	1.887E+08	3.973E+04
Ovaries	3.974E-05	7.518E-03	1.386E+08	3.740E+04
R Marrow	1.709E-04	3.245E-02	1.771E+08	4.008E+04
Spleen	1.036E-05	1.958E-03	1.689E+08	3.740E+04
Thymus	1.033E-05	1.951E-03	1.771E+08	3.775E+04
Uterus	1.033E-05	1.951E-03	1.410E+08	3.495E+04
Bld Wall	1.034E-05	1.954E-03	1.561E+08	3.763E+04
Brain	1.033E-05	1.951E-03	1.957E+08	3.600E+04
Esophagu	1.033E-05	3.155E-03	1.491E+08	3.180E+04
SI Wall	1.086E-05	1.951E-03	1.445E+08	3.483E+04
LLI Wall	2.365E-05	2.696E-03	1.468E+08	3.600E+04
Liver	1.210E-04	2.298E-02	1.678E+08	3.740E+04
Muscle	1.033E-05	1.951E-03	1.876E+08	5.079E+04
Pancreas	1.033E-05	1.951E-03	1.445E+08	3.320E+04
Skin	1.033E-05	1.951E-03	2.843E+08	1.247E+05
Testes	4.033E-05	7.629E-03	1.992E+08	5.417E+04
Thyroid	1.033E-05	1.951E-03	1.980E+08	4.299E+04
EFFEC	1.772E-03	3.458E-01	1.829E+08	4.404E+04

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	1.469E-07	2.283E-05	1.713E-01	3.658E-05
Stomach	3.293E-07	4.218E-05	6.675E-01	1.514E-04
Colon	3.019E-06	9.250E-05	1.538E+00	3.716E-04
Liver	2.527E-06	3.885E-04	2.540E-01	5.662E-05
LUNG	9.509E-07	1.299E-03	1.841E+00	3.879E-04
Bone	5.254E-06	8.695E-04	4.031E-02	7.922E-06
Skin	9.287E-09	1.336E-06	2.831E-02	1.247E-05
Breast	1.661E-07	2.372E-05	1.120E+00	2.714E-04
Ovary	7.326E-07	1.221E-04	1.969E-01	5.324E-05
Bladder	3.700E-07	5.624E-05	3.775E-01	9.099E-05
Kidneys	5.069E-07	7.807E-05	8.726E-02	1.992E-05
Thyroid	2.542E-08	3.630E-06	6.303E-02	1.363E-05
Leukemia	8.140E-07	1.288E-04	9.937E-01	2.248E-04
Residual	1.029E-06	1.391E-04	2.400E+00	5.895E-04
Total	1.587E-05	3.267E-03	9.798E+00	2.283E-03

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* NUCLIDE Ac-227 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	8.725E-06	1.635E-03	4.613E+05	1.121E+02
B Surfac	1.730E-03	3.250E-01	1.957E+06	4.322E+02
Breasts	8.725E-06	1.635E-03	8.132E+05	2.470E+02
St Wall	8.728E-06	1.635E-03	5.208E+05	1.235E+02
ULI Wall	1.001E-05	1.845E-03	4.648E+05	1.177E+02
Kidneys	1.313E-05	2.511E-03	5.371E+05	1.270E+02
Lungs	8.725E-06	2.066E-02	6.081E+05	1.328E+02
Ovaries	3.455E-05	6.479E-03	4.171E+05	1.162E+02
R Marrow	9.080E-05	1.711E-02	5.347E+05	1.316E+02
Spleen	8.773E-06	1.643E-03	5.312E+05	1.247E+02
Thymus	8.725E-06	1.635E-03	5.778E+05	1.235E+02
Uterus	8.725E-06	1.635E-03	4.264E+05	1.136E+02
Bld Wall	8.739E-06	1.637E-03	4.928E+05	1.247E+02
Brain	8.725E-06	1.635E-03	6.023E+05	1.155E+02
Esophagu	8.725E-06	6.601E-03	4.334E+05	1.018E+02
SI Wall	8.739E-06	1.635E-03	4.369E+05	1.125E+02
LLI Wall	1.295E-05	2.226E-03	4.415E+05	1.165E+02
Liver	3.737E-04	7.008E-02	5.324E+05	1.235E+02
Muscle	8.725E-06	1.635E-03	6.186E+05	2.027E+02
Pancreas	8.725E-06	1.635E-03	4.299E+05	1.087E+02
Skin	8.725E-06	1.635E-03	1.282E+06	8.656E+02
Testes	3.431E-05	6.434E-03	6.734E+05	2.202E+02
Thyroid	8.725E-06	1.635E-03	6.524E+05	1.456E+02
EFFEC	1.194E-03	2.695E-01	5.976E+05	1.643E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	1.506E-07	2.394E-05	4.986E-04	1.177E-07
Stomach	4.107E-07	5.698E-05	2.097E-03	4.986E-07
Colon	1.391E-06	1.443E-04	4.695E-03	1.212E-06
Liver	1.066E-05	1.724E-03	8.073E-04	1.876E-07
LUNG	1.084E-06	4.218E-03	5.942E-03	1.293E-06
Bone	2.549E-06	4.218E-04	1.864E-04	4.101E-08
Skin	1.128E-08	1.624E-06	1.282E-04	8.633E-08
Breast	2.264E-07	3.193E-05	3.926E-03	1.188E-06
Ovary	7.067E-07	1.221E-04	5.930E-04	1.654E-07
Bladder	3.585E-07	5.550E-05	1.188E-03	3.017E-07
Kidneys	1.384E-07	2.168E-05	2.796E-04	6.606E-08
Thyroid	3.201E-08	4.477E-06	2.074E-04	4.637E-08
Leukemia	5.661E-07	8.769E-05	3.006E-03	7.386E-07
Residual	1.476E-06	1.991E-04	7.491E-03	2.097E-06
Total	1.976E-05	7.104E-03	3.111E-02	8.050E-06

