ACL POLICY AND INFORMATION REQUIREMENTS

APPENDICES

APPENDICES

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D. Summary Sheet on Health Effects Factors

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APPENDIX A

Outline of Information That May Be Cross Referenced from the Permit Application

The following information, required in the Part B permit, may be cross-referenced in the ACL application:

§270.14(b) General information requirements for all hazardous waste management facilities.

(1) General description of the facility.

(2) Chemical and physical analyses of the hazardous waste, in accordance with Part 264.

(8) Description of the procedures, structures, or equipment used at the facility to prevent contamination of water supplies.

(11) Facility location information:

- (i) Identification of the political jurisdiction (e.g., county or township) in which the facility is located,
- (ii) If the facility is located in an area listed in Appendix VI of Part 264, information must be submitted to demonstrate compliance with the seismic standard under §264.18(a),
- (iii) Identification of whether a facility is located within a 100-year floodplain,
- (iv) Information required if a facility is located in a 100- year floodplain.

(19) A topographic map clearly showing:

- (i) Map scale (at least one inch: 200 feet) and date,
- (ii) 100-year floodplain area,
- (iii) Surface waters including intermittent streams,
- (iv) Surrounding land uses,
- (vi) Orientation of the map,
- (vii) Legal boundaries of the facility,
- (ix) Injection and withdrawal wells, both on-site and off- site,

(x) Buildings, treatment, storage, or disposal operations, or other structures,
(xi) Barriers for drainage or flood controls, and
(xii) Location of operational units within the facility site, where hazardous waste is or will be.

§270.14(c) Additional information required for the protection of ground water for hazardous waste surface impoundments, piles, land treatment units, and landfills.

(1) A summary of the interim status ground-water monitoring data.

(2) Identification of the uppermost aquifer and aquifers hydraulically interconnected beneath the facility property, including ground-water flow direction and rate, and the basis for such identification.

(3) Additional information to be included on the topographic map:

(a) Delineation of the waste management area, the property boundary, and the proposed "point of compliance;"
(b) The location of ground-water monitoring wells; and
(c) The hydrogeologic information required under §270.14(c)(2).

(4) A description of any plume of contamination that has entered the ground water that:

(i) Delineates the extent of the plume on the topographic map, and
(ii) Identifies the concentration of each Part 261 Appendix VIII constituent throughout the plume, or identifies the maximum concentrations of each Appendix VIII constituent in the plume.

(7) Information needed to establish a compliance monitoring program under §264.99:

(i) A description of the wastes previously handled at the facility;

(ii) A characterization of the contaminated ground water, including concentrations of hazardous constituents;

(iii) A list of hazardous constituents for which compliance monitoring will be undertaken in accordance with §§264.97 and 264.99;

(iv) Proposed concentration limits for each hazardous constituent, based on the criteria set forth in §264.94(a), including a justification for establishing any ACLs;

(v) Detailed plans and an engineering report describing the proposed ground-water monitoring program to be implemented to meet the requirements of §264.97; and

(vi) A description of the proposed sampling, analysis, and statistical comparison procedures to be utilized in evaluating ground-water monitoring data.

The following additional sections of the Part B permit application may also be used in an ACL demonstration if they apply to the site-specific characteristics:

§270.14(b)(5) General inspection requirements under §264.15(b), if applicable to the ACL demonstration.

(13) A copy of the closure plan and the post-closure plan, if applicable to the ACL demonstration.

(20) Additional information necessary to satisfy other Federal law requirements under §270.3. These laws may include:

(a) The Wild and Scenic Rivers Act (16 USC 1273),

(b) The National Historic Preservation Act of 1966 (16 USC 470),

(c) The Endangered Species Act (16 USC 1531),

(d) The Coastal Zone Management Act (16 USC 1451), or

(e) The Fish and Wildlife Coordination Act (16 USC 661).

§270.14(c)(8) Information needed to establish either a corrective action program that meets the requirements of §264.100, if applicable to the ACL demonstration, or a compliance monitoring program that meets the requirements of §§264.99 and 270.14(c)(6).

