Appendix K.8

Munitions and Explosives of Concern RCRA Facility Investigation Union Carbide Corporation-Woodbine

CH2M Hill

October 2007

98 Pages

Draft Report

Munitions and Explosives of Concern RCRA Facility Assessment

Union Carbide Corporation-Woodbine

Woodbine, Georgia

Contract No. NA-1022
Purchase Order No. 93130672

Prepared for

Union Carbide Corporation

Prepared by

CH2MHILL

October 2007

Contents

Figures

Tables

Appendices

Acronyms and Abbreviations

°F	Fahrenheit
AAR	After Action Report
Apex	Apex Environmental Inc.
BCS	Bayer Cropscience
bgs	below ground surface
CAP	Corrective Action Plan
COPC	Chemical of Potential Concern
CS	orthochlorbenzalmalonintirle
DGM	digital geophysical mapping
DOD	Department of Defense
EOD	explosive ordnance disposal
EODT	Explosive Ordnance Disposal Technology, Inc.
ESE	Environmental Science and Engineering, Inc.
ESQD	Explosives Safety Quantity Distance
GA EPD	Georgia Environmental Protection Division
GPO	geophysical prove-out
GPR	ground penetrating radar
GWPS	ground water protection standard
HE	high explosives
HSWA	Hazardous and Solid Waste Amendments
ID	identification
Law	Law Environmental
lb	pound
MCLs	maximum contaminant levels
MD	munitions debris
MEC	munitions and explosives of concern
mm	millimeter
MNA	monitored natural attenuation
MPPEH	material potentially presenting an explosive hazard
MRA	munitions response area
msl	mean sea level
NASA	National Aeronautics and Space Administration
NFA	no further action
O&M	operation and maintenance
OEW	ordnance and explosives waste
ORS	oxygen release system
PTTF	powder train time fuse
QA	quality assurance
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SDZ	surface danger zone
SUXOS	Senior UXO Supervisor

SWMU	Solid Waste Management Unit
UCC	Union Carbide Corporation
UIC	Underground Injection Control
UXO	unexploded ordnance
XM	experimental

Executive Summary

CH2M HILL has completed a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) with respect to past use of munitions and explosives of concern (MEC) at the Union Carbide Corporation (UCC) site in Woodbine, Georgia.

This RFA report has been prepared to meet the applicable corrective action requirements of the Hazardous and Solid Waste Amendments (HSWA) to RCRA and Georgia Hazardous Waste Act and requirements of the Georgia Rules at Chapter 391-3-11, the requirements for notifications pertaining to newly discovered releases at previously identified Solid Waste Management Units (SWMUs) as required by the facility Hazardous Waste Permit No. HW 063(D), and to evaluate the site's suitability for future land use. The RFA report is based on the results of an archival search review of records retained at UCC Charleston, West Virginia and Atlanta, Georgia combined with a site inspection and interviews with the current site caretaker.

Findings of this RFA indicate that residual MEC associated with historic activity prior to UCC's acquisition of the site is currently present, but the extent has not been defined. Specifically MEC is known to be present within the bounds of the former 40-mm test range co-located with SWMU 03. MEC is additionally suspected within the bounds of the former 81-mm mortar test range and in the vicinity of the former munitions disposal site at SWMU 07.

Review of existing and available documentation indicates that previous site investigations at UCC were focused on chemical contamination resulting primarily from buried chemical waste. MEC-related objectives associated with previous investigations were limited to MEC removal to mitigate the potential for Unexploded Ordnance (UXO) safety hazards during the conduct of sampling, drilling, and remediation activities and/or to eliminate the immediate and visible MEC hazards. MEC hazards remain at the site, but the nature and extent of MEC is unknown at this time.

1.0 Introduction

This document reports the findings and recommendations of a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) prepared by CH2M HILL with respect to past use of munitions and explosives of concern (MEC) at the former Union Carbide Corporation (UCC) site in Woodbine, Georgia (UCC-Woodbine).

1.1 Project Summary

UCC initiated this MEC RFA to assess the potential presence of residual MEC at the site and to:

- Meet the applicable corrective action requirements of the Hazardous and Solid Waste Amendments (HSWA) to RCRA and Georgia Hazardous Waste Act and requirements of the Georgia Rules at Chapter 391-3-11.
- Abide by the requirements for notifications pertaining to newly discovered releases at previously identified Solid Waste Management Units (SWMUs) as required by the facility Hazardous Waste Permit No. HW 063(D).
- Evaluate the site suitability for future land use.

The RFA report is based on the results of an archival search review of records retained at UCC Charleston, West Virginia and Atlanta, Georgia combined with a site inspection, on-site observations of CH2M HILL personnel operating at the site, and interviews with the current site caretaker.

1.2 Scope and Objectives

This report presents the findings and recommendations resulting from the conduct of the MEC RFA at the UCC-Woodbine.

The specific objectives of the MEC RFA were as follows:

- Locate, retrieve, and review all available and appropriate information related to UCC-Woodbine to include historical documents, maps, drawings, photographs, and interviews in order to document the operational history of the site related to MEC use (types, quantities and period(s) of MEC use and disposal); previous MEC incidents, surveys, and/or removal actions; and the environmental setting and conditions of the site.
- Evaluate available data and, in conjunction with a visual site inspection, assess the potential for a continued threat to human health or the environment due to the presence of MEC at UCC-Woodbine and determine whether that threat warrants further action.
- If appropriate, recommend specific actions to investigate, mitigate, or remove MEC hazards.

Section 2 describes the site location and environmental setting; Section 3 describes the site history; and the results of archival review and visual site inspection are provided in Sections 4 and 5. Findings and conclusions are discussed in Section 6. References are noted in Section 7.

The following supporting documentation is included:

- Appendix A Site Photograph Collection
- Appendix B Figure Plates From Previous Studies and Reports
- Appendix C List of Documents Reviewed
- Appendix D After Action Report for 40-mm High Explosive Disposal

2.0 Site Location and Description

2.1 Site Location

UCC-Woodbine is a 4,012-acre parcel of a former manufacturing facility located approximately 11.5 miles due east of the town of Woodbine, in Georgia Militia District No. 31, Camden County, Georgia. The nearest major cities are Jacksonville, Florida (30 miles to the southwest) and Brunswick, Georgia (15 miles north) (Environmental, Science & Engineering, 1994). The Satilla River and Todd Creek lie to the north of the site; the Cumberland River, Floyd Creek, and the Bayer Cropscience (BCS) property are southeast of the facility; and the Sea Island Land Company owns property west of the facility. Figure 2-1 is a regional map showing the location of UCC-Woodbine within the state of Georgia. Figure 2-2 is a site map showing distinguishing features of the site. Appendix A provides a photographic log depicting site features, while Appendix B contains a series of map templates from previously published reports indicated the locations of site features noted in this report.

UCC-Woodbine (Facility Identification [ID] Number: GAD 981235294) currently operates under Hazardous Waste Facility Permit No. HW 063(D), issued on April 23, 1990 and amended February 7, 2006 for post closure care of a hazardous waste landfill closed with wastes in place and corrective action for releases from solid waste management units (SWMUs).

Current post-closure care requirements at UCC-Woodbine are designed to preserve the integrity of the 22-acre landfill disposal system and ensure the disposal unit continues to prevent or control releases of contaminants. UCC's current operations at the site include operation and maintenance (O&M) of the 22-acre RCRA landfill and its corrective action system. The corrective action system is designed to reduce organic contamination in the groundwater before it reaches Todd Creek. The target area of the corrective action is the northern end of the site, between the landfill and Todd Creek. In addition to the Hazardous Waste Facility Permit, UCC-Woodbine additionally holds Underground Injection Control (UIC) Permit No. 073 to allow for injection of ambient air through a well system to assist in the remediation of groundwater contaminated with organic hydrocarbons. Corrective action began under the UIC permit in February 1998. UCC has recently determined that the corrective action system is not operating as it was intended. Therefore, UCC submitted a Class 3 permit modification request on May 4, 2007 to Georgia Environmental Protection Division (GA EPD), as described in Section 3.2. Aside from occasional tree harvesting, the UCC-Woodbine property does not currently conduct any commercial, industrial, or agricultural activities.

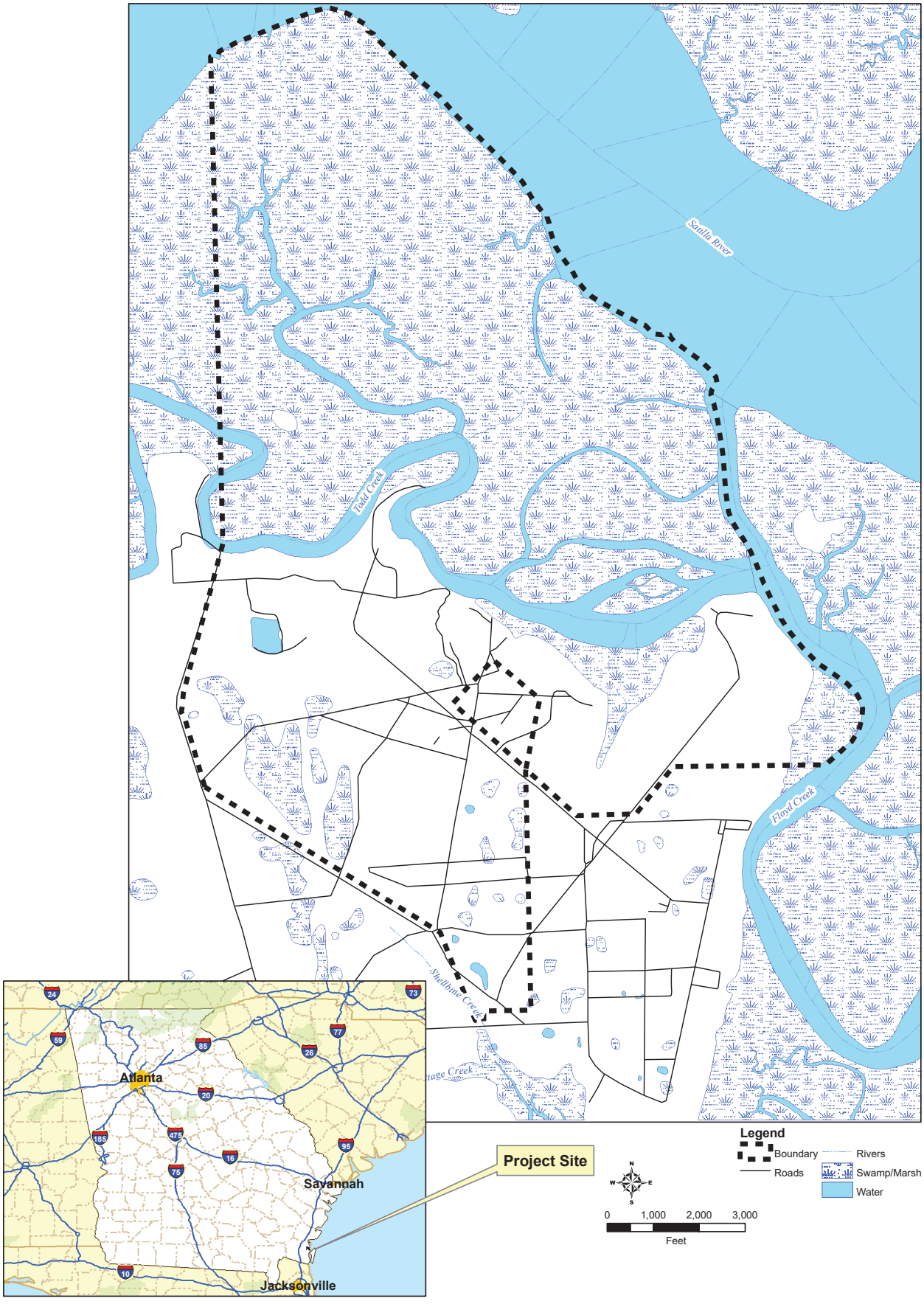
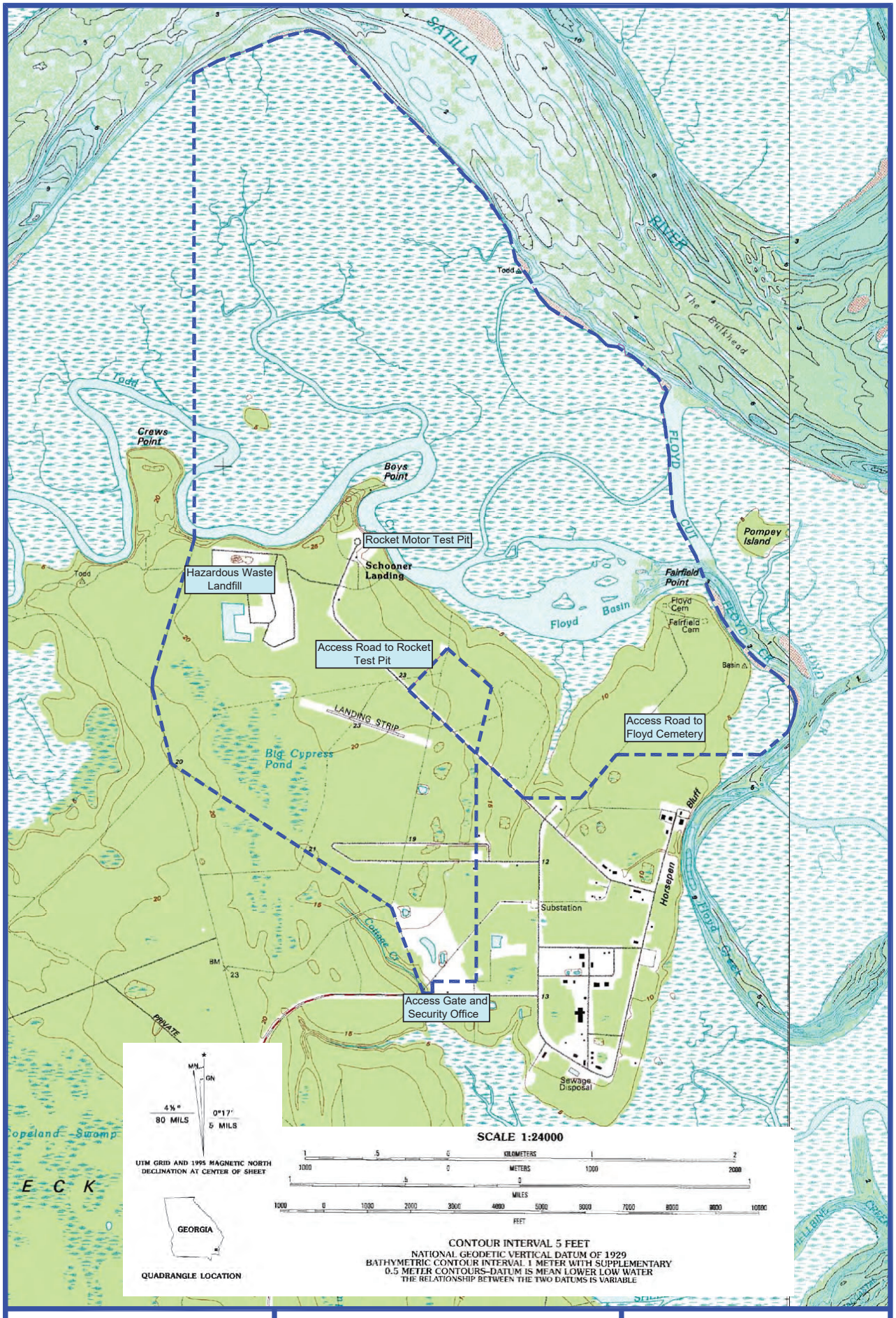


Figure 2-1

Regional Map
UCC Site
Woodbine, GA

CH2MHILL



NOTE:
BOUNDARY LOCATION IS APPROXIMATE AND BASED ON REVIEW OF 1986 UNDERWOOD SURVEY AND OTHER AVAILABLE DOCUMENTS

FIGURE 2-2. SITE MAP

CH2MHILL

2.2 Environmental Setting

UCC-Woodbine is located in the Atlantic Coastal Plain Physiographic Province on flat uplands on a point known as Floyds Neck. The topography is generally flat with slight depressions and shallow drainage ways. Adjacent rivers, Todd Creek, Floyd Basin, and Cumberland River, have eroded steep banks. The facility grounds contain few natural streams. Stormwater is controlled by culverts located along the roadways. There are several depressions and seasonally flooded areas throughout the upland areas. The elevations of the areas of interest (i.e., SWMU locations) ranges between 15 and 25 feet above mean sea level (msl) (Apex, 1996).