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* NUCLIDE Sr-90 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.457E-06	1.273E-07	5.441E+05	1.957E+02
B Surfac	1.511E-03	6.997E-05	2.656E+06	9.681E+02
Breasts	2.457E-06	1.273E-07	1.106E+06	4.078E+02
St Wall	3.335E-06	8.447E-07	6.326E+05	2.318E+02
ULI Wall	2.165E-05	1.310E-05	5.429E+05	2.050E+02
Kidneys	2.457E-06	1.273E-07	6.745E+05	2.516E+02
Lungs	2.457E-06	4.773E-03	7.503E+05	2.551E+02
Ovaries	2.457E-06	1.273E-07	4.695E+05	1.864E+02
R Marrow	6.627E-04	3.127E-05	6.338E+05	2.248E+02
Spleen	2.457E-06	1.273E-07	6.396E+05	2.318E+02
Thymus	2.457E-06	1.273E-07	7.246E+05	2.458E+02
Uterus	2.457E-06	1.273E-07	4.835E+05	1.887E+02
Bld Wall	5.487E-06	3.260E-07	5.965E+05	2.330E+02
Brain	2.457E-06	1.273E-07	7.200E+05	2.004E+02
Esophagu	2.457E-06	1.611E-04	4.835E+05	1.608E+02
SI Wall	4.196E-06	1.986E-06	5.010E+05	1.911E+02
LLI Wall	8.103E-05	4.444E-05	5.068E+05	1.981E+02
Liver	2.457E-06	1.273E-07	6.442E+05	2.318E+02
Muscle	2.457E-06	1.274E-07	7.957E+05	3.390E+02
Pancreas	2.457E-06	1.273E-07	4.835E+05	1.782E+02
Skin	2.457E-06	1.273E-07	1.072E+09	1.631E+05
Testes	2.457E-06	1.273E-07	9.064E+05	3.879E+02
Thyroid	2.457E-06	1.273E-07	8.539E+05	2.901E+02
EFFEC	1.024E-04	5.805E-04	1.145E+07	1.911E+03

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.070E-09	1.387E-10	5.557E-04	1.852E-07
Stomach	2.190E-08	3.848E-09	2.551E-03	9.355E-07
Colon	8.251E-07	3.811E-07	5.441E-03	2.085E-06
Liver	5.624E-09	1.876E-10	9.763E-04	3.518E-07
LUNG	4.144E-08	3.959E-05	7.340E-03	2.493E-06
Bone	2.176E-07	6.697E-09	2.516E-04	9.192E-08
Skin	4.107E-10	1.151E-11	1.069E-01	1.631E-05
Breast	2.028E-08	5.291E-10	5.336E-03	1.969E-06
Ovary	4.736E-09	1.669E-10	6.675E-04	2.656E-07
Bladder	1.880E-08	7.585E-10	1.445E-03	5.639E-07
Kidneys	1.950E-09	6.438E-11	3.507E-04	1.305E-07
Thyroid	1.391E-09	3.533E-11	2.714E-04	9.238E-08
Leukemia	4.773E-06	1.606E-07	3.553E-03	1.258E-06
Residual	6.475E-08	1.665E-09	9.040E-03	3.542E-06
Total	5.994E-06	3.996E-05	1.445E-01	3.029E-05