APPENDIX B

Summary of Figures, Tables, and Information Required in ACL Demonstrations

1. Figures
2. Tables
3. Information

This appendix can be used as a quick reference to determine what types of information are needed for various types of ACL demonstrations. As was discussed in earlier chapters, not all the information discussed in this document is necessary in all applications. The applicant is responsible for deciding what information is necessary for the site, though the appropriate permitting authority may provide some help in making this determination. Most notably, a simplified ACL demonstration may be based strictly on an EPA reviewed dose level (with no mechanisms of attenuation considered). In some cases, as was discussed in the first chapter, this may be the only type of ACL demonstration acceptable to EPA.

However, all ACL applications are required to provide certain information. If this information is not provided or is supplied in an unacceptable form, then the ground-water protection standard will be set at background or one of the MCLs listed in the regulations (40 CFR §264.94(a)). This appendix points out what information is usually required in all demonstrations, and what additional information may be required in some cases.

This appendix is only a summary; it is not comprehensive. The applicant or reviewer should refer to the main body of the guidance for a more thorough discussion of the types of information needed in an ACL application.

FIGURES

A. Figures That Should Be Included in All ACL Demonstrations

1. Plume map(s) of each hazardous constituent
2. A site map showing:
   - all structures
   - all waste management areas
   - all monitoring wells and surface water sampling locations (if applicable)
   - all ground-water withdrawal and injection wells
   - all surface water bodies
3. Horizontal and vertical ground-water flow map(s)

B. Figures That Should Be Included in All Detailed Demonstrations

1. Areal soil map
2. Vertical soil map
3. Facility subsurface stratigraphy map(s)
4. Regional subsurface stratigraphy map(s)
5. 100 year floodplain map
6. Ground-water recharge and discharge map
7. Agricultural land uses map

C. Additional Figures That May Be Necessary in a Demonstration

1. Withdrawal well cones of depression
2. Map showing locations of other potential sources of pollution
3. Map showing locations of stressed terrestrial environments
4. Map showing locations of stressed aquatic environments

TABLES

A. Tables That Should Be Included in All ACL Demonstrations

1. Background concentration of each hazardous constituent in both ground water and each surface water body (if applicable)
2. Uppermost aquifer characteristics
3. Ground-water well location and use information
4. Health effects information of each constituent (including EPA-reviewed allowable dose levels if available)

B. Tables That Should Be included in All Detailed Demonstrations

1. Location information of surface water bodies
2. Soil characteristics
3. Subsurface geology characteristics
4. Horizontal flow net data
5. Vertical flow net data
6. Ground-water withdrawal data (if applicable)
7. Annual and monthly precipitation data
8. Endangered and threatened species information (if applicable)
9. Degradation and attenuation properties of hazardous constituents
10. Soil attenuation properties
11. Mathematical model(s) assumptions (if applicable)
12. Ground-water use

C. Additional Tables That May Be Necessary in a Demonstration

1. Physical characteristics data of each water body
2. Designated uses of each surface water body
3. Point source information
4. Population characteristics
5. Toxicity information on terrestrial impacts
6. Terrestrial environment diversity information

TABLES (CONT'D)

7. Aquatic toxicity information
8. Aquatic diversity
9. Agricultural crop impacts data
10. Animal husbandry impacts data
11. Agricultural land use information
12. Physical structural impacts data

INFORMATION

Hazardous Constituent Characteristics (Chapter II)

1. Extent of Ground-Water Contamination (§270.14(c))

   A. Information Required for All Demonstrations
      i. Appendix VIII (under revision to Appendix IX of Part 264) analysis results
      ii. plume definition of each hazardous constituent

2. Waste Characteristics (§264.13)

   A. Information Required in All Demonstrations
      i. quantity of waste in regulated unit
      iii. characteristics of waste in regulated unit

3. Characteristics of ACL Constituents

   A. Information Required for a Detailed Demonstration
      i. density
      ii. solubility
      iii. vapor pressure
      iv. viscosity
      v. octanol-water partitioning coefficient (if applicable)

   B. Additional Information That May Be Required Depending on Fate-Related Arguments
      i. chemical degradation data
         a. oxidation
         b. reduction
         c. hydrolysis
      ii. biological degradation data
         a. biodegradation
         b. biotransformation

iii. physical attenuation data
   a. ion exchange
   b. precipitation
   c. complexation

Hydrogeological Characteristics (Chapter III)

1. Identification of Uppermost Aquifer (§270.14(c))

   A. Information Required in all Demonstrations
      i. horizontal extent
      ii. vertical extent

2. Characteristics of Each Soil Type

   A. Information Required for a Detailed Demonstration
      i. thickness
      ii. areal extent
      iii. hydraulic properties