A collection of site photographs including Photographs 1, 2, and 3 depicting aspects of the environmental setting is provided as Appendix A.

A portion of the areas of interest are located in areas of previous tree farming activities and the existing slash or loblolly pines are planted in rows. Other areas are relatively unharvested and contain oaks and other hardwoods (Apex, 1996).

A map template showing the location of past and planned tree harvesting at UCC-Woodbine is provided in Appendix B, Template 1, figure title "Forestry Areas, Former SWMUs Locations & Phase I Findings, Woodbine, GA Site."

2.2.1 Climate and Meteorology

The average yearly temperature as measured in nearby Brunswick, Georgia is 69 degrees Fahrenheit (^{o}F), with an average temperature of 89 ^{o}F in July and 51.1 ^{o}F in January. Annual rainfall averages about 51.1 inches in Camden County (http://www.camdencounty-ga.com/civic/area_info.html#CLIM).

2.2.2 Soils

The two dominant soil types at the facility are reported as the Mandarin fine sand and Pottsburg sand. The Mandarin fine sand is a deep, somewhat poorly drained, nearly level soil on slight ridges and broad flats. The subsurface soil is underlain by typically 15 inches of an organic hardpan layer. The permeability is rapid (6 to 20 inches per hour) except in the hardpan where the permeability is moderate (0.6 to 20 inches per hour). Mandarin soils are found in the central, south central and western portions of the property. The Pottsburg sand has characteristics very similar to the Mandarin soils. The main difference is the depth and thickness of the hardpan layer which, in the typical soil profile, is at a depth of 63 to 80 inches. Although not listed, the permeability of the hardpan layer is probably similar to the Mandarin soils. Pottsburg soils are found in the eastern and north eastern portions of the property (Apex, 1996).

2.2.3 Geology

UCC-Woodbine is located in the Barrier Island Sequence District of the Atlantic Coastal Plain Physiographic Province. The Barrier Island Sequence is a series of barrier islands and salt marsh deposits, deposited during Pleistocene sea level changes. The facility is situated on the Princess Anne terrace complex. The terrace deposits consist of mantle of undifferentiated surficial sands and the underlying Santilla Formation. The Santilla Formation consists of variably fossil ferous, shelly sands and clays of offshore, inner shelf

origin; bedded and non-bedded barrier island deposits; and marsh deposits. The Santilla Formation exposed at areas of bank erosion mentioned above consists of fine to medium, indistinctly bedded sand overlaying a layer of reddish humate-cemented sandstone (Apex, 1996).

2.2.4 Hydrology

The uppermost aquifer below the site is the Pliocene to Recent aquifer system. The system is reported to extend to a depth of approximately 265 feet. The underlying confining layer is the Miocene Berryville Clay Member of the Coosawhatchie Formation. Aquifers below the Berryville Clay are part of the Miocene aquifer system. The principle aquifer used for drinking water supplies in Coastal Georgia occurs at a depth of approximately 430 feet.

Groundwater is reported to occur at a depth of less than 10 feet, ranging from less than 2 feet below ground surface (bgs) to 8 feet bgs. The uppermost, unconfined aquifer is found in unconsolidated sands of the Santilla formation (Apex, 1996).

2.2.5 Surface Water

The UCC-Woodbine property is bounded on the north by the Santilla River. Todd Creek flows through the middle of the property from east to west and separates the upland portion of the property to the south from the salt mashes to the north.

3.0 History

3.1 Site History

UCC-Woodbine is located within property of the historic homestead of Charles and General John Floyd. Remnants of the former plantation home, Bellevue, still stand on the UCC property and the Floyd Family Cemetery is still visited annually by family and visitors (refer to Appendix A, Photographs 4 and 5). From 1927 to 1942, the site was part of a tract known as the Sea Island Game Preserve at Cabin Bluff and used as a hunting preserve (CH2M HILL, 2005). The property offers protected habitat to a wide variety of wildlife, including a large population of boar (refer to Appendix A, Photograph 6). In the early 1940s, the land was bought by a paper company for use as a tree farm.

In 1962, Thiokol Corporation purchased the property for the production and testing of solid rocket motors for the National Aeronautics and Space Administration (NASA). The site was chosen due to low-cost shipping access to the then Kennedy Space Center in Florida. Shipment by barge was the only practical method for motors of the size anticipated (i.e., 260 inches in diameter and greater than 21 feet long) later in the program and potentially for subsequent flights. To simplify processing for the demonstration phase, a large casting pit was constructed at UCC-Woodbine, which also served as the static test facility. The pit, which is still present at UCC-Woodbine is 52 feet in diameter and 120 feet deep (refer to Appendix A, Photograph 7). The pit is covered and the area has been fenced. Three large load cells were located at the bottom, which could measure motor weight and thrust up to 6 million pounds. An inflatable dome was located over the casting pit to maintain an appropriate thermal and humidity environment during motor processing (McGrath, 1995).

An article in the April 19, 1963 issue of the Camden County Tribune reported that, "Thiokol Chemical Corporation was awarded Tuesday long-anticipated contracts for construction of the largest and most powerful rocket motors ever built in the United States. Thiokol received three parts of a four-part contract by the NASA acting in conjunction with the Air Force. The two contracts affecting Camden County include one for demonstration firings of 260-inch solid fuel motors and another for demonstration firings of a 156-inch motor with a three million pound thrust both to be assembled and tested at the new Thiokol plant in Camden now under construction. This contract marks the first time that NASA has participated in a demonstration program looking toward the use of solid propellants for space vehicles."

On February 27, 1965, the first static test of the most powerful rocket motor ever built was a conducted at the site. The 156-inch, 3-million-pound thrust engine was constructed by Thiokol Chemical Corporation to prove the feasibility of very large (260-inch), solid-propellant boosters. The “subscale” motor tested was 100 feet long, 156 inches in diameter, paced with 800,000 pounds of ammonium perchlorate and powdered aluminum held together with synthetic rubber (McGrath, 1995). Articles report the test as a resounding success. However, on April 11, 1965, the case of the Thiokol Chemical Corporation’s

260-inch diameter SL-1 rocket motor failed during hydrotest and the program at UCC-Woodbine was subsequently terminated.

In 1966, Thiokol began toll production of silicone coatings and sealants for General Electric and TEMIK (aldicarb) for UCC. In 1967, Thiokol began to manufacture orthochloro-benzalmalononitrile (CS) for Edgewood Arsenal, Maryland. This work developed into Thiokol's production of several "deterrent containing" munitions items including, a 40-mm CS round and the XM-15 (CS canister cluster). Later production included M49 trip flares, 81mm mortar illuminating cartridges and M84A1 Fuses. During the following 7 to 8 years, Thiokol continued to operate with sales from two distinct areas, custom toll processing and government contracts for specialty chemicals and munitions items (Thiokol History and Background, no date).

On February 3, 1971, an explosion occurred at the Thiokol Chemical Plant at UCC-Woodbine. A newspaper article in the Camden County Tribune (Tribune, 1971) describes the tragic event as follows, "The Thiokol Chemical Plant, a sprawling complex of 36 buildings on 7,000 acres, was working on a U. S. Army contract for trip flares (flares that are ignited by an external trigger, normally an enemy soldier approaching a camp's perimeter). Suddenly an explosion leveled one building and damaged three others. As a result of the explosion a forest fire, which would eventually destroy 200 acres of timber near the facility, was also set. Since the flares contained magnesium, many of the injured were severe burn victims, with second and third degree burns over more than 25% of their bodies." Other on-line research indicates that the explosion occurred in Building M132 located on current BCS property and places the death toll at 27 and the number injured at 34. The on-line article states that the building was "shattered" and the blast was felt 50 miles away (http://ourgeorgiahistory.com/chronpop/1685). No information regarding post-explosion evaluations or cleanup activities has been located to date.

In 1976, UCC purchased the approximately 7,193-acre property from Thiokol. A UCC subsidiary operated the facility from 1976 to 1986 as an agricultural chemical formulation and manufacturing facility. In December 1986, UCC sold the manufacturing plant and some of the adjacent land to Rhone-Poulenc, which was later renamed Aventis Cropscience and then Bayer Crop Science (BCS). UCC retained ownership of the approximate 4,012 acres referred to herein as UCC-Woodbine.

UCC continues O&M of the landfill. BCS owns and operates the adjacent manufacturing facility.

During groundwater sampling activities at UCC-Woodbine in March 2006, CH2M HILL personnel working at the site noted the presence of potential MEC in the near vicinity of the hazardous waste landfill. CH2M HILL munitions response personnel were subsequently called to the site to inspect the item and recommend an appropriate response.

On May 2, 2006, CH2M HILL's Munitions Response Segment Director Ben Redmond, a certified Master Explosives Ordnance Disposal (EOD) Technician, inspected the item in question and identified it as an expended 81-millimeter (mm) illumination mortar. The item was identified as probable munitions debris (MD), posing no explosive hazard. In accordance with Department of Defense (DOD) guidance and CH2M HILL policy, final determination requires dual inspection. On May 15, 2006, Fred Pasteris of CH2M HILL, a

certified Senior Unexploded Ordnance (UXO) Technician, was mobilized to the site to verify Mr. Redmond's determination.

Mr. Pasteris confirmed that the item in question was inert MD. During the May 15, 2006 site visit, Mr. Pasteris was accompanied by Mr. Milton Lynn. Mr. Lynn is the current site caretaker and has been employed at the site since the 1960s. Mr. Lynn accounted to Mr. Pasteris a site history that involved manufacture and testing of 40-mm orthochlorobenzalmalononitrile (CS) and experimental (XM) 15 CS canisters, 81-mm mortar illumination projectiles and M84 fuses, and M49 trip flares, as well as onsite MEC disposal. Mr. Lynn also indicated that potential MEC items remained onsite despite past remediation efforts.

Initial RFA efforts began in November 2006 with a visual site inspection detailed in Section 5 of this report.

3.2 Regulatory History

The RCRA history of the site begins after the sale of property to Rhone-Poulenc. UCC submitted a RCRA Part B permit application for post-closure care in September 1985 (and revised in July 1987), inclusive of a closure and post-closure plan addressing the landfill. (SWMU-01). The closure plan was implemented and certified in 1988, and subsequently approved by GA EPD (Law Environmental Inc. (Law), 1988). GA EPD issued a permit for post-closure care and corrective action in April 1990 based on UCC's submittal of a revised application in August 1988. Six SWMUs were indicated in the permit, three (SWMUs 04, 06, and 07) requiring further investigation and three (SWMUs 02, 03, and 05) requiring no further action (NFA) at that time. Following issuance of the post-closure care permit, UCC initiated RFI activities to assess the potential for and characterize the nature and extent of releases chemical constituents from past operations at the SWMUs. RFI activities were performed in various phases from 1990 to 1997 involving waste and soils removals, media sampling and investigation, and risk assessment as detailed in Section 3.3. The permit was most recently amended in February 2006 to reflect changes to the groundwater monitoring system and performance standard. Based on previous RFI activities, all six SWMUs are identified in the permit as requiring NFA.

As discussed in Section 2.1, UCC submitted a permit modification request in May 2007. In general, UCC requested to modify the permit to:

- Add nine new groundwater monitoring wells to the semiannual groundwater monitoring program per the November 2006 Temporary Authorization.
- Add fluoride, formaldehyde, 2,4,5-trichlorophenoxy propionic acid (2,4,5-TP or silvex) and pyridine to the Table A list, due to 2005 Appendix IX sampling detections.
- Add nickel to the Table A list due to the confirmed 2006 Appendix IX sampling detection.
- Revise the groundwater protection standards (GWPSs) based on surface water quality standards and/or maximum contaminant levels (MCLs).
- Add monitored natural attenuation (MNA) as the primary corrective action remedy.

- Add injection of Advanced Formula Oxygen Release Compound (ORC Advanced) as the contingency corrective action remedy based on approved action levels.
- De-activate and mothball the existing air injection corrective action system.

GA EPD is currently reviewing the permit modification request.

3.3 Suspected Type and Amount of MEC Contamination

As described in Section 3.1, all MEC were manufactured and/or otherwise handled during Thiokol's operations and prior to 1976. Thiokol's files were not available for review. UCC's operations were limited to the manufacture and formulation of agricultural chemicals.

Results of the archival review completed in support of this RFA and summarized in Section 4 revealed no specific documentation related to MEC test or manufacturing activities. No test plans, maps identifying test locations or test ranges, or documents identifying items tested nor specific details regarding the type, amount or location of MEC manufacturing were located or reviewed. The historical information presented previously was taken primarily from environmental reports associated with the RCRA closure and investigations related to chemical waste activities at the various identified SWMUs.