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* NUCLIDE Y-90 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	4.769E-11	1.324E-08	1.631E+07	4.707E+03
B Surfac	1.379E-09	3.829E-07	5.173E+07	1.363E+04
Breasts	4.769E-11	1.324E-08	2.563E+07	6.664E+03
St Wall	3.948E-06	7.903E-07	1.794E+07	5.173E+03
ULI Wall	5.010E-05	1.003E-05	1.631E+07	4.940E+03
Kidneys	4.773E-11	1.324E-08	1.841E+07	5.312E+03
Lungs	4.769E-11	2.566E-05	2.062E+07	5.545E+03
Ovaries	5.280E-11	1.324E-08	1.491E+07	4.858E+03
R Marrow	1.379E-09	3.826E-07	1.887E+07	5.324E+03
Spleen	4.773E-11	1.324E-08	1.829E+07	5.208E+03
Thymus	4.769E-11	1.324E-08	1.946E+07	5.219E+03
Uterus	4.780E-11	1.324E-08	1.503E+07	4.753E+03
Bld Wall	2.242E-10	6.220E-08	1.689E+07	5.208E+03
Brain	4.769E-11	1.324E-08	2.109E+07	4.916E+03
Esophagu	4.769E-11	3.785E-06	1.561E+07	4.287E+03
SI Wall	9.457E-06	1.874E-06	1.538E+07	4.765E+03
LLI Wall	1.166E-04	2.332E-05	1.561E+07	4.940E+03
Liver	1.353E-09	3.756E-07	1.829E+07	5.184E+03
Muscle	4.788E-11	1.324E-08	2.050E+07	6.326E+03
Pancreas	4.777E-11	1.324E-08	1.514E+07	4.520E+03
Skin	4.773E-11	1.324E-08	7.270E+09	1.223E+07
Testes	4.769E-11	1.324E-08	2.202E+07	6.699E+03
Thyroid	4.769E-11	1.324E-08	2.179E+07	5.848E+03
EFFEC	9.942E-06	5.147E-06	9.238E+07	1.282E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	7.918E-14	1.846E-11	1.794E-02	4.928E-06
Stomach	2.316E-08	4.403E-09	7.246E-02	2.085E-05
Colon	1.443E-06	2.731E-07	1.654E-01	5.103E-05
Liver	2.986E-12	6.882E-10	2.773E-02	7.852E-06
LUNG	8.436E-13	2.675E-07	2.015E-01	5.417E-05
Bone	1.735E-13	4.181E-11	4.916E-03	1.293E-06
Skin	8.399E-15	1.732E-12	7.258E-01	1.223E-03
Breast	4.144E-13	8.658E-11	1.235E-01	3.215E-05
Ovary	1.058E-13	2.239E-11	2.120E-02	6.908E-06
Bladder	6.882E-13	1.695E-10	4.089E-02	1.258E-05
Kidneys	3.811E-14	8.547E-12	9.576E-03	2.761E-06
Thyroid	2.901E-14	5.772E-12	6.932E-03	1.864E-06
Leukemia	1.399E-11	2.942E-09	1.059E-01	2.994E-05
Residual	1.295E-12	2.631E-10	2.575E-01	7.712E-05
Total	1.465E-06	5.476E-07	1.782E+00	1.526E-03

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* NUCLIDE Cs-137 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	5.195E-05	1.763E-05	5.697E+05	2.004E+02
B Surfac	5.091E-05	1.729E-05	2.668E+06	9.495E+02
Breasts	4.148E-05	1.407E-05	1.127E+06	4.043E+02
St Wall	4.958E-05	1.652E-05	6.582E+05	2.353E+02
ULI Wall	5.343E-05	1.807E-05	5.697E+05	2.097E+02
Kidneys	4.991E-05	1.693E-05	6.990E+05	2.540E+02
Lungs	4.692E-05	1.602E-05	7.782E+05	2.586E+02
Ovaries	5.298E-05	1.797E-05	4.940E+05	1.934E+02
R Marrow	4.854E-05	1.649E-05	6.640E+05	2.295E+02
Spleen	4.995E-05	1.694E-05	6.664E+05	2.353E+02
Thymus	4.847E-05	1.648E-05	7.491E+05	2.481E+02
Uterus	5.347E-05	1.814E-05	5.091E+05	1.946E+02
Bld Wall	5.354E-05	1.816E-05	6.209E+05	2.365E+02
Brain	4.359E-05	1.482E-05	7.526E+05	2.050E+02
Esophagu	4.836E-05	2.747E-05	5.114E+05	1.666E+02
SI Wall	5.187E-05	1.759E-05	5.266E+05	1.957E+02
LLI Wall	6.186E-05	2.086E-05	5.336E+05	2.039E+02
Liver	5.025E-05	1.705E-05	6.710E+05	2.353E+02
Muscle	4.640E-05	1.577E-05	8.202E+05	3.390E+02
Pancreas	5.332E-05	1.808E-05	5.103E+05	1.829E+02
Skin	3.966E-05	1.346E-05	1.005E+09	3.204E+05
Testes	4.651E-05	1.578E-05	9.273E+05	3.856E+02
Thyroid	4.836E-05	1.644E-05	8.796E+05	2.924E+02
EFFEC	5.017E-05	1.729E-05	1.081E+07	3.483E+03