   B. Additional Information That May be Required Depending on Attenuation Arguments
      i. dispersion properties
      ii. retardation and sorptive properties
         a. organic and mineral content
         b. cation and ion exchange
         c. grain size

3. Characteristics of Each Subsurface Stratigraphic Unit

   A. Information Required in a Detailed Demonstration
      i. horizontal and vertical extent
      ii. hydrologic properties
         a. hydraulic conductivity
         b. specific yield or storage
         c. effective porosity

   B. Additional Information Required if Aquitard is Present
      i. hydraulic conductivity
      ii. pump test results

Ground-Water Flow Direction and Quantity (Chapter IV)

1. Ground-Water Flow Characteristics (§270.14(c))

   A. Information Required in All Demonstrations
      - i. horizontal flow in saturated zone
         - a. ground-water elevation data
         - b. storage or specific yield data
      - ii. vertical flow in saturated zone
         - a. nested piezometer data
         - b. storage data

   B. Additional Information That May Be Required Depending on Site Conditions
      - i. temporal variability in ground-water flow
         - a. seasonal recharge patterns
         - b. surface water elevation changes
            - 1. tidal effects
            - 2. riverine or lake
      - ii. ground-water withdrawal effects on ground-water flow
         - a. drawdown effects

Rainfall (Chapter V)

1. Precipitation Characteristics

   A. Information Required in a Detailed Demonstration
      i. monthly rainfall and/or snowfall
      ii. effects of rainfall on seasonal recharge

   B. Additional Information Required if Surface Waters are Nearby (see Chapter VII)
      i. storm frequency patterns (1, 10, 25, 100 years)
      ii. effects of storms on infiltration
      iii. effects of storms or flooding
         a. 100-year floodplain (§270.14(b))
      iv. site-specific characteristics affecting flooding and infiltration
      v. ground-water discharge pathways

Proximity of Surface Water and Ground-Water Users (Chapter VI)

1. Surface Water Information

   A. Information Required in a Detailed Demonstration
      i. location of each water body within 5 km downgradient of facility
         a. distance from facility
         b. travel time of ACL constituents from facility to the water body

   B. Additional Information is Required if Ground-Water Discharge of ACL Constituents is Likely to Reach Surface Waters
      i. physical characteristics of each water body
         a. dimensions
         b. hydraulic residence time, flow rate, or tidal periodicity
      ii. discharge zone size

2. Ground-Water User Information

   A. Information Required in All Demonstrations
      i. location and distance from facility of ground water users
      ii. types of users
         a. potable
         b. domestic
         c. industrial
         d. agricultural
         e. recharge

   B. Additional Information That May Be Required
      i. demography of surrounding area
      ii. zoning patterns
      iii. projected population growth
      iv. projected ground-water use

Uses of Ground Water and Surface Water (Chapter VII)

1. Ground-Water Uses

   A. Information Required in a Detailed Demonstration
      i. use or potential use of local ground water
      ii. State certification of groundwater's beneficial use

2. Surface Water Uses

   A. Additional Information is Required if Surface Waters are Nearby and Contaminated Ground Water Discharge is Likely
      i. designated use of each water body
         a. drinking water source
         b. fish and wildlife propagation
         c. industrial or agricultural use
         d. area of ecological concern
         e. recreational area

Existing Quality of Ground Water and Surface Water and Other Sources of Contamination (Chapter VIII)

1. Ground-Water Background Quality (§264.99)

   A. Information Required in All Demonstrations
      i. ground-water assessment for Appendix VIII constituents
         a. hydrologic units in uppermost aquifer
         b. upgradient of facility

   B. Additional Useful Information
      i. historical regional ground-water quality information

2. Surface Water Quality

   A. Additional Information is Required if Ground-Water Discharge of ACL Constituents to Surface Waters is Likely
      i. surface water assessment for ACL constituents
         a. each surface water body that receives the contaminated ground water or that is downstream from a water body that does
      ii. historical regional ground-water quality information

3. Ground-Water Contamination Sources

   A. Information Required in All Detailed Demonstrations
      i. statement as to the presence or absence of other contamination sources

   B. Additional Information is Required if Background Ground Water is Contaminated
      i. location of other potential sources of contamination, including other RCRA facilities, Superfund sites, landfills, industrial areas, surface impoundments, etc.
      ii. available ground-water data from these sources