The potential for MEC residual to be present at the site is surmised based on reports prepared by Explosive Ordnance Disposal Technology (EODT) detailing previous MEC clearance and disposal activities as summarized in Section 4.2, and was confirmed in part by visual observation.

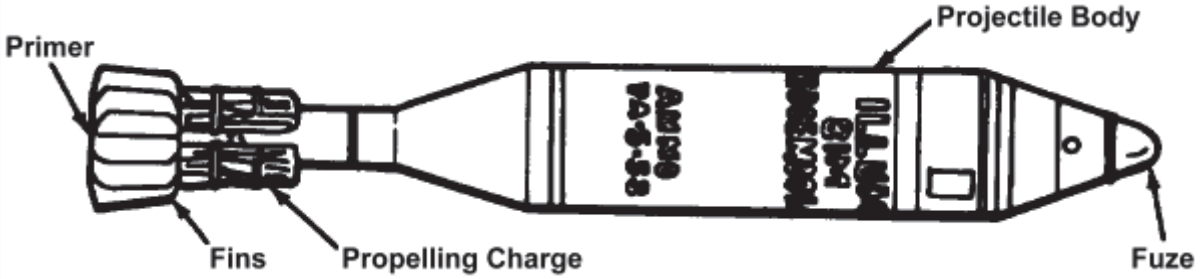
Table 3-1 lists the types of MEC known or suspected to be present at UCC-Woodbine.

TABLE 3-1
Suspected MEC Type UCC-Woodbine

Item	Type	Function	Use	Fuse	Comment
1	M301 Illumination Projectile for 81-mm mortar	Target Illumination	Projected High Angle Ejection	Powder Train Time Fuse (PTTF)	Reported by EODT
2	40-mm grenade	CS, High Explosive (HE)	Projected low velocity	Always Acting	Reported by EODT and confirmed by visual observation
3	XM 15 CS Canisters	Pyrotechnic burn	Irritant Smoke	Percussion Cap	Reported by EODT and confirmed by visual observation
4	M84 - Fuse	Delay	81-mm Illumination Projectile	PTTF	Reported by EODT and confirmed by visual observation
5	M49 Trip Flare	Illumination	Provides warning of infiltrating troops	Pressure Release	Reported by EODT

3.3.1 M301 Illumination Projectile

The 81-mm mortar was designed to fire a range of munitions including high explosives (HE) and white phosphorous in addition to the illumination projectile produced by Thiokol. The M301 has a cylindrical body that contains an illuminating candle and parachute assembly. The round has a burst height of 600 meters and provides illumination for about 60 seconds. The M301 utilized the M84 time fuse, adjustable from 5 to 25 seconds before priming charge detonated, releasing the illum and chute.



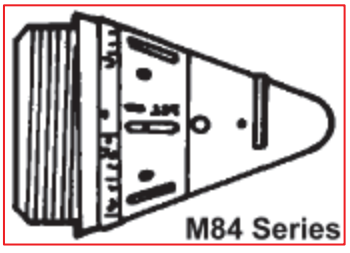
3.3.2 40-mm Grenades

The DOD has produced a variety of 40-mm Grenade cartridges including HE, anti-personnel, smoke, signal, illumination, riot control, and other unique and specialized versions. Thiokol is assumed to have produced 40-mm CS Grenades at UCC-Woodbine. The standard CS gas cartridge is designated M651.The round is filled with about 2 ounces of CS pyrotechnic mix containing approximately 0.75 ounces (21 grams) of CS. Maximum accuracy is obtained at ranges up to 219 yards (200 meters). Area targets may be engaged up to 437 yards (400 meters). UCC-Woodbine is also known to have procured an unknown quantity of an experimental variety of M406 HE Grenades as described in Section 4.

3.3.3 XM 15 CS Canisters

In addition to standard 40-mm CS Grenades, archival review indicates that a portion of CS cartridges recovered at UCC-Woodbine are of an experimental variety designed to be dispensed in the XM 15 CS Cluster.

3.3.4 M84 Time Fuse



The M84 Time Fuse is a single-purpose, powder-train, mechanical-time fuse used with the 81-mm M301A1 and M301A2 Illumination Projectiles. It has a time setting of up to 25 seconds. The fuse consists of a brass head, body assembly, and expelling charge. Safety before firing is provided by a safety wire, which must be removed just before firing.

3.3.5 M49 Surface Trip Flare

.

The trip flare provides warning of infiltrating troops by illuminating the field when the trip wire is activated. It puts out a light intensity of 35,000 candlepower for one minute; it can also be activated by trigger or pull pin. A trip flare is used primarily to illuminate and to give warning of attacking or infiltrating enemy troops. The M49 Trip Flare resembles a hand grenade in size and shape, except that it is provided with a bracket for attachment to a tree or post and a trigger mechanism for firing. The flare burns with a yellowish light and illuminates an area radius of approximately 300 meters. The flare has a laminated paper body, containing one 1-ounce flare charge and is closed at both ends by metal caps. The upper cap has taped holes and a threaded central hole for the trip fuse

4.0 Summary of Archival Review

On November 16, 2006, CH2M HILL conducted a file review of the available Woodbine files at the UCC offices in Charleston, West Virginia. The files were organized somewhat chronologically, with almost every year from 1986 to 1999 containing an index of the available files.

During the file review, copies were made of those documents deemed pertinent to this task. A list of the copied documents with notations as to their importance is provided in Table 1 of Appendix C.

An additional file review was conducted at the Hunton & Williams offices in Atlanta on November 21, 2006. Prior to the review date, Hunton & Williams provided an index of over 100 boxes of documents related to the UCC/Thiokol litigation. This index is provided in Table 2 of Appendix C. Approximately 10 boxes were selected from the index as boxes that could possibly contain documents related to this effort. As with the Charleston review, pertinent documents were copied and are summarized in Table 3 of Appendix C.

Lastly, CH2M HILL has a limited number of documents on file related to the SWMU investigation and remediation activities. These files, listed in Table 4 of Appendix C, provided the most relevant details related to previous site work related to MEC though none specifically focused on MEC objectives. All previous site investigations were focused on chemical contamination resulting primarily from buried chemical waste. MEC-related objectives associated with previous investigations were limited to MEC removal to mitigate the potential for Unexploded Ordnance (UXO) safety hazards during the conduct of sampling, drilling, and remediation activities and/or to eliminate the immediate and visible MEC hazard.

The archival review provided general summary information, primarily focused on the location of SWMUs and related chemical disposal activities. The archival review revealed no details pertaining to the type, amount, or location of MEC past manufacturing or testing activities. Anecdotal information has also been provided by the site caretaker, Mr. Milton Lynn, based on his years (approximately 30) of work history at the site. While specific details have not been confirmed by documentation reviewed to date, Mr. Lynn's anecdotal information is generally corroborated by information in the available files and reports of past remedial activities, as well as the results of the visual site inspection.

Appendix A contains a photographic log depicting significant aspects noted during the visual site inspection. Appendix B provides a series of map templates from previous reports depicting site features described in this Section.

4.1 Previous Site Investigations

Pertinent reports of previous site investigations are summarized below. Table 4-1 provides a snapshot of past RFI and MEC related activities.

TABLE 4-1
Summary of Past RFI and MEC Related Activities

Study	Date	Project Objectives	MEC Related Activities
Phase I RFI – SWMUs 02, 03, 04, 05, 06, and 07	1991	Complete soils and groundwater investigation to identify nature and extent of contamination. Included soils sampling at all SWMUs, groundwater wells and sampling at all SWMUs except 02 and 07.	Pre-RFI surface debris removal completed. SWMUs 03, 04, 05, 06, and 07 were swept of visible debris including munitions. Munitions related items were found in SWMUs 03 and 07. Munitions were not discovered in SWMUs 05 and 06.
Phase II RFI	1996	Collect additional information to address GAEPD comments to Phase I. Included background soils samples at all SWMUs, limited geophysical investigation at SWMUs 03, 06, and 07, collect subsurface soil samples at SWMUs 03, 04, 06 and 07, install wells at SWMU 03 and sample monitoring wells and 03, 04, 05, 06, and 07, complete test pitting at SWMUs 03, 06, and 07, and identify, remove and deactivate UXO.	Surface MEC removal only at SWMUs 03 and 07. Recommended additional surface/subsurface removal.
Expanded Phase II RFI	1996 and 1997	Address GAEPD comments by resampling wells with an improved methodology, complete additional surface MEC removal at SWMU 03, complete additional soil borings at SWMUs 04 and 06	Surface and subsurface munitions and debris removal at SWMUs 03 and 07 and UXO avoidance in support of other remediation activities.

4.1.1 Phase I RFI Report

RCRA Facility Investigation Report, Union Carbide Corporation, Woodbine, Georgia, Law Environmental inc., February 5, 1993.

Following issuance of the RCRA Post-Closure Permit, UCC initiated RFI activities to address corrective action of the identified SWMUs. Phase I RFI activities were completed by Law in 1992 and included the installation of a groundwater monitoring well network and a combination of soil and groundwater sampling to identify the nature and extent of contamination at SWMUs 02, 03, 04, 05, 06, and 07. The presence of MEC and MD were suspected at SWMUs 03, 04, 06, and 07. MEC surface removal was included in the scope of work for pre-RFI surface debris removal conducted from September 1992 through October 1993. Appendix B, Templates 2 and 3, Figures titled, "Plot Plan Pre-RCRA Disposal Sites" and "Figure B-4, Facility Topographic Map" were developed by Law and depict the locations of the SWMUs, original monitoring wells, and other site features. EOD Technology, Inc. (EODT) of Knoxville, Tennessee, was employed to complete the MEC-related activities during the Phase I activities. Munitions-related items were found in SWMUs 03 and 07. No munitions were discovered at SWMUs 05 and 06. The aerial extent of the MEC investigation is not defined in any available report. Further details regarding the MEC clearance activities related to the Phase I RFI are provided in Section 3.4.

As a result of the Phase I RFI, Law Environmental concluded that:

- SWMU 03 did not appear to present a risk to potential receptors and recommend NFA.

- Releases to groundwater did not appear to present a risk to potential receptors at SWMU 07, but recommended additional assessment to locate and characterize buried material.

Following the submittal of the Phase I report, information was discovered regarding additional disposal areas and GA EPD requested additional investigation as part of the Phase II activities.

4.1.2 Phase II RFI Report

Report of the Phase II RCRA Facility Investigation (RFI) Conducted on the Union Carbide Corporation Woodbine, Georgia Facility, Apex, September 20, 1996.

A Phase II RFI was subsequently performed by Apex Environmental, Inc., on behalf of Thiokol. The Phase II RFI included the collection of background soil samples for metals analysis, completion of surface geophysics of selected SWMUs, collection of subsurface soil samples; installation and sampling of monitoring wells; test pitting; and identification, removal, and deactivation of UXO.

The Phase II RFI describes SWMU 03 as being located on the east side of the asphalt road leading to the rocket test pad. During the Phase I RFI, SWMU 03 was thought to be limited to an area used for surface storage/disposal of scrap metal and munitions and a trench reportedly used for subsurface disposal of CS material, Nuchar, and other unknown waste materials. Subsequent to the submittal of the Phase I RFI, a burn area for munitions was identified in the northern section of SWMU 3 and an aldicarb disposal area was identified on the east side of the paved road across from the entrance road to the RCRA landfill (refer to Appendix B, Template 4, titled "Figure 3, SWMU 03 Site Map, Woodbine, Georgia" developed by Apex Environmental depicting significant site features of SWMU 03. Phase II activities at SWMU 03 were directed at characterizing the burn area and aldicarb disposal area. EODT, was employed to provide MEC support during Phase II activities. Prior to commencing Phase II sampling at the Burn Area, the surface and near surface were swept for munitions due to observance of 40mm grenades in and around the area. Four 40mm grenades were located within the area under investigation and deactivated by EODT. A Ground Penetrating Radar (GPR) survey was completed to locate the Burn Area. The GPR survey identified four anomalous areas within the survey area that may have been associated with the Burn area. Four test pits were completed and one of the four was identified as a potential burn area based on the presence of charcoal. The other three pits revealed non-munitions related debris or concrete.

The Phase II investigation of the aldicarb burial area included a geophysical survey of the mound. Prior to commencing excavation of test pits, the area was swept for munitions due to the observance of 40-mm Grenades and an "M301 timing train fuse" in the area.

The Phase II RFI describes SWMU 7 as being located on the east and west sides of the firebreak road leading to Floyd Cemetery (refer to Appendix B, Template 5, titled "Figure 7, SWMU 07 Site Map, Woodbine, Georgia" developed by Apex Environmental depicting significant site features of SWMU 07). The area was reportedly used from 1966 to 1978 for surface disposal of off-specification energetic materials from trip flares, illuminating mortar flares, and CS pyromix and subsurface disposal of approximately 50 drums containing trip flares and concrete, approximately 40 drums containing CS gas, and an unknown number of

drums containing aldicarb. The Phase II Investigation of SWMU 7 included a visual surface sweep followed by geophysical survey and shallow test pits to expose the sources of anomalous areas identified using geophysics. Further test pitting and excavation of drummed material was performed to assess the potential for a release to the environment in the final phase.

A magnetometer survey of SWMU 07 was conducted to locate munitions-related items and buried ferrous objects. Other geophysical surveys were not conducted due to the ubiquitous metal scrap present on and near the ground surface. Nineteen areas of anomalous magnetometer readings were identified during this sweep. Thirty-one exploratory test pits were excavated to identify the sources of the anomalous magnetic readings (refer to Appendix B, Template 6, titled "Figure 22, SWMU 07 Exploratory Test Pits). The test pits were intended to identify the work that would be required to analyze the site and confirm the location and extent of disposal areas. Therefore, samples were not collected from the test pits during this initial phase.

A trench containing 408 concrete capped drums was excavated. The material inside the drums was sorted for live munitions related items. Four hundred eight 55-gallon drums of live munitions were recovered and destroyed. Also found were 3,000 warhead components of the 40-mm Grenades. All 3,000 grenades were destroyed by detonation. To support the destruction of the recovered munitions, a burn pit and blasting area were constructed at the rocket test pad adjacent to SWMU 03. A drum log is provided as Appendix B. Following the recovery of the munitions, an additional 18 test pits were excavated to investigate and characterize the area.

