DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 2/5/99

RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA725)
Current Human Exposures Under Control

Facility Name: **Lockheed Martin**
Facility Address: **Electronics Park, Liverpool, NY**
Facility EPA ID #: **NYD059385120**

1. Has **all** available relevant/significant information on known and reasonably suspected releases to soil, groundwater, surface water/sediments, and air, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

   __X__ If yes - check here and continue with #2 below.

   _____ If no - re-evaluate existing data, or

   _____ if data are not available skip to #6 and enter "IN" (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Current Human Exposures Under Control" EI

A positive "Current Human Exposures Under Control" EI determination ("YE" status code) indicates that there are no "unacceptable" human exposures to "contamination" (i.e., contaminants in concentrations in excess of appropriate risk-based levels) that can be reasonably expected under current land- and groundwater-use conditions (for all "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Current Human Exposures Under Control" EI are for reasonably expected human exposures under current land- and groundwater-use conditions ONLY, and do not consider potential future land- or groundwater-use conditions or ecological receptors. The RCRA Corrective Action program's overall mission to protect human health and the environment requires that Final remedies address these issues (i.e., potential future human exposure scenarios, future land and groundwater uses, and ecological receptors).

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

Current Human Exposures Under Control
Environmental Indicator (EI) RCRIS code (CA725)

2. Are groundwater, soil, surface water, sediments, or air **media** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective risk-based "levels" (applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action (from SWMUs, RUs or AOCs)?

	Yes	No	?	Rationale / Key Contaminants
Groundwater	_X_	___	___	**VOCs (TCE & others) at ppm levels**
Air (indoors)[2]	___	_X__	___	**See attached information.**
Surface Soil (e.g., <2 ft)	_X__	___	___	**VOCs in former drum storage area**
Surface Water	___	_X__	___	
Sediment	_X__	___	___	**Cadmium in off-site stream sediments**
Subsurf. Soil (e.g., >2 ft)	_X__	___	___	**VOCs and Petroleum Compounds**
Air (outdoors)	___	_X__	___	

_____ If no (for all media) - skip to #6, and enter "YE," status code after providing or citing appropriate "levels," and referencing sufficient supporting documentation demonstrating that these "levels" are not exceeded.

__X___ If yes (for any media) - continue after identifying key contaminants in each "contaminated" medium, citing appropriate "levels" (or provide an explanation for the determination that the medium could pose an unacceptable risk), and referencing supporting documentation.

_____ If unknown (for any media) - skip to #6 and enter "IN" status code.

Rationale and Reference(s):

Footnotes:

[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriately protective risk-based "levels" (for the media, that identify risks within the acceptable risk range).

[2] Recent evidence (from the Colorado Dept. of Public Health and Environment, and others) suggest that unacceptable indoor air concentrations are more common in structures above groundwater with volatile contaminants than previously believed. This is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration necessary to be reasonably certain that indoor air (in structures located above (and adjacent to) groundwater with volatile contaminants) does not present unacceptable risks.

Site History

The Lockheed Martin Corporation, Electronics Park (EP) facility is located on Electronics Parkway in the Town of Salina, New York(see Figure 1). The EP facility was constructed in the mid-1940's by the General Electric (GE) Company. The ownership was transferred by GE to Martin Marietta Corporation in April 1993. In March 1995, Marin Marietta merged with Lockheed Corporation. As a result, the Martin Marietta Corporation became a wholly-owned subsidiary of Lockheed Martin Corporation. In September 1996, the property was transferred to the Empire State Development Corporation, however, Lockheed Martin is responsible for completing the necessary corrective actions and for cleaning up contamination both on and off-site of the Electronics Park facility.

In the past, various electronic components were manufactured at the EP facility. These

included television picture tubes, semi-conductors, transmitters and receivers, and specialty products. Presently, sonar and radar systems are manufactured at the facility.

CONTAMINATION ON-SITE and in BLOODY BROOK

As a result of past manufacturing and operations, a variety of chemicals used at the EP facility have impacted soils, sediment and groundwater. These include volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), heavy metals, and hazardous constituents found in petroleum based products (BTEX). Below is a summary of the locations and type of contaminants found on-site and off-site in Bloody Brook:

Table 1
AREAS IMPACTED BY CONTAMINATION

Location	Type of Contamination found at that Location	Media Impacted
Bloody Brook (west branch)	Cadmium, PCBs	Stream sediments
On-Site Groundwater	Volatile Organic Compounds (including trichloroethene, 1,2,dichloroethene, and vinyl chloride, PCBs	Groundwater
Former Gasoline Storage Area	Petroleum based compounds (benzene, toluene, ethylbenzene, and xylene)	Soil & Groundwater
Former Drum Storage Area	Volatile Organic Compounds and Petroleum based compounds	Soils
Storm Sewers	Volatile Organic Compounds	Groundwater & Surface Water

RCRA FACILITY INVESTIGATION

Beginning in the 1980's, Lockheed Martin initiated a series of voluntary investigations to identify the impacts from hazardous waste or constituents. Extensive soil and groundwater investigations were conducted to evaluate all Solid Waste Management Units (SWMUs) and process areas at the EP facility. In addition a sediment sampling program was conducted in both the Middle and West Branches of Bloody Brook at locations upstream and downstream of the facility and within the facility boundaries. The purpose of these investigations was to determine the presence, nature, rate, and extent of releases of contamination at the EP facility and in Bloody Brook. Once enough data was gathered to define the extent of any impacts at the EP facility so that

corrective measure alternatives could be chosen, RCRA Facility Investigation (RFI) Reports were completed, summarizing this information. With respect to Bloody Brook, a separate technical evaluation was completed. This information was used to help make the final recommendations for corrective measures at the EP facility and Bloody Brook. The results of those investigations are summarized below:

EP Facility Investigations

Lockheed Martin has voluntarily undertaken a series of soil and groundwater investigations at and near the EP facility. A Phase I groundwater investigation was conducted to evaluate groundwater conditions near Building EP-7A. The findings of this investigation are presented in the "Phase I Ground-Water Investigation Report" prepared by Malcolm Pirnie, Inc., dated September 1990. A Phase II groundwater investigation was conducted to evaluate the foundation drain and sump systems throughout the facility. A "Phase II Ground-Water Investigation Report", dated August 1991, summarizing the findings of this investigation was prepared by Law Environmental. A Phase III investigation was conducted by Blasland, Bouck & Lee, Inc. (BB&L) in 1992. This investigation included the evaluation of the physical, chemical, and hydraulic characteristics of the overburden groundwater system at the facility. The results of the Phase III investigation are presented in the "Phase III Ground-Water Investigation Report", dated April 1993, and the "Supplemental Phase III Ground-Water Investigation Report", dated October 1993.

Several additional groundwater-related investigations were conducted by BB&L from 1992 to 1994. The results of these investigations are documented in the following reports: "Storm Sewer Action Plan", dated October 1992; "Storm Sewer Investigations", dated December 1992; "West Electronics Park Ground-Water Investigation Report", dated February 1994; the "Supplemental West Electronics Park Ground-Water Investigation Report", dated September 1994; and "Additional Ground-Water Investigation Report, Building EP-5", dated November 1996. Lockheed Martin continues to monitor site-wide groundwater quality on a periodic basis. .

The investigations identified above have provided a hydrogeologic database consisting of soil gas, subsurface geologic, groundwater hydraulic and groundwater quality data, as well as information pertaining to the hydraulic influence of building sumps and subsurface utilities at the EP facility.

Site Geology

Based on the results of the investigations listed above, the general stratigraphy beneath the site is interpreted as consisting of the following geologic units (in descending order from ground surface):

A heterogeneous upper overburden unit composed primarily of brown silt, sand, and gravel;

Greenish-gray shaley/silty glacial till;
Brown silty to clayey glacial till; and
Gray to green Vernon Shale bedrock.

The site geology is detailed in the previously referenced reports.

Site Hydrogeology

Groundwater investigations at the site have generated data on the upper silt, sand, and gravel overburden unit of the site as well as the underlying Vernon Shale bedrock.

In general, the overburden groundwater flow system at the site is comprised primarily of the silt, sand and gravel unit underlain by a glacial till unit. Owing to its density, fine grain size, and compact nature, the glacial till unit acts as a hydraulic confining unit between the silt, sand and gravel unit, and the underlying bedrock formation.

Overburden groundwater elevation data obtained from the existing groundwater monitoring network (including monitoring wells, piezometers and sumps) demonstrates that groundwater underlying the central portion of the site converges upon the upper/lower sump located in Building EP-7. This hydraulic control, evidenced by a continuous groundwater depression centered near the upper/lower sump, is attributed to the active pumping (at approximately 30-50 gallons per minute) from the sump. Water pumped from the upper/lower sump, as well as other building sumps, is combined and treated in the Long Term Treatment System (discussed below).

Groundwater elevation data indicates that the hydraulic control of the sump network influences overburden groundwater flow throughout interior areas of the site, including the Former Gasoline Storage Tank Area, and the Storm Sewers. Overburden groundwater is not present in the western portion of the site known as the Former Drum Storage Area. **(See Attached Figure - Groundwater Elevation Contours)**.

Bedrock monitoring wells installed along the southern and western boundaries of EP indicate that the top of the Vernon Shale is highly fractured but has a relatively low permeability.

The site hydrogeology is detailed in the previously referenced reports. Variations to the general site hydrogeology may be encountered in each area of the site; pertinent hydrogeologic variations will be described in subsequent sections.

Site Chemical Characterization

Groundwater

Previous investigations have identified VOCs, including trichloroethylene (TCE) and potential degradation products (1,2-dichloroethene [1,2-DCE] and vinyl chloride [VC]) in water samples collected from the building sumps and storm sewers at the site and in overburden groundwater samples obtained from the monitoring wells located within the site boundaries. Other VOCs,

including petroleum-related compounds (benzene, toluene, ethylbenzene, and xylenes, collectively referred to as BTEX), were detected in groundwater near the former location of two underground storage tanks used for gasoline and diesel fuel storage near EP-9 (known as the Former Gasoline Storage Tank Area). Based on analytical data obtained from monitoring wells installed at the perimeter of the site, the Department believes that VOC-impacted groundwater has not migrated off-site.

Semi-volatile organic compounds (SVOCs) have been detected in the overburden groundwater at monitoring wells located near Building EP-15 and EP-9, and at an upgradient monitoring well location at the eastern perimeter of the facility. No organochlorine pesticides have been detected in the groundwater at the facility. PCBs have been detected at two monitoring wells located near Buildings EP-15 and EP-5; the PCBs were identified in unfiltered water samples and may be related to PCB-impacted soils.