4. Surface Water Contamination Sources

   A. Additional Information is Required if Ground-Water Discharge of ACL Constituents to Surface Water is Likely
      i. statement as to the presence or absence of other surface water contamination sources
      ii. point source loading information including industrial facilities and publicly owned treatment works (POTWs)
         a. NPDES permit information
         b. waste load allocations
         c. mixing zone information
         d. monitoring data
      iii. Non-point source loading information including run-off and infiltration sources

Potential Health Risks (Chapter IX)

1. Exposure Assessment

   A. Information Required in All Demonstrations
      i. location of potential point of exposure (POE)
      ii. information or type of assumptions used for exposure

   B. Additional Information is Required Depending on Likelihood of Exposure (e.g., off-site plume, on-site ground-water use)
      i. description of likely exposure pathways
         a. drinking water (ground or surface water)
         b. ingestion of contaminated food (aquatic or agricultural products)
         c. dermal contact (bathing or recreation)
         d. inhalation of volatile organics
      ii. population information
         a. sensitive subgroups

2. Health Assessment

   A. Information Required in All Demonstrations
      i. allowable exposure levels for each ACL contaminant
         a. Reference Dose level (RfD)
         b. Potency Factor (PF)
      ii. basic toxicological data if EPA approved allowable exposure levels are not available
      iii. cumulative impacts if background is contaminated
      iv. if applicable and available, data on additive impacts for mixtures of contaminants

Potential Environmental Impacts (Chapter X)

1. Terrestrial Impacts

   A. Information Required in All Demonstrations
      i. statement as to the likelihood of any terrestrial environmental exposure

   B. Additional Information is Required if Terrestrial Environmental Exposure Can Occur
      i. toxicity and bioaccumulation values for ACL constituents
      ii. environmental effects for ACL constituents
         a. literature description
         b. stressed vegetation analysis and diversity studies if exposure has occurred

2. Endangered Species Impacts

   A. Information Required in All Demonstrations
      i. statement describing the presence of any endangered or threatened species near the facility

   B. Additional Information is Required if Endangered or Threatened Species are Found Near the Facility
      i. assessment of habitat impacts due to ACL constituents
      ii. assessment of species impacts

3. Aquatic Impact Assessment

   A. Information Required in All Demonstrations
      i. statement as to the likelihood of aquatic environmental exposures

B. Additional Information is Required if Aquatic Environmental Exposure Can Occur
   i. sampling protocol to show no statistical significance
      a. QA/QC
      b. sampling points and justification
   ii. data requirements
      a. water
      b. sediment

4. Agricultural Impacts

   A. Information Required in All Demonstrations
      i. statement as to the likelihood of agricultural operations exposures

   B. Additional Information is Required if Exposure is Likely
      i. data on agricultural land use near the facility
      ii. information on exposure pathways including shallow ground water and irrigation
      iii. assessment of crop impacts
      iv. assessment of livestock impacts

5. Physical Structure Impacts

   A. Information Required in All Demonstrations
      i. statement as to the likelihood of physical structure exposure

   B. Additional Information is Required if Exposure is Likely
      i. data on physical structures in area
      ii. information on exposure pathways
      iii. assessment of reactivity, ignitability, and migration potential of ACL constituents and their impact or physical structure

Persistence of Contamination and Permanence of Effects (Chapter XI)

1. Persistence

   A. Information Required in All Demonstrations
      i. statement on whether degradation of ACL constituent is used as a fate-related argument

   B. Additional Information is Required if Fate Arguments are Used
      i. assessment of degradation of ACL constituents (Chapter II information)
         a. biodegradation, bioconcentration, biotransformation
         b. oxidation/reduction
         c. hydrolysis
         d. precipitation, ion exchange, complexation
      ii. assessment of rates of degradation
         a. parameters
         b. coefficients
         c. assumptions

2. Permanence

   A. Information Required in All Demonstrations
      i. statement on whether acceptable risk arguments are used

   B. Additional Information is Required if Exposures Do Occur
      i. long-term effects associated with exposure to ACL contaminants
         a. chronic effect levels
         b. reversibility of effect