Test pitting at SWMU 07 indicated that CS and related degradation compounds were present in the soil. An unknown number of additional drums reportedly could not be removed during the Phase II investigation and remained buried at the site. Analysis of soil samples indicated elevated levels of chemicals of potential concern (COPCs).

Further details regarding the MEC clearance activities related to the Phase II RFI are provided in Section 3.1.1.

Based on the information generated during Phase I and II RFI, Apex determined that:

- COPCs were present in soils beneath SWMU 07.
- An unknown quantity of drums and loose munitions (i.e., trip flares and munitions-related debris) remained buried at this site.
- CS compounds presented an important concern at this site and recommended coordination with GA EPD to determine the necessity for a Corrective Action Plan (CAP) to address SWMU 07.

During the conduct of the Phase II RFI, Apex observed additional surface areas containing MEC-related items that were outside the work zones to be cleared of MEC for the geophysical surveys and test pitting conducted as a portion of the Phase II RFI. Additional MEC clearance was, therefore performed at SWMU 3 by EODT in February 1997. The clearance efforts are described in the Addendum to the Report of the Phase II RFI summarized below.

4.1.3 Addendum to Phase II RFI Report

Addendum to the Report of the Phase II RCRA Facility Investigation (RFI) Conducted on the Union Carbide Corporation Woodbine, Georgia Facility, Apex Environmental, Inc., June 12, 1997.

Additional Phase II activities were performed to resolve GA EPD comments to the Phase II Report and to address the additional MEC noted at SWMU 03 during Phase II. The 1997 clearance was performed by EODT. EODT, reportedly swept the area from fire break road to the paved Rocket Test Pad road (refer to Appendix B, Template 7, titled "Figure 1, SWMU 3 Unexploded Ordnance Location, Woodbine, Georgia" developed by Apex Environmental depicting UXO recovered at SWMU 03) and the area from the dirt road eastward approximately 75 feet. EODT did not locate munitions related items between 50 and 75 feet east of fire break and road and, therefore, did not sweep further eastward. EODT also reswept the SWMU 03 burn area and an area northwest of the rocket test pad. The clearance was accomplished using Schonstedt metal detectors and visual observation. A total of forty-six 40-mm grenades were located on and near the dirt road. An additional two grenades were found in the SWMU 03 burn area, and one round was found near the Rocket Test Pad. EODT also located approximately 24 XM 15 CS cartridges near the rocket test pad and approximately twenty-six 40-mm CS Grenades in the vicinity of the fire break road.

Following the completion of the additional Phase II activities, Apex concurred with Law's recommendation in the Phase I RFI Report and recommended NFA for SWMU 03. However, Apex concluded that "substantial quantities of ordnance, ordnance related scrap metal, drums, and CS gas remain in the soils at the site" and recommended the development of a CAP.

On October 29, 1998, GA EPD responded to the Phase II Addendum requiring the submission of a CAP to address actions to be taken to remediate SWMUs 02, 03, 04, 05, 06 and 07, or a formal demonstration as to why remediation is not required (i.e., site-specific risk assessment) (GA EPD, 1998).

Environmental Science and Engineering, Inc. (ESE), was subsequently contracted by Apex to perform risk assessments for the SWMUs in accordance with GA EPD's *Guidance for Selecting Media Remediation Levels at RCRA Solid Waste Management Units*, 1996. A screening risk assessment for SWMUs 02, 03, and 05 resulted in a recommendation for NFA. Separate comprehensive risk assessments were prepared for SWMUs 04, 06, and 07, as these contained higher levels of residual contamination. The risk assessment at SWMU 07 was performed to assess residual risk only after removal of a large volume of waste and soils (ESE, 2000).

The ESE risk assessment report (ESE, 2000) includes a reference to the Apex Environmental Inc., Summary Report for Assessment, Remediation, and Risk Assessment for SWMUs 02, 03, 04, 05, 06 and 07 dated November 2000, which documents the soils removal at SWMU 07. The Apex document was not available for review.

4.2 Previous MEC Clearances

Three MEC clearance activities have been previously performed at UCC-Woodbine in support of the various phases of RFIs described above. The results of these activities are

summarized in Table 4-1 and described below. The focus of each of the previous removal actions was to prepare the site for media investigation (soil and groundwater sampling). No previous studies are known to have been directed at identifying the nature and extent of MEC across the site. Previous MEC clearances are summarized below. Refer to the map templates included in Appendix B for SWMU locations.

4.2.1 Surface Debris Removal Report

Report of Surface Debris Removal, Law Engineering and Environmental Services, Prepared for Union Carbide Corporation, Woodbine, Georgia, October 1993.

EODT of Knoxville, Tennessee, performed the munitions related activities for RFI implementation and the surface debris removal in August to October 1992. The areas within SWMUs 03, 04, 05, 06, and 07 were swept of visible debris including munitions. The munitions were later deactivated onsite and disposed as non-hazardous waste. Munitions-related items were found in SWMUs 03 and 07. Munitions were not discovered in SWMUs 05 and 06.

Approximately 500 munitions items consisting of M406 40-mm HE Grenades and XM 15 CS Canisters were removed at SWMU 03. At SWMU 07, approximately 700 live munitions related items including M301 81-mm Illumination Projectiles, M301 81-mm Tail Fin Assembly with M71A2 Primers, M84 PTTFs, M49 Trip Flares, and XM 15 CS canisters were recovered and removed. During sweeping operations, heavy rains reportedly exposed additional near surface munitions in the former munitions burn area and an observation was made that "a large amount of munitions is buried near the ground surface" at SWMU 7.

Deactivation of potentially live munitions was completed by open detonation in a bermed area adjacent to the existing bunker at SWMU 03 and/or open burning on the rocket test pit concrete pad. Following the surface debris removal activities, it was recommended that a magnetometer sweep be performed at SWMU 03 and that a magnetometer and conductivity sweep be performed at SWMU 07. It was additionally recommended that excavated materials at SWMU 7 be screened to remove munitions related debris.

EODT issued an After Action Report (AAR) to document the MEC activities described above. A summary of the EODT AAR is provided below.

4.2.2 After Action Report for UXO Support Services

After Action Report for UXO Support Services, Former Union Carbide, Woodbine, Georgia, EOD Technology Inc., Prepared for Law Environmental, Inc., November 18, 1992.

Clearance activities performed during the 1992 mobilization to UCC Woodbine were limited to the surface. No subsurface clearance activities were performed. SWMU 3 is described in the AAR as consisting of approximately 2 acres located east, north, and south of UCC Production Well Number 3. A close interval sweepline utilizing six EOD technicians at 6- to 8-foot intervals was reportedly employed at SWMU 03. Due to the extremely heavy brush, sessile line could not be used to maintain sweep line integrity. Three complete sweeps of the area were completed, alternating sweep path and direction.

Once clearance operations began at SWMU 03, two 40-mm HE launcher fired expended grenades were encountered. Interview with former UCC personnel revealed that a special lot of 40-mm, M406 HE Grenades were procured from the DOD and fired to establish required test elocity for the 40-mm CS Grenades being developed by UCC for DOD. The 40-mm, M-406 Grenades encountered were marked with white stenciled letters "Inert Filler/Inert Fuse" with the grenade bodies painted blue which normally indicates a practice/inert filled round. The ogives were gold in color, indicating a HE round. Normally the grenades would be considered inert filled and would present no imminent danger. Due to the combination of circumstances, all M-406s were considered as HE grenades and treated as such. A 1200 Dearmer Kit was used then used to positively identify the fuse or filler associated with each grenade.

SWMU 07 is described in the AAR as consisting of two areas, 0.52 acres east of the Floyd Cemetery access road and 0.25 acres west of the access road. Clearance operations at SWMU 07 were reportedly performed using close interval sweep techniques with three to six EOD technicians. Due to the large amount of debris the most effective means to sweep and clear the areas was on hands and knees with intervals reduced to 3 feet. The sweep was conducted from south to north followed by a Quality Assurance (QA) sweep from west to east.

Munitions, cleared and disposed at SWMU 03 included M0406, 40-mm Grenades, 40-mm CS Grenades, XM 15 CS canisters, and munitions related debris. Munitions encountered, cleared and disposed at SWMU 07 included M84 PTTFs, M84 PTTF components, M49 Trip Flares, M-71A2 Primers, 40-mm CS Grenades, and XM-15 CS Canisters. Equipment employed by EODT during the 1992 clearances included the GA-72 CV magnetometer and GA-52B magnetometer.

Following clearance operations, a total of 1,778 munitions items were destroyed by burning (8 M301 Illumination Projectiles, 906 M84 PTTF components, 200 M49 Trip Flares, 347 M71A2 Primers, 57 XM 15 CS Canisters, and 260 40-mm CS Grenades). Detonation was employed to destroy 193 M409 40-mm Grenades.

EODT noted in its AAR that though SWMUs 03 and 07 were surface cleared of all visible MEC and MEC related debris, the area was saturated to the point that any disturbance of the ground cover could reveal additional items and recommended a complete surface/subsurface MEC clearance of these areas.

4.2.3 After Action Report for Surface UXO/OEW and Munitions Debris Removal

After Action Report for the Surface UXO/OEW and Debris Removal at Woodbine, Georgia, EOD Technology Inc., Prepared for Apex Environmental, Inc., September 18, 1996.

The 1996 deployment to UCC-Woodbine included survey, grubbing, and remediation activities in SWMUs 03 and 07 and munitions debris monitoring during excavation of trenches in SWMU 07. In addition, EODT personnel were tasked to remove and dispose of surface/subsurface munitions and debris in SWMUs 03 and 07. EODT support services to Apex were completed November 1995 through April 1996.

A backhoe, chainsaws, and weed-eaters were reportedly used to remove select trees and vegetation to enable EODT personnel to access the trenches in SWMU 07 and subsurface UXO in SWMU 03. Vegetation reportedly was only removed if it was absolutely necessary for site activities.

A geophysical survey using a GA-72 C/V Heliflux magnetometer was employed at SWMU 03 in five-foot lanes to identify subsurface magnetic anomalies. A similar procedure is reported to have been used at SWMU 07 to assist in the characterization of the trenches and to determine the areas to be excavated. EODT reports the area excavated at SWMU 07 as 0.52 acres on the east side of the access road to Floyd's Cemetery and 0.25 acres to the west.

Excavation activities at SWMU 07 reportedly resulted in the removal of 408 fifty-five-gallon drums containing M406 40-mm Grenade Ball Assemblies; flare/MEC mixtures; bio waste; 81-mm mortars; riot control agents, such as CS and other assorted waste. The majority of the drums were partially filled with the items noted and the remainder filled with cement. UXO recovered and destroyed 38 81-mm mortar illumination projectiles, 2,635 gallons of flare/MEC mixture/riot control agent and 3,001 40-mm Ball Assemblies.

5.0 Visual Site Inspection

All MEC-related site visits and site inspections performed by CH2M HILL have been completed in accordance with site specific Field Safety Instructions (CH2M HILL, 2006).

Visual site inspection in support of this RFA was completed by Ms. Kyra Donnell and Mr. Fred Pasteris of CH2M HILL on November 6 to 9, 2006. Ms. Donnell is a former Army officer with 18 years of experience with range-related project work. Mr. Pasteris is a retired Navy Senior UXO Technician. The visual site inspection was limited to observation of areas that were readily visible without disturbing brush, debris, or ground cover.

The site visit began on November 6, 2006, with a health and safety briefing and review of site-specific health and safety plan followed by a windshield tour of UCC-Woodbine by Mr. Milton Lynn, site caretaker. Mr. Lynn provided a verbal accounting of the site history based on his personal knowledge and decades of experience employed at the site.

Areas of potential MEC concern were identified through document review, utilization of standard Department of Defense (DoD) range fans and associated Surface Danger Zone (SDZ)s for 40-mm and 81-mm mortars to estimate potential areas affected by past activities, and Mr. Lynn's site description were targeted for inspection on November 7 and 8, 2006. Figure 5-1 depicts areas of interest noted during the visual site inspection.

Visual site inspection began on November 7, 2008 in and around the hazardous waste landfill (SWMU 01). This is the area where the 81mm mortar illumination projectile was discovered in March 2006 (refer to Appendix A, Photograph 7). Archival review indicates that this area has also been subject to previous surface debris removal activities. The visual site inspection included both sides of the dirt access road leading to the landfill and included the circumference of the landfill fence. Ms. Donnell and Mr. Pasteris verified the presence of MD in the form of expended 40mm cartridge casings, the expended 81mm mortar illumination projectile, as well as other non-MEC metal debris near the end of the access road in the area identified as SWMU 01 in map Templates 1, 2, and 3 of Appendix B and as shown on Figure 5-1. Debris is present on the surface and near subsurface revealed by brushing away leaf mulch. Mr. Lynn indicated that the area was historically used for surface disposal of scrap metal debris including MD. MD appears to be fairly concentrated in the area of what was historically identified as SWMU 01 – surface debris. Visual site inspection of the circumference of the landfill fenceline revealed no MEC or MD. Mr. Pasteris noted that previous UXO avoidance operations in 1996 related to monitoring well installation, revealed no MEC or MD along the circumference of the landfill. The area circumference of the landfill has been cleared of trees and undergrowth and is easily accessible. The area where the greatest density of MD was noted (vicinity of former SWMU 01) contains primarily mature hardwoods and underbrush.

The site inspection team next moved to the area in and around the rocket motor static fire test pit (refer to Figure 5-1 and Appendix A, Photograph 8). Mr. Lynn indicated that early testing of XM 15 CS Cluster Dispenser were conducted by dropping "squirrel cages" containing XM 15 CS canisters from a wooden pole erected adjacent to the test pit. Mr. Lynn indicated that the test resulted in numerous CS canisters being dispersed on the soil surface in the area.