Groundwater samples obtained from the bedrock formation contained no VOCs (except for common laboratory contamination), SVOCs, pesticides or PCBs. No dissolved inorganics were present at concentrations exceeding Department Class GA standards. The bedrock groundwater analytical results support the interpretation that VOC impacts to groundwater are limited to the overburden (primarily the silt, sand and gravel unit above the glacial till) groundwater system within the site perimeter.

Soils

Previous investigations have identified chlorinated solvents (i.e., TCE, 1,2-DCE, tetrachloroethene [PCE] and 1,2-dichlorobenzene) and BTEX compounds in soil samples collected from the Former Drum Storage Area. Petroleum-related BTEX compounds were also detected in the unsaturated soil zone near the gasoline storage tank area. No SVOCs, pesticides or PCBs were identified in the site soils. In addition, there is no evidence of elevated concentrations of inorganics in the site soils. The soil chemical characterization for each of the SWMU is described in detail in the previously-referenced reports and is described further below.

SWMU-Specific Existing Conditions

Site-Wide Groundwater

Lockheed Martin's voluntary investigations have identified specific areas of the EP facility which have been impacted by past activities. As described above, overburden groundwater present in select areas (including the Former Gasoline Storage Tank Area, the Storm Sewers and the sump network) within the site boundaries is impacted by VOCs, and is hydraulically connected and controlled by the continuous pumping of water from the existing network of building sumps **(See Attached Figure - Volatile Organic Compounds at Building Sumps)**. The water pumped from these sumps is treated in the existing Long Term Treatment System and discharged to the storm sewer (described below), under the terms of a State Pollutant Discharge Elimination System (SPDES) permit.

VOC impacts to Site-Wide Groundwater at EP have been associated with three discrete areas of the facility: the Building Sumps/Long-Term Treatment System; the Storm Sewers; and the Gasoline Storage Tank Area. As a result of these identified VOC impacts to groundwater, Lockheed Martin has undertaken a series of voluntary remedial measures which address impacted groundwater capture and control. As a result of these actions, contaminated groundwater has been contained within the facility boundary. (See Attached Figure - Volatile Organic Compounds at Monitoring Wells).

Storm Sewers

An on-site network of storm sewers exists at Electronics Park which discharges to the Middle and West Branches of Bloody Brook, both of which are Class C streams. Currently, surface water discharges to the storm sewers are regulated under the terms of SPDES Permit No. NYD002101.

Sampling and analysis of dry weather flows within the storm sewers at Electronics Park identified specific sections which were being impacted by the infiltration of VOC contaminated groundwater. The storm sewer sampling program identified four sections of pipeline that were being impacted by VOC-contaminated groundwater. These sections included:

1. An 18-inch diameter section located north of Building EP-10;
2. A 36-inch diameter section located west of Building EP-7;
3. A 27-inch diameter section located east of Building EP-6; and
4. Two 36-inch diameter sections and one 48-inch diameter section located west of Building EP-15 (West Branch of Bloody Brook).

As a result of these identified VOC impacts to the storm sewers, Lockheed Martin has undertaken a series of voluntary remedial measures which address impacted groundwater infiltration and discharge. In addition, Lockheed Martin is required to routinely monitor the storm sewer network to ensure that surface-water discharges from the facility meet applicable New York State surface-water quality standards, State Pollution Discharge Elimination System (SPDES) discharge limitations, and Department guidance levels.

Former Gasoline Storage Tank Area

Previous investigations conducted at the EP site have included investigatory work related to the Gasoline Storage Tank Area. Specifically, the Phase III Ground-Water Investigation (BB&L, April 1993) and the Supplemental Phase III Ground-Water Investigation (BB&L, February 1994) included soil and groundwater investigations in this area.

Two 4,000-gallon underground storage tanks (USTs), located near Building EP-9, were used for bulk storage of petroleum products, specifically gasoline and diesel fuel. These tanks were taken out of service in August 1996 and abandoned in-place through the removal of product and filling with concrete. As detailed below, subsurface investigations conducted in and around this area

have revealed the presence of petroleum-related VOCs, including BTEX in soils and groundwater, due to past leakage from the piping associated with the gasoline storage tank. Upon discovery of the leakage, this piping was repaired during retrofitting activities conducted pursuant to Department petroleum bulk storage regulations (6NYCRR Part 613). Furthermore, approximately 260 cubic yards of soil, visually impacted or containing petroleum odors, was excavated and disposed of at an off-site location. The excavated area was lined with plastic and backfilled.

Former Drum Storage Area

Based on a review of historical documents, a former drum storage area was identified near the former location of Buildings EP-11 and EP-12 (demolished in 1988). Reportedly, chemical wastes, including spent halogenated and non-halogenated solvents, were stored in steel, 55-gallon drums which were placed in paved and/or gravel areas. No drums or waste materials are currently stored and remedial measures are currently underway in this area. Based on data obtained from previous soil boring investigations (see below), overburden groundwater does not occur in the Former Drum Storage Area. The results of completed investigations in this area are summarized below.

Previous investigations (BB&L, February 1994) undertaken in the Former Drum Storage Area revealed the presence of VOCs in unsaturated soils near the existing ground surface. To further characterize the nature of VOC contamination, 32 soil borings were completed in the area as part of the Supplemental West Electronic Park Ground-Water Investigation (BB&L, September 1994).