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	5.180E-08	1.746E-08	5.883E-04	1.922E-07
Stomach	1.850E-07	5.698E-08	2.656E-03	9.506E-07
Colon	5.143E-07	1.576E-07	5.720E-03	2.144E-06
Liver	7.659E-08	2.457E-08	1.017E-03	3.565E-07
LUNG	3.811E-07	1.254E-07	7.607E-03	2.528E-06
Bone	4.662E-09	1.536E-09	2.528E-04	9.017E-08
Skin	3.589E-09	1.140E-09	1.003E-01	3.192E-05
Breast	1.528E-07	5.143E-08	5.441E-03	1.957E-06
Ovary	6.327E-08	2.257E-08	7.025E-04	2.749E-07
Bladder	1.325E-07	4.292E-08	1.503E-03	5.720E-07
Kidneys	2.612E-08	8.362E-09	3.635E-04	1.316E-07
Thyroid	1.258E-08	4.070E-09	2.796E-04	9.308E-08
Leukemia	2.649E-07	8.658E-08	3.728E-03	1.293E-06
Residual	6.771E-07	2.098E-07	9.425E-03	3.588E-06
Total	2.546E-06	8.103E-07	1.398E-01	4.613E-05

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* NUCLIDE Ba-137m *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	2.738E+09	5.837E+05
B Surfac	0.000E+00	0.000E+00	5.394E+09	9.635E+05
Breasts	0.000E+00	0.000E+00	3.751E+09	6.874E+05
St Wall	0.000E+00	0.000E+00	2.912E+09	6.186E+05
ULI Wall	0.000E+00	0.000E+00	2.714E+09	6.140E+05
Kidneys	0.000E+00	0.000E+00	2.924E+09	6.244E+05
Lungs	0.000E+00	0.000E+00	3.262E+09	6.536E+05
Ovaries	0.000E+00	0.000E+00	2.563E+09	6.291E+05
R Marrow	0.000E+00	0.000E+00	3.180E+09	6.641E+05
Spleen	0.000E+00	0.000E+00	2.959E+09	6.233E+05
Thymus	0.000E+00	0.000E+00	3.029E+09	6.163E+05
Uterus	0.000E+00	0.000E+00	2.540E+09	6.023E+05
Bld Wall	0.000E+00	0.000E+00	2.703E+09	6.233E+05
Brain	0.000E+00	0.000E+00	3.507E+09	6.163E+05
Esophagu	0.000E+00	0.000E+00	2.726E+09	5.592E+05
SI Wall	0.000E+00	0.000E+00	2.610E+09	6.046E+05
LLI Wall	0.000E+00	0.000E+00	2.668E+09	6.291E+05
Liver	0.000E+00	0.000E+00	2.947E+09	6.198E+05
Muscle	0.000E+00	0.000E+00	3.192E+09	7.083E+05
Pancreas	0.000E+00	0.000E+00	2.586E+09	5.697E+05
Skin	0.000E+00	0.000E+00	4.345E+09	1.922E+06
Testes	0.000E+00	0.000E+00	3.285E+09	7.188E+05
Thyroid	0.000E+00	0.000E+00	3.355E+09	6.839E+05
EFFEC	0.000E+00	0.000E+00	3.134E+09	6.734E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	3.134E+00	6.431E-04
Stomach	0.000E+00	0.000E+00	1.177E+01	2.493E-03
Colon	0.000E+00	0.000E+00	2.784E+01	6.407E-03
Liver	0.000E+00	0.000E+00	4.462E+00	9.390E-04
LUNG	0.000E+00	0.000E+00	3.192E+01	6.396E-03
Bone	0.000E+00	0.000E+00	5.126E-01	9.145E-05
Skin	0.000E+00	0.000E+00	4.334E-01	1.922E-04
Breast	0.000E+00	0.000E+00	1.817E+01	3.320E-03
Ovary	0.000E+00	0.000E+00	3.646E+00	8.947E-04
Bladder	0.000E+00	0.000E+00	6.536E+00	1.503E-03
Kidneys	0.000E+00	0.000E+00	1.526E+00	3.250E-04
Thyroid	0.000E+00	0.000E+00	1.068E+00	2.179E-04
Leukemia	0.000E+00	0.000E+00	1.782E+01	3.728E-03
Residual	0.000E+00	0.000E+00	4.229E+01	9.238E-03
Total	0.000E+00	0.000E+00	1.713E+02	3.635E-02