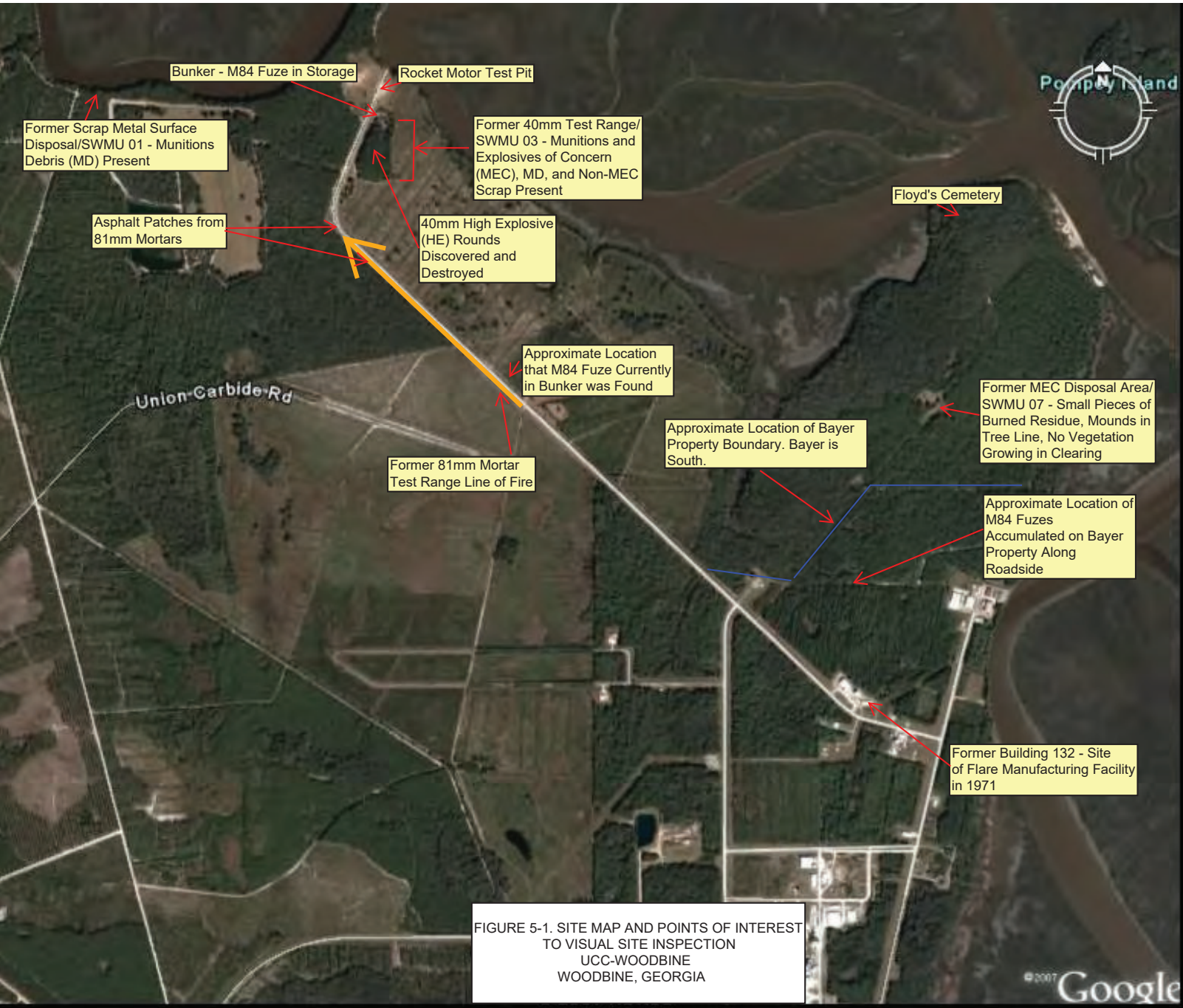


FIGURE 5-1. SITE MAP AND POINTS OF INTEREST
TO VISUAL SITE INSPECTION
UCC-WOODBINE
WOODBINE, GEORGIA

The area immediately surrounding the test pit is maintained by mowing and is easily accessible. Surrounding the mowed areas are stands that have been subject to tree harvesting and planting and contain dense pine growth which was inspected by traversing the areas between the planted trees. Visual site inspection revealed no MEC or MD or any visible evidence of either the post(s) or cages that may have been used during the conduct of testing. Archival review indicates that this area was subject to limited MEC clearance.

The site inspection team next proceeded to the location of SWMU 03 (refer to Figure 5-1). Mr. Lynn indicated that SWMU 03 had historically been used to test fire 40-mm grenades produced at the site. Mr. Lynn indicated that the direction of fire was south/southeast and that the firing occurred east of the rocket motor test pit access road. The assumed approximate boundaries of the former 40-mm test range are depicted on Figure 5-2. No information has been obtained that would indicate the use of a designated/formal firing line or range boundaries, or that a test protocol or test plan was followed. The range fan depicted in Figure 5-2 is based on standard U.S. Army range criteria, anecdotal information provided by Mr. Lynn, and the scatter pattern of 40-mm grenades discovered and removed to date according to the figures provided in previous studies and reports. The inspection of SWMU 03 began at the bunker currently used for the storage of groundwater sampling equipment. Mr. Lynn indicated that he had recently recovered MEC along the roadside in the vicinity noted on Figure 5-1. Mr. Pasteris inspected the item and verified that it was an M84 Time Fuse (refer to Appendix A, Photograph 9). The item was placed back into the bunker and Ms. Donnell and Mr. Pasteris began to traverse the area east of the road and south of the bunker following a meandering path in the accessible areas. Both MD and non-munitions related surface debris (metal and non-metal) were noted across the site. MEC in the form of 40-mm grenades and XM 15 CS Canisters were also noted (see Appendix A, Photograph 10). The area traversed is characterized by areas of sparse to dense hardwood and areas of sparse to dense undergrowth (see Appendix A, Photograph 11). Archival review indicates that this area was subjected to numerous MEC clearance operations both surface and subsurface as described in Section 4. It is likely that the visible MEC at the site has been revealed by rain and erosion at the site.

Prior to departing UCC-Woodbine for the day, Mr. Fred Pasteris led Ms. Donnell to a location on the current Bayer property where a small number of 81-mm mortar fuses had been accumulated and laid along the road side (refer to Figure 5-1 and Appendix A, Photograph 12). Mr. Lynn had pointed the items out to Mr. Pasteris during a previous site visit. The origin of these items or how they became accumulated at their location along side the dirt road is unknown. Ms. Donnell and Mr. Pasteris walked the dirt road from west to east. Dense vegetation on both sides of the roadway limited visual observation to areas directly adjacent to the roadway. No MEC or MD other than the fuses was observed.

On November 8, 2006, the visual site inspection team mobilized to the location of SWMU 07 (see Figure 5-1). Based on information provided in previous studies and reports as well as anecdotal information from Mr. Lynn, SWMU 07 was historically used for waste disposal including open burning of off-specification MEC produced at the site. Mr. Lynn indicated that though the site was not intended for disposal by open detonation, burning operations frequently resulted in inadvertent detonations. The assumed approximate boundaries of the former MEC disposal area are depicted on Figure 5-3.

CH2MHILL

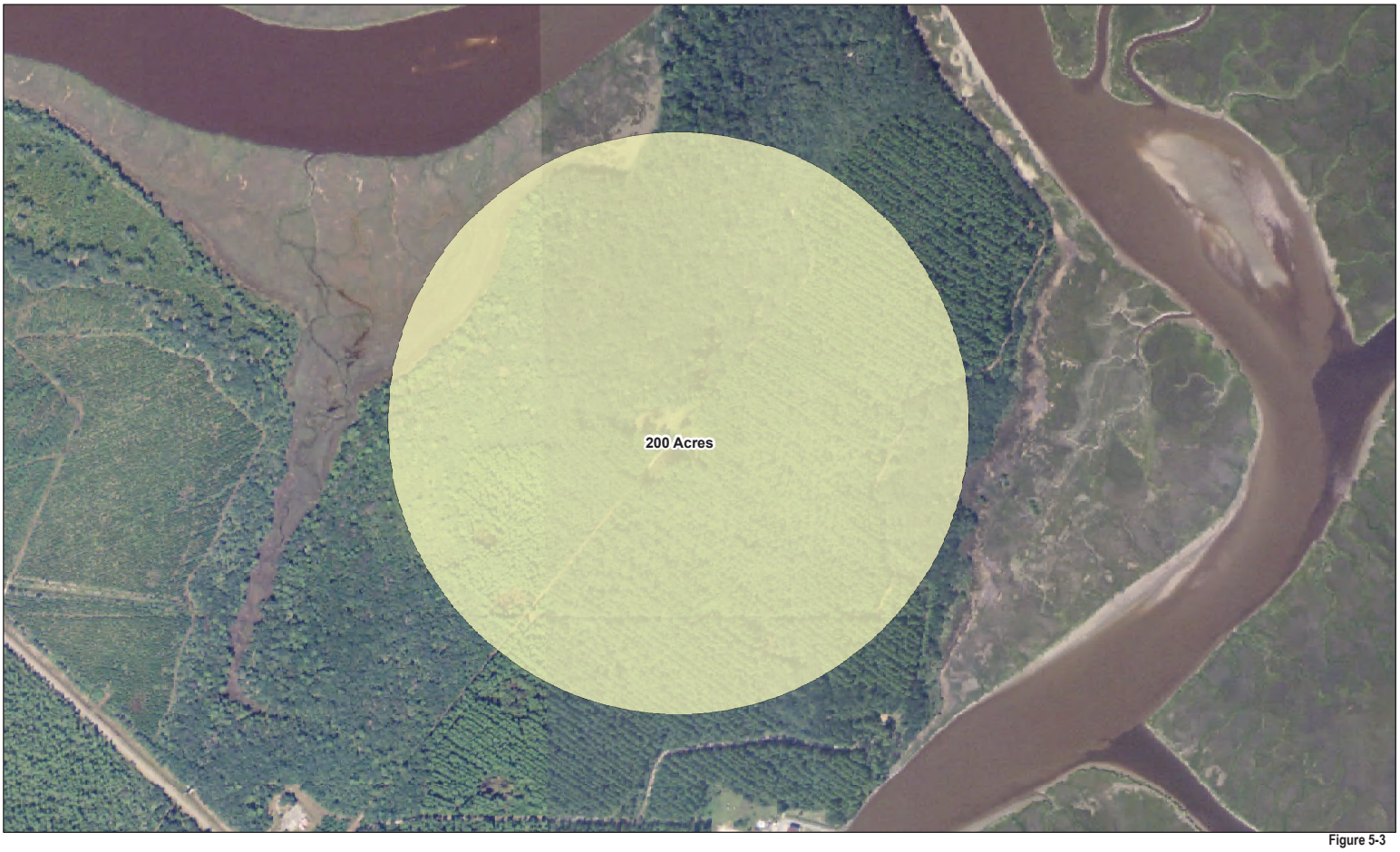
Former 40mm Test Range

N

0 50 100 200 300 400 500
Feet

Figure 5-2
Former 40mm Test Range
UCC Site
Woodbine, GA

File Path: H:\projects3\DOW Woodbine\MXDs\MEC 40mm.mxd, Date: July 11, 2007 3:35:14 PM, User: JKELLY3



CH2MHILL

Former Open Burning/Open Detonation Area

N

0 750 1,500 3,000

Feet

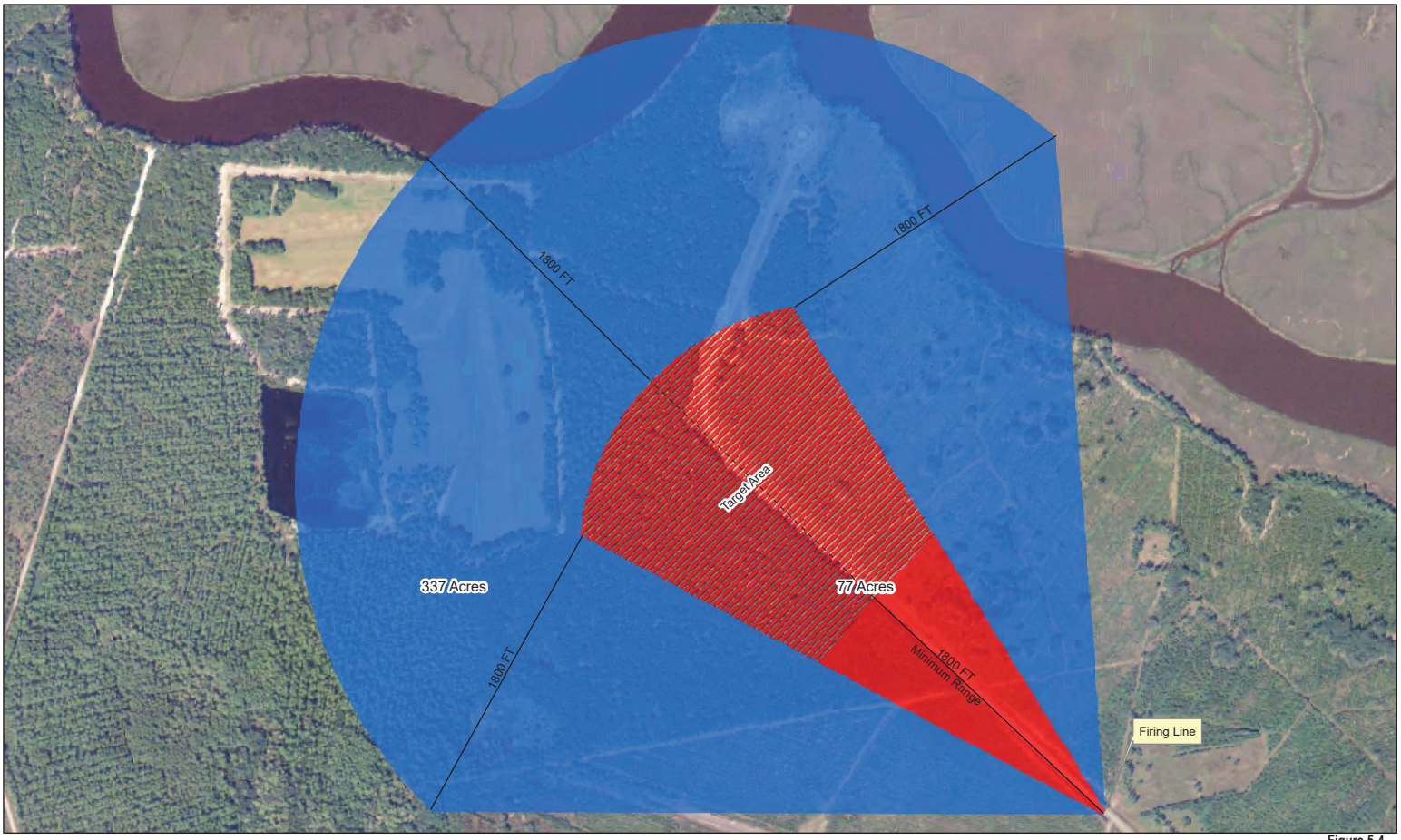
Figure 5-3

Former MEC Disposal Area
UCC Site
Woodbine, GA

File Path: H:\projects3\DOW Woodbine\MXDs\MEC OBOD.mxd, Date: July 11, 2007 3:43:09 PM, User: JKELLY3

No explosive safety quantity distances (ESQDs) are known to have been established for the disposal site and the actual boundaries are unknown. Archival review indicates that this area was subjected to numerous corrective and investigation activities including MEC and surface debris clearance, waste and soils removal, and soil and groundwater monitoring as detailed in Section 4. The immediate location of former disposal and remediation activities is discernible on either side of the access road to Floyd's Cemetery as a clearing with sparse vegetation. Large areas reveal sand and visible remnants of former burning in the form of small pieces of charred metal. Failed attempt to plant seedlings was evident in the area. Photographs depicting the site are included as Appendix A, Photographs 13 and 14. The area immediately surrounding the clearings contain medium to dense pine tree stand and minimal to medium undergrowth. Surrounding the pine stand is primarily hardwood with minimal to medium undergrowth (see Appendix A, Photograph 15). The area is traversable on foot and Ms. Donnell and Mr. Pasteris proceeded with the visual inspection by walking in larger and larger circles in a circumference around the clearing. Other than a single MEC-related item (not positively identified) (see Appendix A, Photographs 16 and 17), very small indiscernible metal pieces, and visible residual from past burning within the clearing; no other visible evidence of MEC or MD was observed. Earthen mounds just within the tree line surrounding the clearing were noted. The presence of the mounds may indicate that debris may have been pushed into piles during MEC disposal operations or previous removals at SWMU 07 and warrants further investigation.