VOCs detected in the soil samples include chlorinated solvents [TCE, 1,2-DCE, PCE, and 1,2-dichlorobenzene] as well as non-chlorinated hydrocarbons (BTEX). The identified VOCs are compatible with the reported contents of the drums formerly stored at the EP-11/EP-12 area (GE, 1987). VOCs were detected above the Department-issued Technical Administrative Guidance Memorandum (TAGM): Determination of Soil Cleanup Objectives and Cleanup Objectives (TAGM No. 4046) cleanup objectives only in shallow samples obtained within 4 feet of ground surface.

The soil samples obtained at borings performed on the margins of the 50-foot by 50-foot sampling grid, as well as the four borings performed along the roadway south of the Former Drum Storage Area, contained either low concentrations or no detectable VOCs.

The analysis of VOC concentrations in these soil samples allows horizontal and vertical delineation of the zone of impacted soils within the Former Drum Storage Area. Two limited areas of soil were delineated with VOC concentrations equal to or above the TAGM soil cleanup objectives.

Bloody Brook Investigations

As part of an ongoing study, the Department sampled the tributaries to Onondaga Lake, including Bloody Brook, in 1994 and 1995. In certain areas of the stream, the water quality and wildlife appear to have been impacted by the presence of metals and PCBs.

Based on Departments findings and in consideration of a pending real-estate transfer of the EP facility, Lockheed Martin elected to collect and analyze surface water and sediment samples from within the Middle and West Branches of Bloody Brook at select locations. The objective of this initial investigation (the Phase I investigation) was to provide data that could be used to assess the presence or absence of PCBs, cadmium, copper or mercury in surface water and sediments. The results of this investigation indicated the presence of PCBs, cadmium, copper and mercury in sediments collected from the Middle and West Branches of Bloody Brook; no surface-water impacts were identified. Based on the results of the Phase I investigation, Department and the New York State Department of Health (NYSDOH) requested that Lockheed Martin conduct additional sampling and analysis (the Phase II investigation) to assess the extent of PCBs, cadmium, copper and mercury in sediments.
(See Attached Figure- Bloody Brook Sediment Sampling Cadmium and PCBs)

The sampling data showed that elevated concentrations of cadmium are in the sediments of the West Branch of Bloody Brook. The samples from the segment of the West Branch of Bloody Brook immediately downstream of the New York State Thruway contained the most elevated concentrations of cadmium. The investigation has also shown the presence of trace levels of copper, mercury and PCBs in sediment samples from the stream and these levels do not pose a human health concern.

INTERIM CORRECTIVE MEASURES (ICM)

Based on the results of previous investigations, Lockheed Martin has voluntarily implemented several interim corrective measures at the EP facility, with oversight and approval from the Department.

Groundwater Pump &Treatment

A series of foundation drains and sumps exist throughout the EP facility. The purpose of these drains and sumps is to collect and control groundwater in and around subgrade structures (primarily utility tunnels and basements) at the facility. Originally, groundwater collected in these sumps was discharged to the storm or sanitary sewer systems. Based on these findings, Lockheed Martin designed and constructed the Long-Term Treatment System which is intended to collect and treat groundwater from those building sumps found to be impacted by VOCs. The Long-Term Treatment System consists of duplex pumping systems installed in the following building sumps **(See Attached Figure)**:

EP-5 Office Sump;
EP-5 Artesian Well Sump (including artesian well flow);

EP-6 Office Sump;
EP-6 Basement Sump; and
EP-7 Upper/Lower Sump.

The pumping systems serving these sumps discharge into a dedicated piping system which conveys water to Building EP-10 for treatment.

Ongoing monitoring has indicated that the groundwater remedial system is effective in capturing and controlling VOC-impacted groundwater occurring within the overburden in the central portion of the EP facility. Furthermore, the Long-Term Treatment System seems to be effectively controlling VOC-impacted groundwater within the facility boundaries, thus preventing off-site migration.

Lockheed Martin has developed and instituted a periodic groundwater quality and elevation monitoring program to ensure continued hydraulic control and treatment of VOC-impacted groundwater from the Gasoline Storage Tank Area and other EP areas. The most recent groundwater elevation data (1999) obtained by this program supports previous conclusions that the site-wide groundwater is being hydraulically controlled by the upper/lower sump located in Building EP-7 and that impacted groundwater has not migrated off-site.

Soil Vapor Extraction and Bioventing

Since the soil and groundwater impacts in the EP Gasoline Storage Tank Area were defined, LMC with the concurrence of the Department completed a focused CMS which evaluated potential area-specific corrective measures. This results of this focused study are presented in the Department-approved Technical Memorandum, Gasoline Storage Tank Area, Corrective Measures Study (BB&L, August 1994). This document made the following recommendations regarding corrective measures to be taken for the Gasoline Storage Tank Area:

Continued use of the long-term treatment system to provide control and treatment of VOC-impacted groundwater; and

In-situ bioremediation of impacted area soils.

In response to the Department's approval of the recommended corrective measures, Lockheed Martin conducted bioventing bench-scale and pilot studies in support of the final design of the soil remedy. The results of these studies are presented in the Department-approved Bioventing System Gasoline Storage Tank Area Pilot Study and Implementation Report (Report) (BB&L, December 1994). The Implementation Report also provides a preliminary description of the bioventing system configuration proposed for the Gasoline Storage Tank Area. The Bioventing System was constructed in August 1995 and commenced operation in October 1995. The system

was enhanced in 2001 and is currently under an ongoing operation and maintenance program.