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* NUCLIDE U-233 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	5.254E-06	3.237E-06	1.212E+06	3.087E+02
B Surfac	1.551E-04	1.477E-04	4.800E+06	1.549E+03
Breasts	5.254E-06	3.237E-06	2.586E+06	1.491E+03
St Wall	5.461E-06	3.303E-06	1.351E+06	3.483E+02
ULI Wall	8.306E-06	4.244E-06	1.200E+06	3.122E+02
Kidneys	5.383E-05	3.673E-05	1.410E+06	3.891E+02
Lungs	5.254E-06	1.473E-02	1.573E+06	3.728E+02
Ovaries	5.280E-06	3.570E-06	1.078E+06	3.390E+02
R Marrow	1.553E-05	1.261E-05	1.445E+06	4.206E+02
Spleen	5.254E-06	3.238E-06	1.375E+06	3.379E+02
Thymus	5.254E-06	3.237E-06	1.503E+06	3.728E+02
Uterus	5.254E-06	3.237E-06	1.103E+06	2.982E+02
Bld Wall	5.272E-06	3.249E-06	1.282E+06	3.542E+02
Brain	5.254E-06	3.237E-06	1.561E+06	3.076E+02
Esophagu	5.254E-06	6.712E-03	1.132E+06	2.633E+02
SI Wall	5.757E-06	3.403E-06	1.132E+06	2.971E+02
LLI Wall	1.421E-05	6.198E-06	1.146E+06	3.099E+02
Liver	2.049E-05	1.564E-05	1.375E+06	3.448E+02
Muscle	5.254E-06	3.237E-06	1.794E+06	1.038E+03
Pancreas	5.254E-06	3.237E-06	1.115E+06	2.819E+02
Skin	5.254E-06	3.237E-06	5.324E+06	6.920E+03
Testes	5.280E-06	3.575E-06	1.969E+06	1.212E+03
Thyroid	5.254E-06	3.237E-06	1.806E+06	5.149E+02
EFFEC	1.897E-04	3.549E-02	1.654E+06	6.990E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	8.177E-08	3.996E-08	1.305E-03	3.029E-07
Stomach	2.309E-07	8.843E-08	5.452E-03	1.410E-06
Colon	2.523E-06	7.289E-07	1.212E-02	3.215E-06
Liver	5.698E-07	3.060E-07	2.085E-03	5.231E-07
LUNG	5.735E-07	2.686E-03	1.538E-02	3.646E-06
Bone	3.622E-07	2.168E-07	4.555E-04	1.468E-07
Skin	5.883E-09	2.497E-09	5.312E-04	6.908E-07
Breast	1.128E-07	4.588E-08	1.247E-02	7.200E-06
Ovary	9.435E-08	5.217E-08	1.538E-03	4.823E-07
Bladder	2.002E-07	9.694E-08	3.099E-03	8.563E-07
Kidneys	6.438E-07	3.127E-07	7.328E-04	2.027E-07
Thyroid	1.650E-08	6.771E-09	5.755E-04	1.643E-07
Leukemia	9.176E-08	5.365E-08	8.108E-03	2.365E-06
Residual	7.363E-07	2.775E-07	2.039E-02	8.085E-06
Total	6.253E-06	2.690E-03	8.435E-02	2.924E-05

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* NUCLIDE U-238 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	4.492E-06	2.648E-06	6.850E+04	4.520E+01
B Surfac	1.301E-04	8.321E-05	8.621E+05	9.425E+02
Breasts	4.492E-06	2.648E-06	9.949E+05	1.503E+03
St Wall	4.669E-06	2.706E-06	9.623E+04	6.151E+01
ULI Wall	7.145E-06	3.522E-06	6.559E+04	3.134E+01
Kidneys	4.666E-05	3.119E-05	1.247E+05	1.075E+02
Lungs	4.492E-06	1.214E-02	1.160E+05	6.512E+01
Ovaries	4.492E-06	2.649E-06	5.079E+04	8.050E+01
R Marrow	1.320E-05	8.469E-06	1.445E+05	1.491E+02
Spleen	4.492E-06	2.648E-06	8.738E+04	4.310E+01
Thymus	4.492E-06	2.648E-06	1.375E+05	9.600E+01
Uterus	4.492E-06	2.648E-06	5.324E+04	2.645E+01
Bld Wall	4.507E-06	2.658E-06	9.227E+04	6.687E+01
Brain	4.492E-06	2.648E-06	9.262E+04	2.843E+01
Esophagu	4.492E-06	5.705E-03	4.905E+04	1.876E+01
SI Wall	4.928E-06	2.792E-06	5.685E+04	2.738E+01
LLI Wall	1.228E-05	5.213E-06	5.790E+04	3.146E+01
Liver	1.749E-05	1.127E-05	9.436E+04	5.557E+01
Muscle	4.492E-06	2.648E-06	4.299E+05	9.134E+02
Pancreas	4.492E-06	2.648E-06	5.091E+04	2.283E+01
Skin	4.492E-06	2.648E-06	3.390E+06	8.644E+03
Testes	4.492E-06	2.648E-06	5.114E+05	1.124E+03
Thyroid	4.492E-06	2.648E-06	3.169E+05	2.377E+02
EFFEC	1.648E-04	2.973E-02	2.924E+05	4.940E+02

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	7.067E-08	3.574E-08	5.639E-05	2.155E-08
Stomach	2.013E-07	7.992E-08	3.879E-04	2.481E-07
Colon	2.283E-06	7.622E-07	6.431E-04	3.239E-07
Liver	4.921E-07	2.368E-07	1.433E-04	8.423E-08
LUNG	4.995E-07	2.246E-03	1.135E-03	6.373E-07
Bone	3.104E-07	1.480E-07	8.190E-05	8.947E-08
Skin	5.106E-09	2.135E-09	3.378E-04	8.621E-07
Breast	9.953E-08	4.588E-08	4.811E-03	7.258E-06
Ovary	8.103E-08	4.033E-08	7.223E-05	1.145E-07
Bladder	1.732E-07	8.103E-08	2.237E-04	1.619E-07
Kidneys	5.624E-07	2.708E-07	6.489E-05	5.592E-08
Thyroid	1.436E-08	5.883E-09	1.009E-04	7.572E-08
Leukemia	1.502E-07	9.139E-08	8.108E-04	8.365E-07
Residual	6.401E-07	2.512E-07	2.726E-03	4.870E-06
Total	5.587E-06	2.246E-03	1.159E-02	1.561E-05