From SWMU 07, Ms. Donnell and Mr. Pasteris proceeded north/northwest on the roadway toward the rocket motor test pit to the point in the road where it makes the sharp turn toward the northeast where numerous asphalt patches are noted in the access road. Per Mr. Lynn, the stretch of access road from the access road gates to the curve was at one time used to test fire 81-mm mortars (see Appendix A, Photograph 18). The assumed approximate boundaries of the former 81-mm mortar test range are depicted on Figure 5-4. The range fan depicted in Figure 5-4 is based on firing line and direction provided by Mr. Lynn and the standard surface danger zone (SDZ) for an 81-mm mortar range. The mortars were primarily fired with the intent of hitting the road so that the trajectory could be observed. Mortars that landed in accessible areas were retrieved and damage to the access road was repaired. There is no documentation to indicate that formal firing lines or range boundaries were established or that a test protocol or test plan was followed. Mr. Pasteris and Ms. Donnell traversed the properties on both sides of the roadway. Properties to the north/northeast had been subject to tree harvesting. Trees have been replanted in rows and currently are very dense. During the harvesting, debris was moved into mounds between the rows of trees. Mr. Lynn had no recollection of MEC incidents or discoveries during tree harvesting. No MEC or MD was visible to the inspection team. Properties to the south/southwest have not been harvested and the vegetation is typical oak hammock as shown on Appendix A, Photograph 19.



Former 81mm Mortar Test Range Buffer Zone
Former 81 mm Mortar Test Range
Target Area

N

0 250 500 1,000 1,500
Feet

CH2MHILL

Figure 5-4
Former 81mm Test Range
UCC Site
Woodbine, GA

File Path: H:\projects3\DOW Woodbine\MXDs\MEC 81mm.mxd, Date: July 11, 2007 3:39:29 PM, User: JKELLY3

On November 9, 2006, Mr. Pasteris and Ms. Donnell reviewed the visual observations with Mr. Lynn and asked him whether he thought any other source of MEC may be present onsite. Mr. Lynn described his recollections of the February 1971 explosion of the flare manufacturing facility. Insufficient detail of the event was uncovered in available documentation during this RFA to determine what the potential MEC impact may have been from this event (i.e., residual presence of MEC due to kick-out from the explosion). As this RFA is limited to the current UCC properties (and not the current BCS property, which is the site of the explosion), this issue has not been further investigated at this time.

Following demobilization from UCC-Woodbine in preparation for briefing to Dow, Mr. Redmond (CH2M HILL's Munitions Response Segment Director and a Master EOD Technician) noted the resemblance of an MEC item photographed by Ms. Donnell and Mr. Pasteris during the November 2006 visual site inspection to the M406 40-mm HE grenades identified by EODT in its *After Action Report for UXO Support Services* dated 1992 (see Appendix A, Photograph 20). From the photograph, it was noted that the item had the potential to be live and this uncertainty presented a substantial risk to human health.

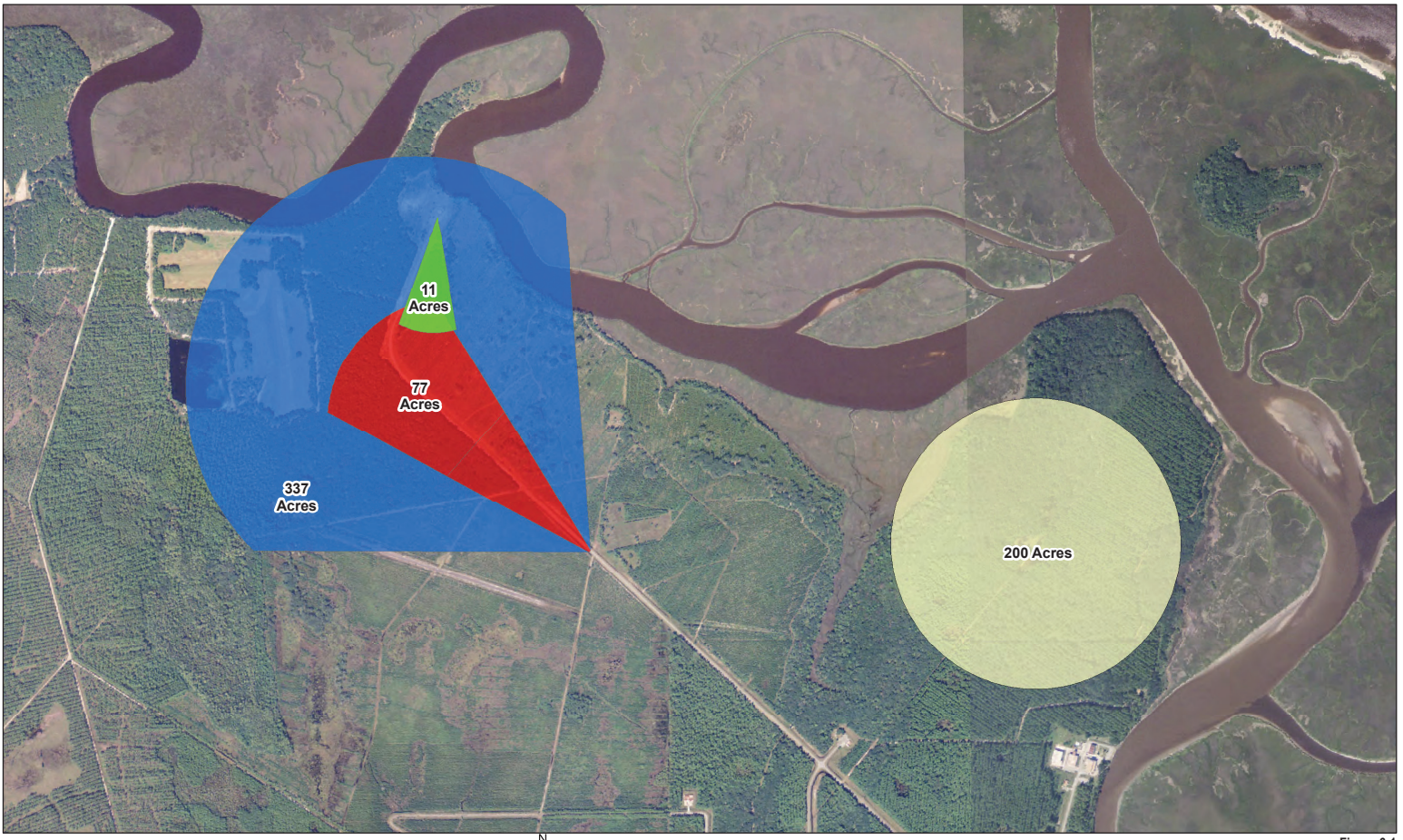
Mr. Dan Young (CH2M HILL's Munitions Safety Manager) was subsequently mobilized to the site to positively identify the item and secure it until an appropriate response could be implemented (see Appendix A, Photograph 21). While onsite, Mr. Young identified a second 40-mm grenade of the same description. Both items were secured and an emergency response coordinated through the GA EPD. The emergency disposal was subcontracted to USA Environmental, Inc., of Tampa, Florida. The AAR prepared in regard to the emergency response is included as Appendix D.

6.0 Findings and Conclusions

The following findings and conclusions are drawn based on the summary of information detailed in the previous sections of this report:

- Although three phases of investigations have been completed at UCC-Woodbine, their objectives and scopes were focused on the nature and extent of potential chemical contamination within specific areas. None of the RFI work to date had the objective to characterize the potential nature or extent of MEC contamination across the site.
- Recent visual site inspection confirmed that surface and subsurface MD is present in the vicinity of the hazardous waste landfill access road in the area encompassing the original SWMU 01.
- Based on the results of recent visual inspection, MEC is known to be present within the bounds of the former 40-mm test range including SWMU 03. MEC identified to date includes 40-mm HE and CS grenades. Two 40-mm HE rounds were recently recovered and disposed. Numerous CS grenades are visible on the soil surface.
- Three previous surface and subsurface MEC clearances within the bounds of the former 40-mm test range were intended to clear specific areas of MEC hazards to facilitate nature and extent investigations of chemical contamination. They were not designed to characterize the nature or extent of MEC hazards.
- The history of site operations suggests that MEC ejection or kickout occurred during past waste munitions disposal activities at SWMU 07. Additionally, the limitations of historical MEC removal activities in this area suggest that residual MEC in heavily vegetated areas and mounds may be present. Due to the dense vegetation and thick ground cover and limitations of the recent visual site inspection, presence of absence of MEC could not be confirmed.
- 81-mm mortars were reported to have been test fired in the vicinity of the former 81-mm test range (Figure 5-4). MEC in the form of mortar fuses have on occasion been recovered from the property by the site caretaker. The potential for MEC within the vicinity of the area identified as the former 81-mm mortar range is deemed possible, given that this area was not previously characterized. (Figure 6-1 shows the identified MEC hazard areas at UCC-Woodbine.)
- An explosion of the Thiokol flare manufacturing facility in 1971 on the property currently occupied by BCS may have resulted in MEC kickout. However, no documentation or details regarding the amount of munitions or explosives involved in the explosion, type or amount of munitions that may have been stored in proximity the manufacturing facility and thus subject to sympathetic detonation, or post-detonation clearance activities were uncovered during the RFA. Given the proximity of the explosion site to the UCC properties (approximately 2,500 feet), further review appears warranted.

- No documentation has been identified through historical records review that identifies the specific practices that were followed during historic test firing of munitions and disposal of waste munitions on the UCC-Woodbine property. In absence of these kinds of operational records, potential areas of interest for MEC have been identified through personnel interview, visual site inspection, and the application of standard 40-mm and 81-mm mortar range SDZs.



CH2MHILL

Figure 6-1
MEC Hazard Areas
UCC Site
Woodbine, GA

File Path: H:\projects3\DOW Woodbine\MXDs\MEC areas.mxd, Date: July 18, 2007 8:42:05 AM, User: JKELLY3

7.0 References

Apex Environmental. 1996. Report of the Phase II RCRA Facility Investigation. September 20.

Apex Environmental Inc. 1997. Addendum to the Report of the Phase II RCRA Facility Investigation. June 12.

Apex Environmental Inc. 2000. Baseline Risk Assessment for SWMU 7 Former Union Carbide Corporation Site Woodbine, Georgia, November 2.

Apex Environmental Inc. 2000. Summary Report for Assessment, Remediation, and Risk Assessment, SWMUs 2,3,4,5,6,7 November.

CH2M HILL. 2005. *Phase 1 Environmental Audit – Union Carbide Corporation, Woodbine, Georgia Facility.* May 31.

CH2M HILL. 2006. Dow Program Field Safety Instructions for Operations & Maintenance Activities at UCC Woodbine, October 10.

CH2M HILL. 2006. *Refined Conceptual Site Model,* Amended Hazardous Waste Permit EPD-HW-63(D). August 17.

Environmental Science & Engineering, Inc. 1994. *Facility Investigation.* February.

GA EPD. 1998. Letter from to UCC (Mr. McClain), subject: Addendum to Phase II RFI Report Permit No. HW-063(D), Woodbine, Georgia, EPA ID No. GAD981235294, dated October 29, 1998.

http://ourgeorgiahistory.com/chronpop/1685

http://www.camdencounty.org/history/bellevue.html

http://www.camdencounty-ga.com/civic/area_info.html#CLIM

Law Environmental. 1988. Union Carbide RCRA Permit Application, Part I, August.

Law Environmental. 1992. Work Plan for Surface Debris Removal SWMU #3, #5, #6 and #7, Union Carbide, Woodbine, Georgia. August.

Law Environmental. 1993. RCRA Facility Investigation Report, Union Carbide Corporation, Woodbine, Georgia. February 5.

Law Environmental. 1993. Report of Surface Debris Removal and Disposal. October.

McGrath, David. 1995. "Thiokol's "Big Booster Work at the Georgia Division during the 1960s." Thiokol Corp, Elkton DLV Operations, Elkton, MD, Copyright 1995 by the American Institute of Aeronautics and Astronautics, Inc.

The Camden County Tribune. 1971. Reprinted on March 20, 1998. February 11.

Thiokol Corporation. No date. *Georgia Division – History and Background.*

Thiokol. 1976. *Interoffice Memo – Special Hazards at the Georgia Facility.* August.

Union Carbide Corporation. 1986. *Woodbine Plant Alleged CERCLA Sites.* August 1.