Corrective measures for the EP Former Drum Storage Area were evaluated in the Corrective Measures Study ([CMS] discussed below). The CMS recommended in-situ soil vapor extraction to address soil impacts identified in the Former Drum Storage Area. The recommended alternative was approved by the Department in April 1995. In response to the Department's approval, Lockheed Martin prepared a final design of the in-situ soil vapor extraction system, which has been approved by the Department. The in-situ vapor extraction system began operations in January 1997. Because subsequent performance monitoring data indicated that the system was not achieving the design objectives, LMC decided to undertake a source removal action at the area. The area was certified "clean closed" in 2000.

Clean up of soil contamination in these areas removed potential sources of groundwater contamination and should expedite restoration of site groundwater.

Storm Sewer Repair/Replacement

As a result of these previous investigations which identified the infiltration of VOC-impacted groundwater into select storm sewers, LMC initiated action to eliminate the infiltration into the following sections:

1. An 18-inch diameter section located north of Building EP-10;
2. A 36-inch diameter section located west of Building EP-7;
3. A 27-inch diameter section located east of Building EP-6; and
4. Two 36-inch diameter sections and one 48-inch diameter section located west of Building EP-15 (West Branch of Bloody Brook).

For the first three Storm Sewer sections identified above, LMC installed a resin-impregnated liner system (Insituform). Due to additional infiltration identified in late 1995, the 36-inch diameter section located west of Building EP-7 and the 27-inch diameter section located east of Building EP-6 were replaced. An additional section of reinforced concrete sewer present east of Building EP-6 and the sewer present north of Building EP-7 were removed and replaced with HDPE. Also a groundwater collection trench was installed adjacent to a section of the HDPE sewer installed east of Building EP-6 and adjacent to a section of the sewer installed north of Building EP-7, to collect VOC-impacted groundwater in that area in order to reduce potential storm sewer infiltration; collected groundwater is pumped to the Long-Term Treatment System. Additional activities undertaken by LMC in these Storm Sewers include manhole improvements and/or rerouting of lateral connections.

With respect to the triple-barrel Storm Sewer section which conveys the West Branch of Bloody Brook, NYSDEC approved a design submittal which resulted in the installation of a high density polyethylene (HDPE) liner inside of each the three reinforced concrete pipes (RCP). The approximate length of the lined sections is 225 feet, extending from a chamber located beneath

Building EP-15 to a downstream chamber located east of Building EP-15. To accommodate the liner pipe, a smaller diameter HDPE pipe was installed in each RCP: a 30-inch HDPE pipe was installed in the 36-inch RCP sections; and a 42-inch HDPE pipe was installed in the 48-inch RCP section. Due to the reduced frictional losses associated with HDPE pipe, no loss in hydraulic capacity occurred due to the smaller diameter pipes.

The HDPE pipes were installed by constructing a continuous 225-foot length of HDPE pipe by fusion welding the required number of sections. This continuous length of HDPE pipe was then pushed into the existing RCP sections through an insertion pit and into an exposed portion of the RCP. The HDPE pipe conveys the existing flow while providing an effective barrier against infiltration of VOC-contaminated groundwater.

Groundwater infiltration through the RCP portion of the sewer is controlled through a collection system which uses the annulus which exists between the existing RCP and the HDPE pipe. The annulus is backfilled with pea gravel which collects and conveys the groundwater infiltrating into the RCP sections; the pea gravel also secures the HDPE pipe within the RCP. A grout plug installed in the annulus at each end of the lined sections maintains the pea gravel in place and serves as a hydraulic barrier to contain groundwater which infiltrates into the RCP. Drain pipes installed through the downstream grout plug are connected to a pumping station, which pumps the groundwater drained from the annulus into a double-containment force main and then to the existing Long-Term Treatment System located at Building EP-10. To accommodate the addition of flows from this and other potential water systems, the existing Long-Term Treatment System was modified to increase treatment capacity as previously discussed.

The groundwater capture, pump and treat system installed within the Storm Sewer section beneath Building EP-15 is operating as designed. Ongoing monitoring at the SPDES outfall indicates that the Storm Sewer lining project has been successful in eliminating the infiltration of VOC-impacted groundwater into the remediated sewer sections.

West Branch of Bloody Brook Sediment Removal

Lockheed Martin's Phase I and Phase II investigations of Bloody Brook have identified the presence of cadmium and PCBs in sediment within the West Branch. The section of the West Branch from the south side of the New York State Thruway to the upstream extent of the drainage improvement project completed by Onondaga County Department of Drainage and Sanitation has been identified as containing the highest concentrations of cadmium and PCBs. This section is approximately 750 feet long, the stream bed in this area averages approximately 6 feet wide. The sediment in this section is primarily non-cohesive sand and gravel which overlie a dense clay within the stream bed.

In 1997, Lockheed Martin removed the sediment within the stream bed from this section of the West Branch and transported the sediments off-site for disposal. In addition, an approximately 6 foot square 200 foot long concrete culvert conveys the West Branch beneath the NYS Thruway

was cleaned out. Subsequent to the completion of the sediment removal program, additional studies were undertaken to evaluate the impacts posed by the residual sediment contamination which has been observed in lower reaches of the stream. Although the presence of the residual contaminants does not pose a significant current threat, additional sediment removal actions are currently being planned to further reduce the potential impacts associated with those sediments. Those actions are being addressed as part of the Onondaga Lake superfund program.