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* NUCLIDE Th-234 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	2.006E-13	1.020E-12	2.540E+07	6.652E+03
B Surfac	4.684E-12	2.988E-11	1.305E+08	3.064E+04
Breasts	2.006E-13	1.020E-12	4.695E+07	1.066E+04
St Wall	2.007E-13	1.025E-12	2.959E+07	7.607E+03
ULI Wall	2.184E-13	1.101E-12	2.563E+07	7.153E+03
Kidneys	3.101E-12	1.321E-11	3.087E+07	7.747E+03
Lungs	2.006E-13	3.132E-09	3.507E+07	8.283E+03
Ovaries	1.803E-12	3.357E-12	2.225E+07	6.792E+03
R Marrow	4.939E-13	3.067E-12	2.901E+07	7.456E+03
Spleen	2.006E-13	1.020E-12	3.017E+07	7.736E+03
Thymus	2.006E-13	1.020E-12	3.344E+07	7.794E+03
Uterus	2.006E-13	1.020E-12	2.307E+07	6.792E+03
Bld Wall	2.007E-13	1.023E-12	2.784E+07	7.666E+03
Brain	2.006E-13	1.020E-12	3.378E+07	6.967E+03
Esophagu	2.006E-13	1.722E-09	2.283E+07	5.965E+03
SI Wall	2.014E-13	1.033E-12	2.377E+07	6.780E+03
LLI Wall	3.193E-13	1.275E-12	2.412E+07	7.060E+03
Liver	5.946E-13	3.992E-12	3.017E+07	7.666E+03
Muscle	2.006E-13	1.020E-12	3.530E+07	9.670E+03
Pancreas	2.006E-13	1.020E-12	2.307E+07	6.524E+03
Skin	2.006E-13	1.020E-12	8.737E+07	2.004E+04
Testes	1.831E-12	3.398E-12	3.938E+07	1.037E+04
Thyroid	2.006E-13	1.020E-12	3.786E+07	8.551E+03
EFFEC	1.259E-05	2.847E-05	3.437E+07	8.738E+03

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	4.514E-12	8.806E-11	2.633E-02	6.862E-06
Stomach	2.187E-08	4.958E-09	1.200E-01	3.076E-05
Colon	1.854E-06	3.959E-07	2.575E-01	7.340E-05
Liver	5.809E-11	1.332E-10	4.578E-02	1.162E-05
LUNG	6.179E-11	2.227E-06	3.425E-01	8.097E-05
Bone	2.338E-11	3.101E-11	1.235E-02	2.912E-06
Skin	8.917E-13	1.728E-12	8.714E-03	2.004E-06
Breast	2.535E-11	3.252E-10	2.272E-01	5.149E-05
Ovary	2.035E-10	6.623E-11	3.169E-02	9.658E-06
Bladder	1.169E-10	3.774E-11	6.734E-02	1.852E-05
Kidneys	4.403E-11	5.661E-11	1.608E-02	4.031E-06
Thyroid	1.284E-12	9.805E-12	1.200E-02	2.726E-06
Leukemia	1.110E-09	1.262E-09	1.631E-01	4.182E-05
Residual	2.756E-10	7.992E-10	4.159E-01	1.134E-04
Total	1.876E-06	2.631E-06	1.748E+00	4.497E-04

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* NUCLIDE Pa-234m *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	0.000E+00	0.000E+00	6.652E+07	1.480E+04
B Surfac	0.000E+00	0.000E+00	1.445E+08	2.936E+04
Breasts	0.000E+00	0.000E+00	9.378E+07	1.817E+04
St Wall	0.000E+00	0.000E+00	7.176E+07	1.584E+04
ULI Wall	0.000E+00	0.000E+00	6.699E+07	1.561E+04
Kidneys	0.000E+00	0.000E+00	7.258E+07	1.608E+04
Lungs	0.000E+00	0.000E+00	8.085E+07	1.666E+04
Ovaries	0.000E+00	0.000E+00	6.571E+07	1.503E+04
R Marrow	0.000E+00	0.000E+00	7.806E+07	1.678E+04
Spleen	0.000E+00	0.000E+00	7.305E+07	1.596E+04
Thymus	0.000E+00	0.000E+00	7.584E+07	1.549E+04
Uterus	0.000E+00	0.000E+00	6.291E+07	1.515E+04
Bld Wall	0.000E+00	0.000E+00	6.664E+07	1.596E+04
Brain	0.000E+00	0.000E+00	8.586E+07	1.549E+04
Esophagu	0.000E+00	0.000E+00	6.710E+07	1.398E+04
SI Wall	0.000E+00	0.000E+00	6.466E+07	1.538E+04
LLI Wall	0.000E+00	0.000E+00	6.594E+07	1.596E+04
Liver	0.000E+00	0.000E+00	7.281E+07	1.584E+04
Muscle	0.000E+00	0.000E+00	7.922E+07	1.841E+04
Pancreas	0.000E+00	0.000E+00	6.373E+07	1.445E+04
Skin	0.000E+00	0.000E+00	6.384E+09	1.094E+07
Testes	0.000E+00	0.000E+00	8.213E+07	1.876E+04
Thyroid	0.000E+00	0.000E+00	8.365E+07	1.713E+04
EFFEC	0.000E+00	0.000E+00	1.410E+08	1.258E+05