APPENDIX C

Summary Sheet of Hazardous Constituent Properties

PHYSICAL AND CHEMICAL PROPERTIES OF EACH HAZARDOUS CONSTITUENT

1. Name of Constituent: _____

2. CAS #: _____

3. Molecular Weight: _____

4. Physical state of product/chemical and quantity during storage or disposal.

	Storage	Disposal
Solid		
Gas		
Liquid		

5. Melting Point: _____

6. Boiling Point: _____

7. Solubilities in:
   a. Water: _____
   b. Nonaqueous Solvent (specify): _____

8. Dissociation Constant (specify): _____

9. Partition Coefficient (Kow): _____

10. Density: _____

11. Reactivity (specify)
    a. Photochemical Degradation: _____
    b. Hydrolysis: _____
    c. Chemical Oxidation: _____
    d. Chemical Reduction: _____

12. Vapor Pressure: _____

13. Henry's Law Constant: _____

14. Viscosity of Liquids: _____

15. Biodegradation Characteristics: _____

16. Adsorption/Desorption Characteristics: _____

17. Chemical Incompatibility: _____

18. pH: _____

19. Decomposition Temperature: _____

20. Decomposition Products: _____

APPENDIX D

Summary Sheet on Health Effects Factors

SUMMARY SHEET ON HEALTH EFFECTS

Name of Constituent: _____ CAS #: _____

AGENCY-REVIEWED ALLOWABLE HEALTH LEVELS

MCL	Reference Dose	Risk Specific Dose	Other (water quality criteria, etc.)
_____	Dose _____ _____ Assumptions _____ _____ Concentration _____	Potency Factor _____ Assumptions _____ _____ Concentration at 10^{-6} risk _____	_____ _____ _____

HEALTH EFFECTS TESTING, IF AGENCY-REVIEWED LEVELS ARE UNAVAILABLE

1. a. Has the chemical been evaluated for the following:

Effects	Test Performed		Effects Observed	
	Yes	No	Yes	No
Oncogenicity				
Carcinogenicity				
Mutagenicity/Genotoxicity				
Teratogenicity/Fetotoxicity				
Chronic Toxicity				
Subacute Toxicity				
Other				

b. What organization performed the toxicology testing?

_____

c. Is a protocol for the testing available? _____ Yes _____ No

d. Are copies of the testing reports available? _____ Yes _____ No

If yes, attach copies and check here: _____

2. If a positive response was given in any part of Question 1.a, then summarize test(s) below. Make copies of the table and complete one table for each test performed on the subject chemical.

a. Test Subjects	Sex: _____ Species: _____
b. Dose and Duration	Dose: _____ Frequency of administration: _____ Duration of exposure: _____
c. Route of Exposure	☐ Oral ☐ Dermal ☐ Eyes ☐ Inhalation ☐ Subcutaneous ☐ Intramuscular ☐ Interperitoneal ☐ Intravenous ☐ Other
d. Effects Observed 1/	
e. Protocol Followed	☐ Yes ☐ No If yes, cite protocol: _____
f. Comments 2/	
g. Reference or Source	

1/ Include non-tumorigenic and all other effects observed, dose levels at which the effects were observed, statistical evaluations of data, and latency periods observed.

2/ Report any variables which may have affected the results obtained.

APPENDIX E

Standard Factors Used in Exposure Assessments

Standard Factors Used in Exposure Assessments

A. BIOLOGICAL PARAMETERS

Mass of Standard Humans[1]

male adult: 70 kg
female adult: 60 kg

Skin Surface Area[2]

1.8 m^2	-	totally exposed (man 180 cm high)
0.3 m^2	-	assuming short-sleeved, open-necked shirts, pants, shoes, with no gloves or hats
0.09 m^2	-	assuming long sleeved shirts, gloves, pants, shoes.

Effective Pore Size of Skin and Other External Membranes[3]

4 Angstroms (0.4 nm)

Amount of Food Consumption[4]

1500 gm/day (excluding beverages)

Drinking Water Consumption[5]

1.9 liters per day average with a range of 1 to 2.4 liters per day (2 liters per day is frequently used).