CORRECTIVE MEASURES STUDY

With the completion of the previous investigations at the EP facility, Lockheed Martin voluntarily developed a Final CMS Report (March 1995). The CMS presents an evaluation of corrective measures for impacted media at the EP facility identified through previous investigations. The CMS included: the identification, development and screening of corrective measures technologies; a detailed evaluation of corrective measures alternatives; and justification of the recommended corrective measures. Because the ICM's which had been implemented at the site were effective in addressing the presence of hazardous waste constituents in the soil and groundwater, those ICM's were selected as the primary elements in the Final Corrective Measures for the facility.

FINAL REMEDY

The Department determined that the ICMs have been effective in containing contaminated groundwater within the facility boundary. Eventually, through continued operations of the groundwater collection and treatment system, and the other Corrective Measures, the contaminated soil and groundwater will be cleaned up. Therefore, the Department determined that these measures should serve as the final remedial measures for the EP facility. In addition, the Department has determined that the Corrective Measure implemented for the West Branch of Bloody Brook will minimize the impact of contamination to the environment in a way that is protective to human health and the environment. Subsequent to the completion of the sediment removal program, additional studies were undertaken to evaluate the impacts posed by the residual sediment contamination which has been observed in lower reaches of the stream. Although the presence of the residual contaminants does not pose a significant current threat, additional sediment removal actions are currently being planned to further reduce the potential impacts associated with those sediments.

In December 1997, the NYSDEC executed an Order on Consent with Lockheed Martin that established the Final Corrective Measures for the facility. The remedy includes:

1. Remedial Goals

A. Groundwater

i. Remediation of the overburden groundwater contamination and restoration of the overburden groundwater through the development and operation of a groundwater extraction system;

ii. Containment and control of the VOC contamination of overburden groundwater to prevent its migration off–site of the facility;

iii. Containment and control of contaminated groundwater infiltration into on–site storm sewers through the development of a groundwater collection system or an alternative system as needed;

Termination of the groundwater remedial system will be based upon achieving the groundwater protection standards specified below:

PARAMETER	CAS#	GROUNDWATER PROTECTION STANDARD (ug/L)
Volatile Organic Compounds		
Trichloroethylene	79–01–6	5.0
1,1,1–Trichloroethane	71–55–6	5.0
Acetone	67–64–1	50.0
1,2–Dichloroethylene (total)	75–35–4	5.0
Vinyl chloride	75–01–4	2.0
1,1–Dichloroethane	75–34–4	5.0
Xylene (total)	1330–20–7	5.0
Chloroform	67–66–3	7.0
Toluene	108–88–3	5.0
Benzene	71–43–2	0.7
Ethylbenzene	100–41–4	5.0
p–Dichlorobenzene	106–46–7	4.7
o–Dichlorobenzene	95–50–1	4.7

B. Soils

i. Remediation of the overburden soil contamination associated with the gasoline storage area using in–situ bioremediation technology; and

ii. Remediation of the overburden soil contamination associated with the former drum storage area using in–situ soil vapor extraction (SVE) technology.

2. Remedial Criteria

A. Groundwater

i. Plume Capture

Establish and maintain a groundwater capture zone that extends to the limits of the "Overburden Groundwater Plume". The intent of the groundwater capture zone shall be to control the movement of groundwater so as to prevent the further expansion of the plume.

ii. Cleanliness Standards

Reduce the measured concentration of hazardous waste constituents in the overburden contaminant plumes by 50% within (10) years after system start–up; by 75% within (15) years after system start–up.

iii. Treatment and Discharge

Groundwater collected pursuant to this Order shall be pretreated, as necessary, and discharged in compliance with the requirements of the Department SPDES Program. If additional pretreatment is needed, Lockheed Martin will receive all necessary Permits from the Department prior to discharge of the water.

B. Soils

i. Gasoline Spill Area

The intent of the Bioventing System is to supply atmospheric oxygen to indigenous bacteria to enhance the natural degradation of benzene, toluene, ethylbenzene and xylene ("BTEX") entrained in the soils.

Because the bioventing system was not achieving the clean-up goals required by the NYSDEC (reduce the measured concentration of hazardous waste constituents in the soils by 50% within (1) year after system start–up; by 75% within (2) years after system start–up), Lockheed undertook measures to enhance the performance of the system in 2001 .

ii. Former Drum Storage Area

Because the Soil Vapor Extraction System was not achieving the clean-up goals required by the NYSDEC (reduce the measured concentration of hazardous waste constituents in the soils by 50% within (2) years after system start–up; by 75% within (4) years) Lockheed decided to undertake a soil removal program t at the area. Contaminated soils were removed and the area was “clean-closed” in 2000.

Storm Sewer Protection Program

The storm sewer protection program was designed, constructed, operated, maintained and, if necessary, will be modified to protect human health and the environment from releases of contaminated groundwater into the storm sewers (and, ultimately, Bloody Brook).

(1) Operation

The groundwater investigation suggested that contaminated groundwater was infiltrating the storm sewer system at several locations throughout Electronics Park. A closer examination revealed that major portions of the storm sewer system had deteriorated allowing seepage into the storm sewer lines. Three strategies were employed to restrict this infiltration and are detailed below.