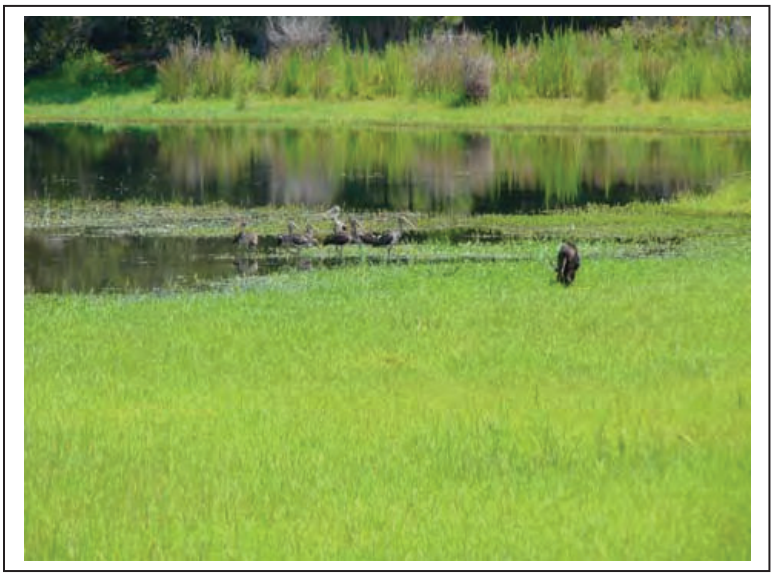
APPENDIX A

Site Photograph Collection

Photograph 1: Todd Creek_Saltilla River Marsh Near Floyd's Cemetery

Photograph 2: Typical Oak Hammock_West of Main Roadway_Vicinity of Former 81mm Range

Photograph 3: Juvenile Woodstorks and Ferel Pig, Pond Adjacent to Landfill



Photograph 4: Former Plantation Home, Bellvue, also Known as Anchor House

Photograph 5: Floyd's Cemetery

Photograph 6: Wild Boar

Photograph 7: Expended 81-mm Illumination Mortar Shell, Vicinity of Former SWMU 01 Surface Disposal of Munitions Debris

Photograph 8: Rocket Motor Test Pit

Photograph 9: M84 Time Fuse from SWMU 03 Bunker

Photograph 10: 40-mm Grenades and XM15 CS Canisters at former 40mm Range and SWMU 03

Photograph 11: Typical Vegetation, Former 40mm Range, SWMU 03

Photograph 12: M84 Time Fuzes on Bayer Property

Photograph 13: Former MEC Disposal Area/SWMU 07, West of Road Leading to Floyd's Cemetery

Photograph 14: Former MEC Disposal Area/SWMU 07, East of Road Leading to Floyd's Cemetery

Photograph 15: Typical Vegetation – Vicinity of SWMU 07

Photograph 16: Item, Found in Clearing at SWMU 07, East of Road Leading to Floyd's Cemetery

Photograph 17: Residual Evidence of Burning, Clearing at SWMU 07, East of Road Leading to Floyd's Cemetery

Photograph 18: Main Access Road, Looking Southeast Towards the Assumed 81mm Mortar Firing Line

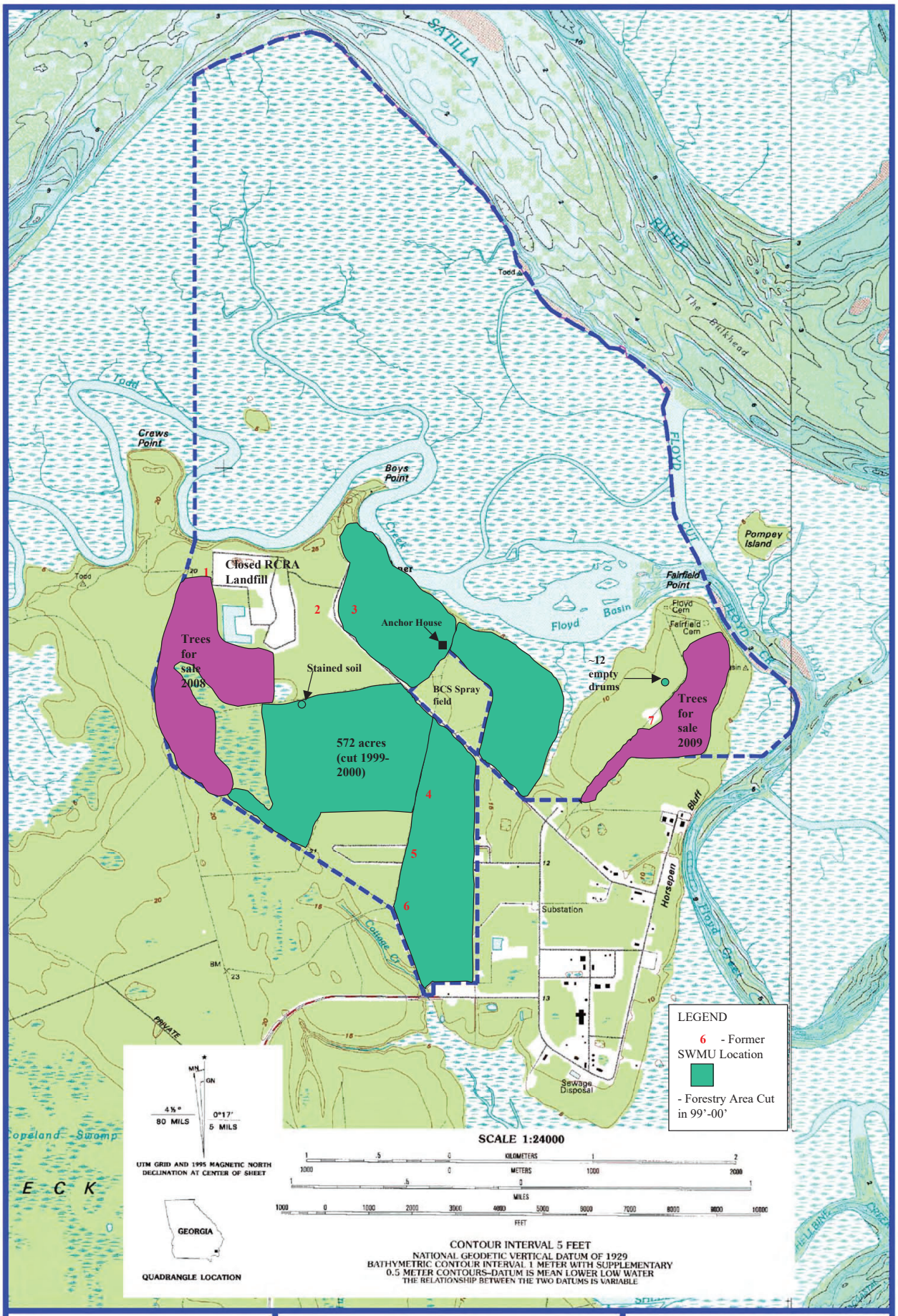
Photograph 19: Typical Oak Hammock South/Southwest of Main Access Road, Former 81-mm Test Range

Photograph 20: Experimental 40mm HE Grenade, Painted Blue with Gold Ogive, Located at Former 40-mm Range, SWMU 03

Photograph 21: Caution Tape and Stakes Used to Secure the Site of the 40mm HE Round

APPENDIX B

Figure Plates from Previous Studies and Reports

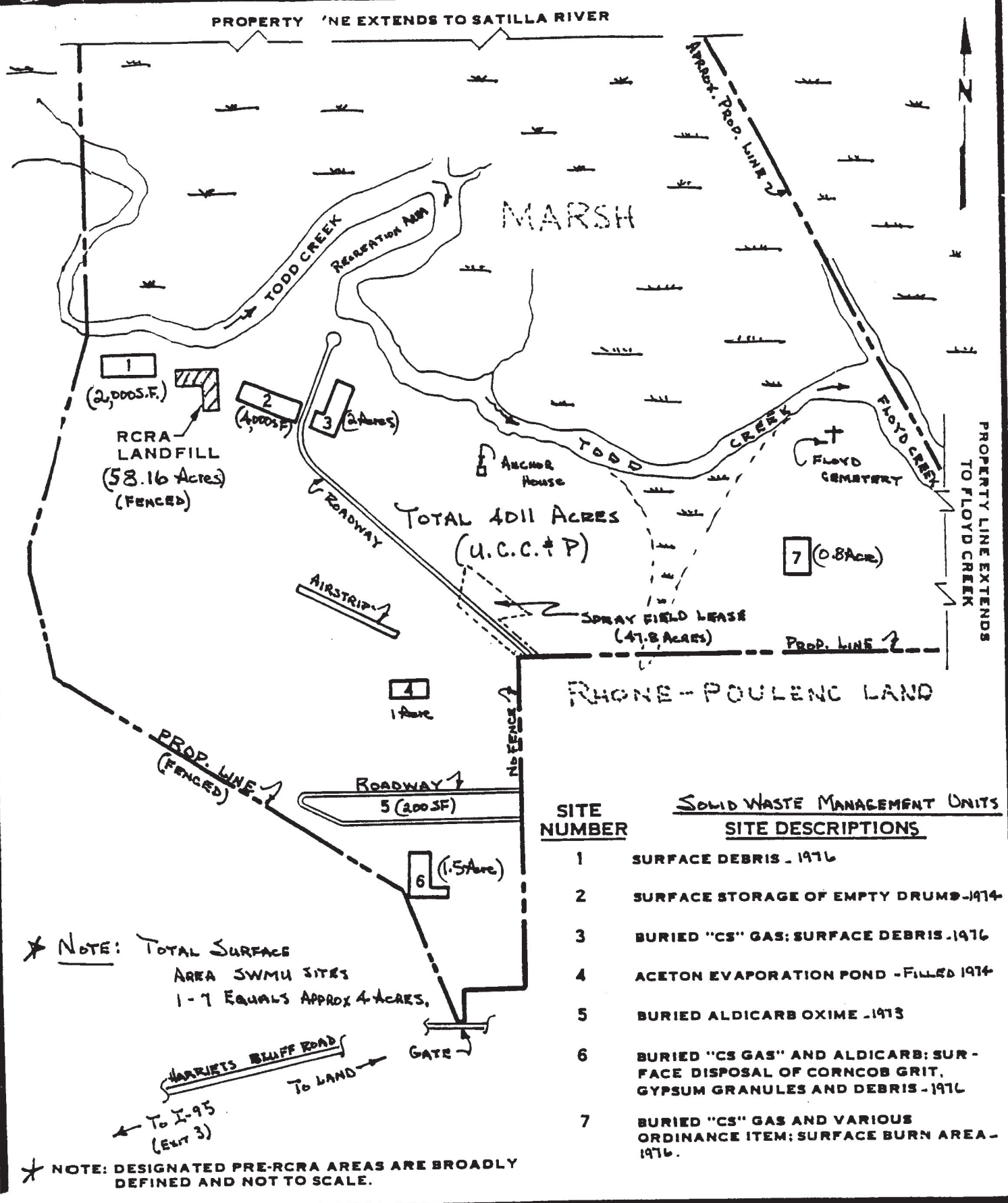


Notes:

1. Property Boundary is approximate and not based on a boundary survey.

Forestry Areas, Former SWMUs Locations & Phase I Findings Woodbine, GA Site

CH2MHILL



★ NOTE: TOTAL SURFACE AREA SWMU SITES 1-7 EQUALS APPROX 4 ACRES.

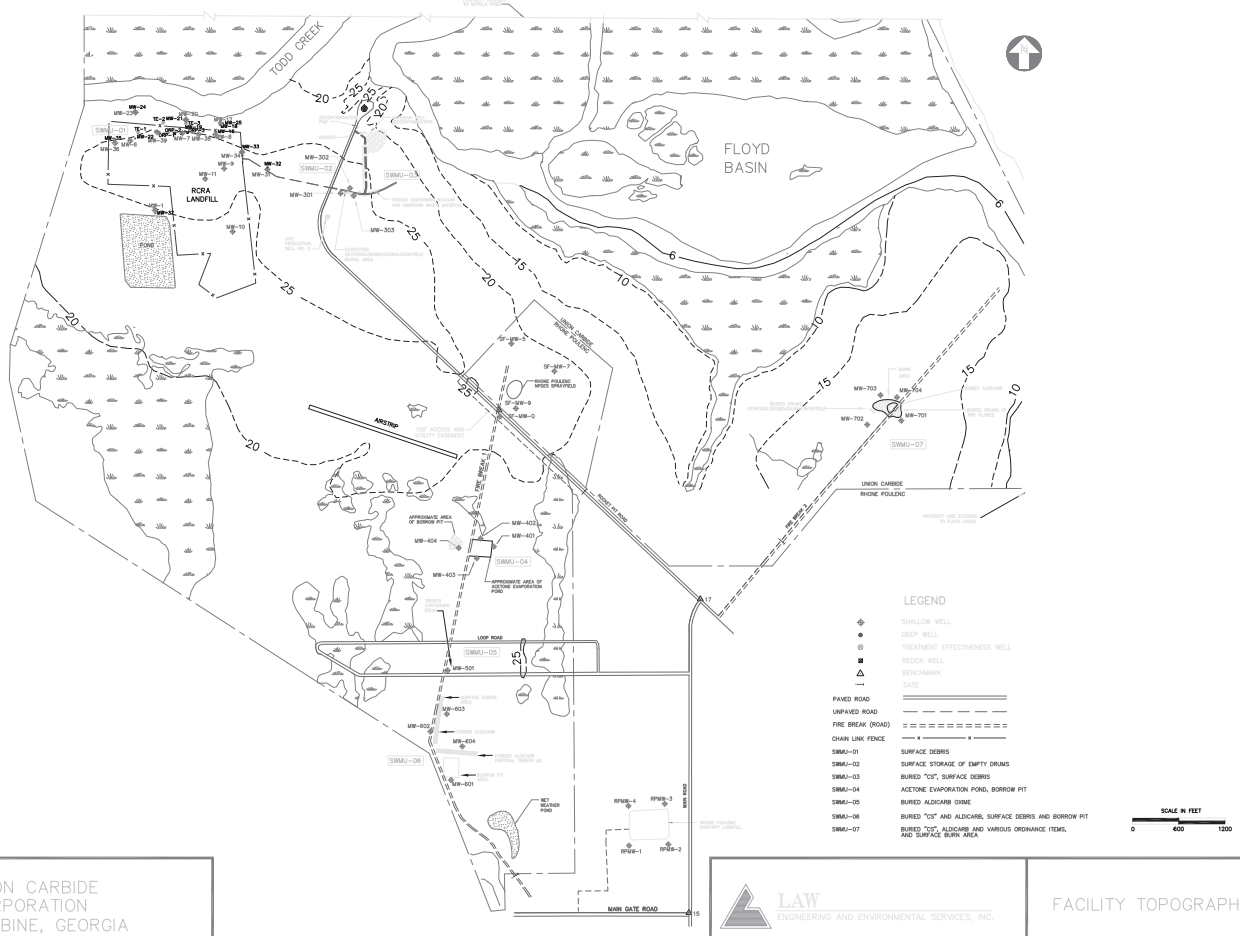
SOLID WASTE MANAGEMENT UNITS

SITE NUMBER	SITE DESCRIPTIONS
1	SURFACE DEBRIS - 1976
2	SURFACE STORAGE OF EMPTY DRUMS - 1974
3	BURIED "CS" GAS; SURFACE DEBRIS - 1976
4	ACETON EVAPORATION POND - FILLED 1974
5	BURIED ALDICARB OXIME - 1973
6	BURIED "CS GAS" AND ALDICARB; SURFACE DISPOSAL OF CORNCOB GRIT, GYPSUM GRANULES AND DEBRIS - 1976
7	BURIED "CS" GAS AND VARIOUS ORDINANCE ITEM; SURFACE BURN AREA - 1976.