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	0.000E+00	0.000E+00	7.724E-02	1.608E-05
Stomach	0.000E+00	0.000E+00	2.901E-01	6.396E-05
Colon	0.000E+00	0.000E+00	6.874E-01	1.631E-04
Liver	0.000E+00	0.000E+00	1.103E-01	2.400E-05
LUNG	0.000E+00	0.000E+00	7.910E-01	1.631E-04
Bone	0.000E+00	0.000E+00	1.375E-02	2.784E-06
Skin	0.000E+00	0.000E+00	6.373E-01	1.092E-03
Breast	0.000E+00	0.000E+00	4.532E-01	8.784E-05
Ovary	0.000E+00	0.000E+00	9.343E-02	2.144E-05
Bladder	0.000E+00	0.000E+00	1.608E-01	3.856E-05
Kidneys	0.000E+00	0.000E+00	3.775E-02	8.365E-06
Thyroid	0.000E+00	0.000E+00	2.668E-02	5.452E-06
Leukemia	0.000E+00	0.000E+00	4.380E-01	9.413E-05
Residual	0.000E+00	0.000E+00	1.039E+00	2.365E-04
Total	0.000E+00	0.000E+00	4.858E+00	2.015E-03

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* NUCLIDE Pa-234 *
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DOSE RATE CONVERSION FACTORS

Organ	Ingestion	Inhalation	Air Immersion	Ground Surface
Adrenals	6.449E-15	1.119E-13	8.796E+09	1.841E+06
B Surfac	1.833E-13	2.994E-12	1.747E+10	3.122E+06
Breasts	6.449E-15	1.119E-13	1.212E+10	2.155E+06
St Wall	6.512E-15	1.120E-13	9.425E+09	1.957E+06
ULI Wall	1.341E-14	1.138E-13	8.842E+09	1.934E+06
Kidneys	7.012E-14	1.401E-12	9.506E+09	1.969E+06
Lungs	6.449E-15	1.553E-11	1.059E+10	2.050E+06
Ovaries	1.117E-14	4.651E-13	8.691E+09	1.887E+06
R Marrow	1.863E-14	3.053E-13	1.032E+10	2.085E+06
Spleen	6.449E-15	1.119E-13	9.611E+09	1.969E+06
Thymus	6.449E-15	1.119E-13	9.891E+09	1.899E+06
Uterus	6.449E-15	1.119E-13	8.318E+09	1.899E+06
Bld Wall	6.471E-15	1.122E-13	8.749E+09	1.957E+06
Brain	6.449E-15	1.119E-13	1.132E+10	1.934E+06
Esophagu	6.449E-15	3.517E-12	8.924E+09	1.759E+06
SI Wall	7.008E-15	1.121E-13	8.563E+09	1.911E+06
LLI Wall	3.227E-14	1.183E-13	8.726E+09	1.992E+06
Liver	2.422E-14	3.700E-13	9.565E+09	1.957E+06
Muscle	6.449E-15	1.119E-13	1.035E+10	2.225E+06
Pancreas	6.449E-15	1.119E-13	8.435E+09	1.806E+06
Skin	6.449E-15	1.119E-13	1.445E+10	4.532E+06
Testes	1.125E-14	4.714E-13	1.065E+10	2.248E+06
Thyroid	6.449E-15	1.119E-13	1.089E+10	2.097E+06
EFFEC	1.937E-06	1.444E-06	1.017E+10	2.097E+06

RISK CONVERSION FACTORS

Cancer	Ingestion	Inhalation	Air Immersion	Ground Surface
Esophagu	3.563E-11	1.528E-10	1.026E+01	2.027E-03
Stomach	1.650E-08	3.060E-09	3.810E+01	7.899E-03
Colon	1.850E-07	3.271E-08	9.075E+01	2.027E-02
Liver	4.551E-10	1.735E-10	1.445E+01	2.971E-03
LUNG	7.992E-10	6.364E-08	1.036E+02	2.004E-02
Bone	1.495E-11	1.839E-11	1.654E+00	2.959E-04
Skin	9.398E-12	4.810E-12	1.445E+00	4.520E-04
Breast	2.716E-10	4.440E-10	5.848E+01	1.042E-02
Ovary	2.087E-09	4.218E-10	1.235E+01	2.680E-03
Bladder	1.099E-09	2.290E-10	2.120E+01	4.730E-03
Kidneys	1.972E-10	5.920E-11	4.951E+00	1.024E-03
Thyroid	4.366E-12	2.068E-11	3.472E+00	6.675E-04
Leukemia	1.702E-09	7.030E-10	5.790E+01	1.165E-02
Residual	4.995E-09	1.850E-09	1.363E+02	2.912E-02
Total	2.135E-07	1.036E-07	5.557E+02	1.143E-01