The west branch of Bloody Brook adjacent to Building 15 was slip-lined with 3 neoprene lines 36 to 48 inches in diameter, each approximately 200 ft. long to isolate infiltrating contaminated groundwater from entering the Bloody Brook discharge. In conjunction with the slip-lining is a sump used to collect the diverted contaminated groundwater prior to pumping directly to the Building 10 Long Term Groundwater Treatment System. Pumping rates are anticipated to be approximately 30 - 50 gpm.

Several runs of sewer piping were lined via the "insituform" process. The storm sewer line north of Building 6 to Outfall 2, the storm sewer line east of Building 6 from manhole 331 to manhole 33 and the storm sewer line west of Building 7 from manhole 20 to 21. Subsequent VOC sampling of the outfalls associated with these sewer lined indicated that the repairs were successful.

Identified in the site studies were also several manholes located throughout Electronics Park that were contributing to the infiltration problem. Although not major sources of VOC contaminated groundwater infiltration, it was decided that these locations should also be addressed. Each manhole identified as a source of contaminated infiltration was rehabilitated and then coated with a high solids epoxy resin. Subsequent sampling of the manholes yielded only a trace quantities of contaminants.

Outfalls are monitored monthly for VOC levels. Any elevated VOC levels will be scrutinized to ensure that the integrity of the storm sewer linings or manhole coatings have not been compromised.

Bloody Brook

Based on the information summarized above and detailed in the Bloody Brook technical evaluation, the following Remedy was implemented for Bloody Brook:

Removed cadmium-impacted sediments present in a section of the West Branch of Bloody Brook which extends from the south side of the NYS Thruway to the upstream extent of the County's stream improvement project. Removed sediments were transported off-site for disposal. Based upon the evaluation of lower reaches of the stream, additional removal of residual contaminants will be implement in 2002 to reduce the long-term potential impacts associated with those sediments.

Institutional Controls

In order to minimize the impacts of the soil and groundwater contamination on the surrounding community, Lockheed Martin::

A. Restricts public access to the remedial systems wherever practicable.

B. Filed a Declaration of Covenants and Restrictions with the Onondaga County

Clerk's Office that will in perpetuity notify any potential purchaser that hazardous waste constituents are present in soil and groundwater at the facility; that subsurface alterations construction or changes in existing building foundations, sewers, utilities, and other subsurface structures, or excavation on the property should be made with appropriate caution. The notice also states that conditions at the property are subject to the CMI Plan. Changes to the filing, including those which reflect the attainment of the remedial goals, may be made only after receipt of written authorization from the Department.

C. Restricted use of the property to industrial or commercial use consistent with site conditions.

In addition, in 1997, the New York State Department of Health sent notification letters and held public meetings to inform residents of the potential health impacts associated with the presence of cadmium contaminated sediments in Bloody Brook. Residents were formally requested to avoid contact with the sediments.

3. Are there **complete pathways** between "contamination" and human receptors such that exposures can be reasonably expected under the current (land- and groundwater-use) conditions?

Summary Exposure Pathway Evaluation Table

	Potential **Human Receptors** (Under Current Conditions)						
"Contaminated" Media	Residents	Workers	Day-Care	Construction	Trespassers	Recreation	Food[3]
Groundwater	No	No	No	No	No	No	No
Air (indoors)	No	Yes	No	No	No	No	
Soil (surface, e.g., <2 ft)	No	No	No	No	No	No	No
Surface Water	No	No	No	No	No	No	No
Sediment	Yes	No	No	No	No	No	No
Soil (subsurface e.g., >2 ft)	No	No	No	No	No	No	No
Air (outdoors)	No	No	No	No	No	No	No

Instructions for Summary Exposure Pathway Evaluation Table:

1. Strike-out specific Media including Human Receptors' spaces for Media which are not "contaminated") as identified in #2 above.

2. enter "yes" or "no" for potential "completeness" under each "Contaminated" Media -- Human Receptor combination (Pathway).

Note: In order to focus the evaluation to the most probable combinations some potential "Contaminated" Media - Human Receptor combinations (Pathways) do not have check spaces ("___"). While these combinations may not be probable in most situations they may be possible in some settings and should be added as necessary.

_____ If no (pathways are not complete for any contaminated media-receptor combination) - skip to #6, and enter "YE" status code, after explaining and/or referencing condition(s) in-place,

whether natural or man-made, preventing a complete exposure pathway from each contaminated medium (e.g., use optional Pathway Evaluation Work Sheet to analyze major pathways).

__X__ If yes (pathways are complete for any "Contaminated" Media - Human Receptor combination) - continue after providing supporting explanation. ***(See note below regarding Bloody Brook sediments and indoor air.)***

_____ If unknown (for any "Contaminated" Media - Human Receptor combination) - skip to #6 and enter "IN" status code

Rationale and Reference(s):

Bloody Brook

As stated previously, contaminated sediments were removed from a 750 foot reach of the stream immediately downgradient of the facility. Subsequent downstream sampling have identified some isolated pockets of sediment contamination. Those areas of the stream are slated for sediment removal in early 2002. Residents in the area have been informed of the contamination and have been directed to avoid contact with the sediments.