Respiratory Rate[5]

	Adult man	Adult woman	Child (10 yr)
minute volume (liters/min)			
resting	7.5	6.0	4.8
light activity	20.0	19.0	13.0
Liters of air breathed			
8 hr working "Light activity"	9,600	9,100	6,240
8 hr nonoccupational activity	9,600	9,100	6,240
8 hr resting	3,600	2,900	2,300

Size of Respirable Particulates (aerodynamic diameter)[3]

<1 μm : 100% reach the alveoli; 0% retention in nasal passage
2 μm : 80% reach the alveoli; 20% retention in nasal passage
5 μm : 50% reach the alveoli; 50% retention in nasal passage
>10 μm : almost complete retention in nasal passage
- mouth breathers can inhale particles up to 15 μm aerodynamic diameter

1980 U.S. Population by Age and Sex (in thousands)[6]

	Male	Female	Total
Total, all years	110,032	116,473	226,505
under 5 years	8,360	7,984	16,344
5-9 years	8,538	8,159	16,697
10-14 years	9,315	8,926	18,241
15-19 years	10,752	10,410	21,162
20-24 years	10,660	10,652	21,313
25-29 years	9,703	9,814	19,518
30-34 years	8,676	8,882	17,558
35-39 years	6,860	7,103	13,963
40-44 years	5,708	5,961	11,668
45-49 years	5,388	5,701	11,088
50-54 years	5,620	6,089	11,709
55-59 years	5,481	6,133	11,614
60-64 years	4,669	5,419	10,086
65 years and older	10,303	15,242	25,544
median age (yrs.)	28.8	31.3	30.0

Time Spent in Various Activities[7]

activity budget for 8 hr workday: 6 hr light work
2 hr heavy work

activity budget for 24 hr day: 12 hr rest
10 hr light work
2 hr heavy work

Birth Rate[5]

1980: 16.2 per 1,000 population

Death Rate[6]

1980: 8.9 per 1,000 population

Average Life Expectancy[6] (1980)

Male - 69.9 years

Female - 77.8 years

Employment by Industry (1980)[6]

	Total (x 10^3)	Percent Female
Agriculture, forestry, fisheries	3,470	19.5
Mining	940	13.5
Construction	6,065	8.0
Manufacturing	21,593	31.4
Transportation, communications, and other public utilities	6,393	25.2
Wholesale and retail trade	19,727	46.4
Wholesale trade	3,827	25.8
Retail trade	15,900	51.4
Finance, insurance, and real estate	5,860	58.2
Banking and other finances	2,504	65.7
Insurance and real estate	3,355	52.6
Services[a]	27,983	61.3
Business Services	2,308	45.1
Automobile services	924	12.6
Personal services[a]	3,738	73.2
Private households	1,229	88.3
Hotels and lodging places	1,106	65.2
Entertainment and recreation	1,017	39.1
Professional and related services	19,472	65.7
Hospitals	3,947	77.2
Health services except hospitals	3,281	74.3
Elementary, secondary schools	5,467	71.0
Colleges and Universities	2,066	48.8
Welfare and religious agencies	1,560	58.6
Public administration[b]	5,240	35.8

a Includes industries not shown separately
b Includes workers involved in uniquely governmental activities, e.g., judicial and legislative

Farms[5] (1980)

number of farms in the U.S. - 2.4×10^6
total farm acreage in the U.S. - 1×10^9 acres
average farm size in the U.S. - 430 acres

Total Land in U.S.[6]

2.3×10^9 acres

Home Gardens[8]

average size - 750 ft^2
annual value of home grown produce - $14 billion
percentage of U.S. household with gardens - 44%
total amount of land used as gardens - 6 million acres

House Size[9]

142 - 425 m^3

Building Size for Typical Endosed Production Facility[10]

7,000 - 26,000 m^3 (250,000 - 925,000 ft^3)

C. CHEMICAL PARAMETERS

pH Ranges for Various Water Quality Categories[11]

Category	Range
Recreation and Aesthetics	5.0 - 9.0
Public Water Supplies	6.0 - 8.5
Fish, Aquatic, and Wildlife	6.0 - 9.0
Marine and estaurine organisms	6.7 - 8.5
Wildlife	7.0 - 9.2
Fresh water organisms	6.0 - 9.0
Agricultural Use	5.5 - 9.0
Irrigation Water Supplies	4.5 - 9.0

D. PHYSICAL PARAMETERS

Air Change Rate (Home Dwelling)[9]

0.25 - 5 per hour

Characterization of Production Emissions[10]

Emission Route	% of Total Emissions of Air
Process Vents	66 - 70%
Fugitive Emissions	15 - 20%
Storage and Transportation	8 - 10%
Solid and Liquid Waste Stream Emissions	2 - 5%

Average Wind Speed[12]

5.5 m/sec

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