C A P 8 8 - P C
Version 3.0

Clean Air Act Assessment Package - 1988

C H I / Q T A B L E S
Non-Radon Individual Assessment
May 15, 2014 01:02 pm

Facility: Waste Isolation Pilot Plant
Address: 34 Louis Whitlock Road
P.O. Box 2078
City: Carlsbad
State: NM Zip: 88221

Source Category: Stack
Source Type: Stack
Emission Year: 2013

Comments: CY 2013 WIPP Compliance Report
40 CFR Part 191, Subpart A MEOSI

Dataset Name: 2013_191SubpartA
Dataset Date: 5/15/2014 11:57:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\WIPP2013.WND

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GROUND-LEVEL CHI/Q VALUES FOR Am-241
SOLUBILITY: M
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	7500
N	2.858E-08
NNW	6.488E-08
NW	1.149E-07
WNW	8.219E-08
W	3.572E-08
WSW	2.321E-08
SW	2.402E-08
SSW	2.447E-08
S	1.242E-08
SSE	1.193E-08
SE	1.620E-08
ESE	1.247E-08
E	1.306E-08
ENE	1.636E-08
NE	1.340E-08
NNE	1.720E-08

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GROUND-LEVEL CHI/Q VALUES FOR Pu-238
SOLUBILITY: M
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	7500
N	2.859E-08
NNW	6.491E-08
NW	1.150E-07
WNW	8.226E-08
W	3.575E-08
WSW	2.323E-08
SW	2.404E-08
SSW	2.449E-08
S	1.242E-08
SSE	1.193E-08
SE	1.620E-08
ESE	1.247E-08
E	1.306E-08
ENE	1.636E-08
NE	1.340E-08
NNE	1.720E-08

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GROUND-LEVEL CHI/Q VALUES FOR Pu-239
SOLUBILITY: M
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	7500
N	2.813E-08
NNW	6.387E-08
NW	1.131E-07
WNW	8.092E-08
W	3.517E-08
WSW	2.285E-08
SW	2.364E-08
SSW	2.409E-08
S	1.223E-08
SSE	1.174E-08
SE	1.594E-08
ESE	1.227E-08
E	1.286E-08
ENE	1.610E-08
NE	1.319E-08
NNE	1.693E-08

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GROUND-LEVEL CHI/Q VALUES FOR Sr-90
SOLUBILITY: S
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	7500
N	2.858E-08
NNW	6.490E-08
NW	1.150E-07
WNW	8.224E-08
W	3.574E-08
WSW	2.322E-08
SW	2.403E-08
SSW	2.448E-08
S	1.242E-08
SSE	1.193E-08
SE	1.620E-08
ESE	1.247E-08
E	1.306E-08
ENE	1.636E-08
NE	1.340E-08
NNE	1.720E-08

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GROUND-LEVEL CHI/Q VALUES FOR Cs-137
SOLUBILITY: F
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	7500
N	2.857E-08
NNW	6.483E-08
NW	1.148E-07
WNW	8.210E-08
W	3.568E-08
WSW	2.318E-08
SW	2.399E-08
SSW	2.446E-08
S	1.242E-08
SSE	1.192E-08
SE	1.619E-08
ESE	1.247E-08
E	1.305E-08
ENE	1.635E-08
NE	1.340E-08
NNE	1.719E-08

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GROUND-LEVEL CHI/Q VALUES FOR U-233
SOLUBILITY: S
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	7500
N	2.861E-08
NNW	6.501E-08
NW	1.152E-07
WNW	8.244E-08
W	3.582E-08
WSW	2.329E-08
SW	2.409E-08
SSW	2.454E-08
S	1.244E-08
SSE	1.195E-08
SE	1.623E-08
ESE	1.248E-08
E	1.308E-08
ENE	1.637E-08
NE	1.341E-08
NNE	1.721E-08

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GROUND-LEVEL CHI/Q VALUES FOR U-238
SOLUBILITY: S
CHEMFORM: unspecified
SIZE: 1
CHI/Q TOWARD INDICATED DIRECTION (SEC/CUBIC METER)

	Distance (meters)
Dir	7500
N	2.861E-08
NNW	6.501E-08
NW	1.152E-07
WNW	8.245E-08
W	3.582E-08
WSW	2.329E-08
SW	2.409E-08
SSW	2.454E-08
S	1.244E-08
SSE	1.195E-08
SE	1.622E-08
ESE	1.248E-08
E	1.308E-08
ENE	1.637E-08
NE	1.341E-08
NNE	1.721E-08