Indoor Air

As stated previously, overburden groundwater contamination is present on-site. At the time that the NYSDEC issued the Order for Final Corrective Measures at the facility, none of the Agencies involved with the remedy selection (NYSDEC, NYSDOH and USEPA Region 2) believed that air exposures related to migration of VOCs from the on-site soils and groundwater was a significant threat. Nevertheless, based on the lessons learned from Colorado sites, further evaluation of the indoor air at representative office buildings at the facility was conducted evaluation (see November 3, 2000 and June 7, 2001 "Indoor Air Quality Sampling Event " reports. i.e. sampling). The indoor air sampling results suggest that the groundwater collection sump that is located in the basement of building EP-7 is a source of low level concentrations (19 ppb) of TCE in the indoor air. Lockheed determined that the "detectable concentrations of TCE are not only several orders of magnitude below the applicable OSHA PEL standard , but are also not indicative of potential impacts to the health of workers at the Electronics Park facility." Nevertheless, the NYSDEC and the NYSDOH have formally recommended that Lockheed take practical measures to reduce the contamination and to inform workers of the exposure (see attached letter). In light of the applicability of the 100 ppm OSHA PEL standard, we believe our actions satisfactorily address the indoor air issue.

[3] Indirect Pathway/Receptor (e.g., vegetables, fruits, crops, meat and dairy products, fish, shellfish, etc.)

Current Human Exposures Under Control
Environmental Indicator (EI) RCRIS code (CA725)

4 Can the **exposures** from any of the complete pathways identified in #3 be reasonably expected to be **"significant"**[4] (i.e., potentially "unacceptable" because exposures can be reasonably expected to be: 1) greater in magnitude (intensity, frequency and/or duration) than assumed in the derivation of the acceptable "levels" (used to identify the "contamination"); or 2) the combination of exposure magnitude (perhaps even though low) and contaminant concentrations (which may be substantially above the acceptable "levels") could result in greater than acceptable risks)?

__**X**___ If no (exposures can not be reasonably expected to be significant (i.e., potentially "unacceptable") for any complete exposure pathway) - skip to #6 and enter "YE" status code after explaining and/or referencing documentation justifying why the exposures (from each of the complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

__ If yes (exposures could be reasonably expected to be "significant" (i.e., potentially "unacceptable") for any complete exposure pathway) - continue after providing a description (of each potentially "unacceptable" exposure pathway) and explaining and/or referencing documentation justifying why the exposures (from each of the remaining complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

__ If unknown (for any complete pathway) - skip to #6 and enter "IN" status code

Rationale and Reference(s): **Groundwater, soil and sediment contamination have been addressed. Final Corrective Measures have been selected and the Corrective Measures have been implemented. These actions, coupled with the institutional controls, are designed to preclude completion of any potentially significant human exposure pathways through those media.** (See references listed above.)

[4] If there is any question on whether the identified exposures are "significant" (i.e., potentially "unacceptable") consult a human health Risk Assessment specialist with appropriate education, training and experience.

5 Can the "significant" **exposures** (identified in #4) be shown to be within **acceptable** limits?

_____ If yes (all "significant" exposures have been shown to be within acceptable limits) - continue and enter "YE" after summarizing and referencing documentation justifying why all "significant" exposures to "contamination" are within acceptable limits (e.g., a site-specific Human Health Risk Assessment). (For groundwater and soil pathways

_____ If no (there are current exposures that can be reasonably expected to be "unacceptable")- continue and enter "NO" status code after providing a description of each potentially "unacceptable" exposure.

-------- If unknown (for any potentially "unacceptable" exposure) - continue and enter "IN" status code

Rationale and Reference(s): Further evaluation is necessary for Indoor Air and for Bloody Brook sediments.

Current Human Exposures Under Control
Environmental Indicator (EI) RCRIS code (CA725)

6. Check the appropriate RCRIS status codes for the Current Human Exposures Under Control EI event code (CA725), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (and attach appropriate supporting documentation as well as a map of the facility):

_X_ YE - Yes, "Current Human Exposures Under Control" has been verified. Based on a review of the information contained in this EI Determination, "Current Human Exposures" are expected to be "Under Control" at the _Lockheed Electronics Park_ facility, EPA ID #_**NYD059385120**, located at _Electronics Parkway, Salina NY (Syracuse)_ under current and reasonably expected conditions. This determination will be re-evaluated when the Agency/State becomes aware of significant changes at the facility.

____ NO - "Current Human Exposures" are NOT "Under Control."

_ IN - More information is needed to make a determination.

Completed by (signature) _____ Date ___September 5, 2001
(print) William E. Wertz, Ph.D.
(title) Senior Engineering Geologist

Supervisor (signature) _____ Date September 5, 2001
(print) Paul J. Merges
(title) Director, Bureau of Radiation & Hazardous Site Management
(EPA Region or State) NYSDEC

Locations where References may be found:

NYSDEC
Division of Solid and Hazardous Materials
625 Broadway
Albany NY 12233

Contact telephone and e-mail numbers
William E. Wertz, Ph.D.
(518) 402-8594
wewertz@gw.dec.state.ny.us

FINAL NOTE: THE HUMAN EXPOSURES EI IS A QUALITATIVE SCREENING OF EXPOSURES AND THE DETERMINATIONS WITHIN THIS DOCUMENT SHOULD NOT BE USED AS THE SOLE BASIS FOR RESTRICTING THE SCOPE OF MORE DETAILED (E.G., SITE-SPECIFIC) ASSESSMENTS OF RISK.