★ NOTE: DESIGNATED PRE-RCRA AREAS ARE BROADLY DEFINED AND NOT TO SCALE.

UNION CARBIDE CORPORATION	LAW ENVIRONMENTAL INC.	PLOT PLAN PRE-RCRA DISPOSAL SITES
HBB Rev. 8/8/91		NO SCALE Aug. 1988

FILE: UNIONCAR/BASE92 DATE: 7/29/98



UNION CARBIDE CORPORATION
WOODBINE, GEORGIA

LAW
ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

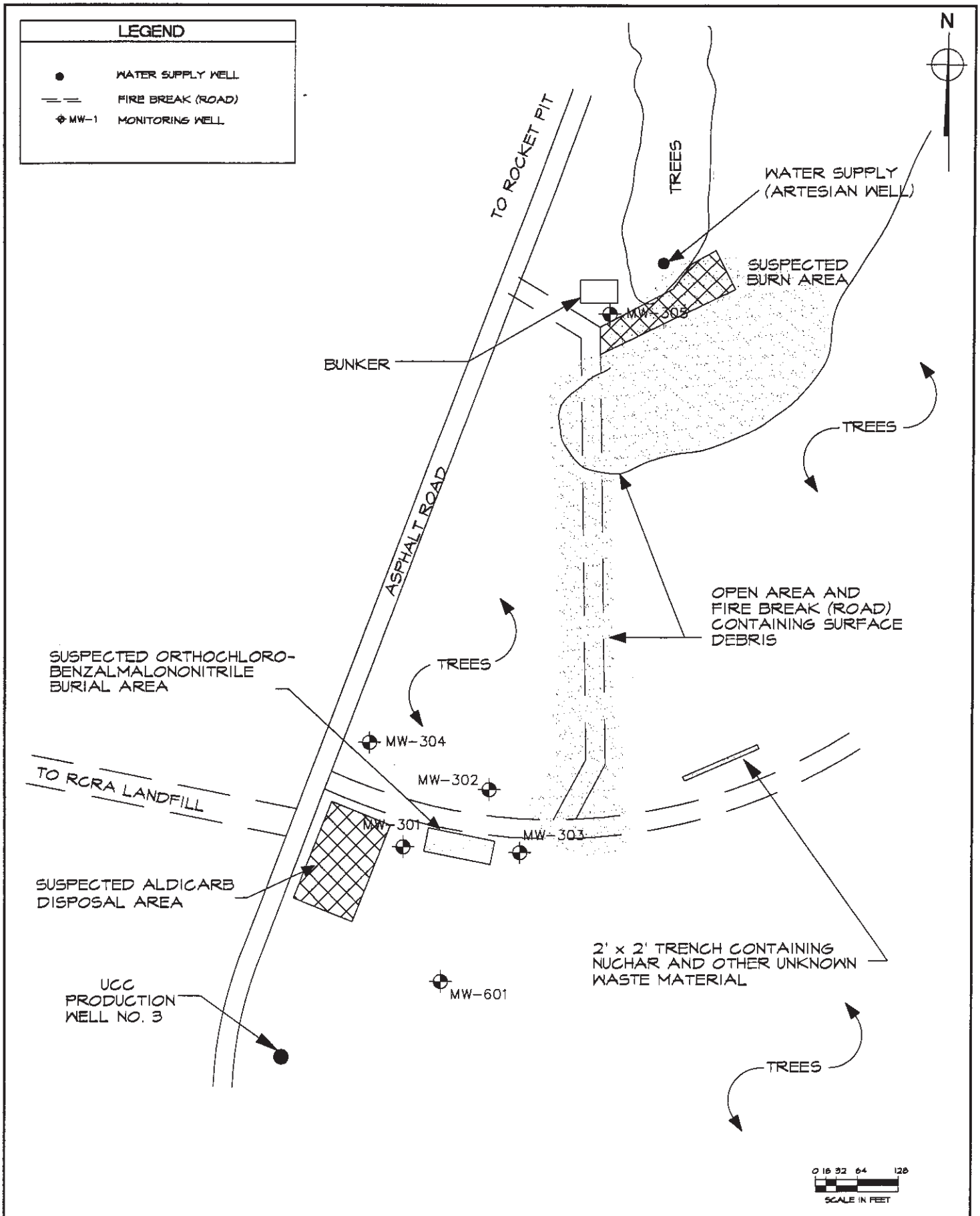
FACILITY TOPOGRAPHIC MAP

JOB NO. 55-5287

FIGURE B-4

PREPARED BY/DATE

CHECKED BY/DATE

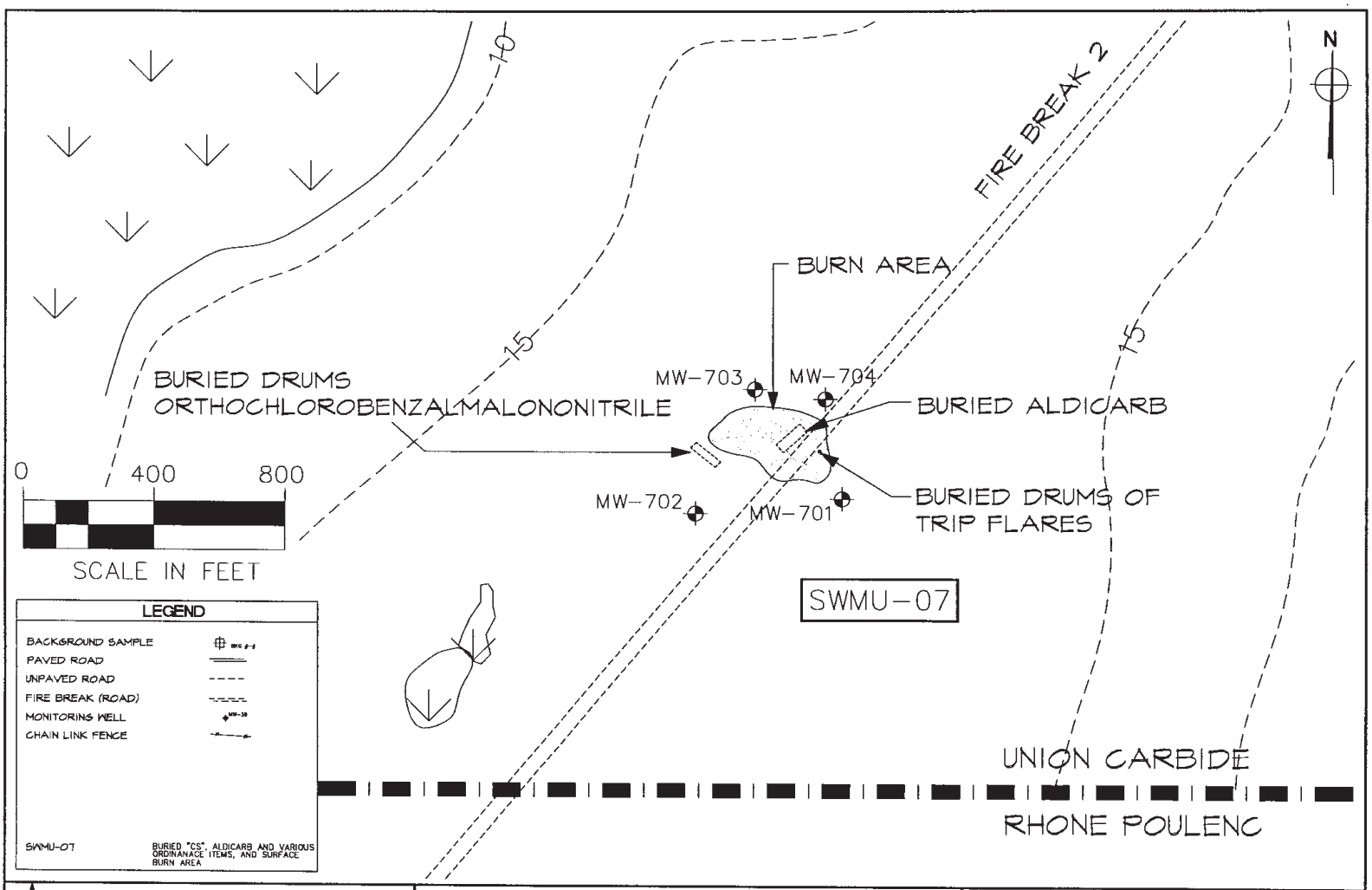


Apex environmental, inc.®
15850 CRABBS BRANCH WAY
SUITE 300
ROCKVILLE, MARYLAND 20855
TELEPHONE: (301) 417-0200

FIGURE 3
SWMU 03
SITE MAP
WOODBINE, GEORGIA

PHASE II RFI
THIOKOL CORPORATION
WOODBINE, GA

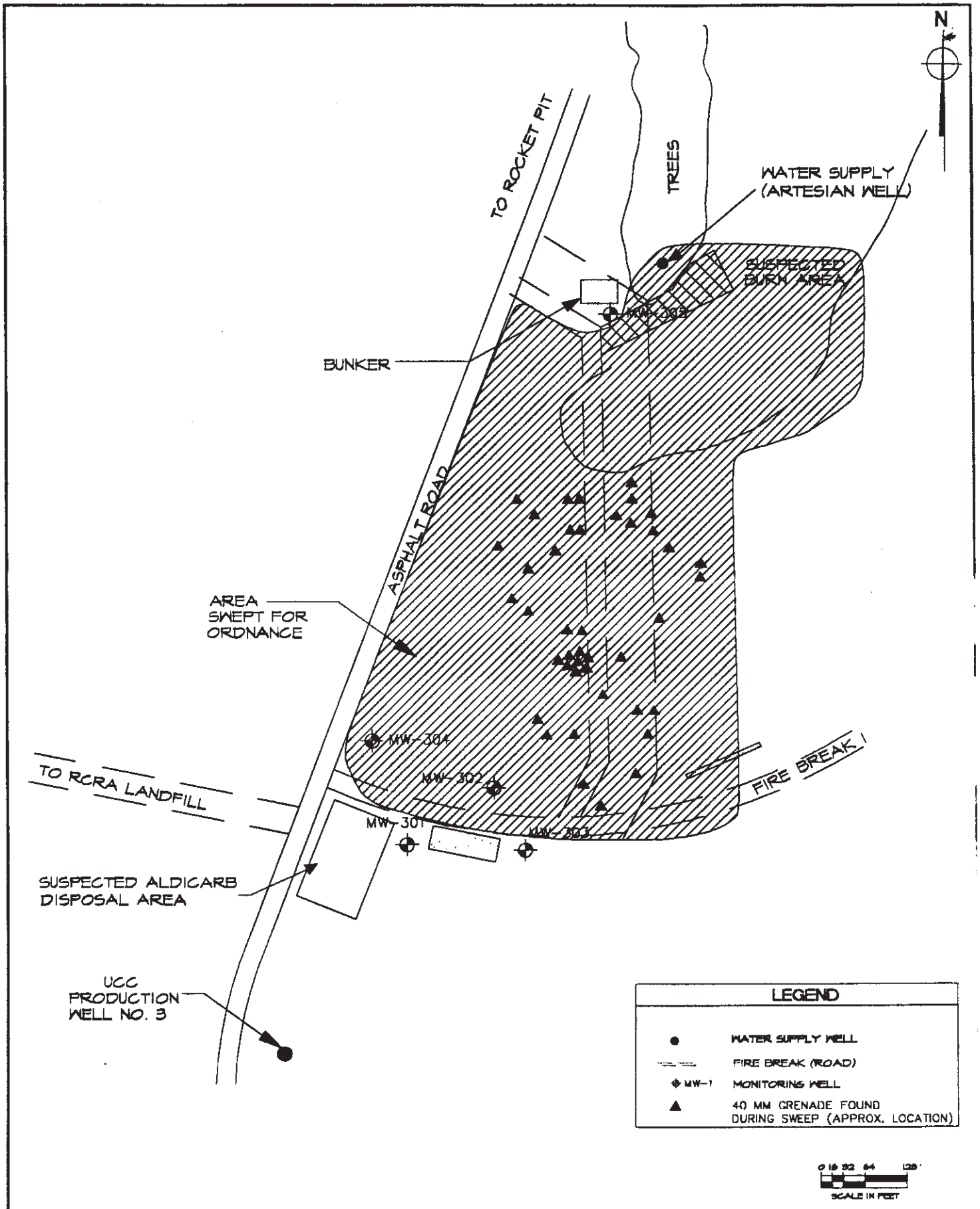
7-18-96	CDC	097.001
UNION-2	AS SHOWN	THIOKOL CORP.



Apex environmental, inc.
15850 CRABBS BRANCH WAY
SUITE 300
ROCKVILLE, MARYLAND 20855
TELEPHONE: (301) 417-0200
FACSIMILE: (301) 975-0169

FIGURE 7
SWMU 07
SITE MAP
WOODBINE, GEORGIA

Date:	Project Title:		
7-15-96	PHASE II RFI THIOKOL CORPORATION WOODBINE, GA		
Drawn By: SJR			
Project Number: 097.001	CAD File: BKG7	Scale: AS SHOWN	Client: THIOKOL CORP



Apex environmental, inc.®
13630 CRABBS BRANCH WAY
SUITE 200
ROCKVILLE, MARYLAND 20850
TELEPHONE (301) 417-0200

FIGURE 1
SWMU 3
UNEXPLODED ORDNANCE LOCATION

WOODBINE, GEORGIA

Project Title:
PHASE II RFI ADENDUM
THIOKOL CORPORATION
WOODBINE, GA

Date:	Drawn By:	Project Number:
6-11-97	CDC	097.005
CAD File:	Scale:	Client:
UNION-A	AS SHOWN	THIOKOL CORP.

APPENDIX C

List of Documents Reviewed

Appendix C
Table 1. Files from UCC-West Virginia Office

DATE	*TITLE*/AUTHOR	NOTES
8/1/1986	*Woodbine Plant Alleged CERCLA Sites*/UCC	Describes 21 Alleged CERCLA sites - several with hand notes describing future SWMU notations.
No date	*Post Closure Care Permit Application*/Union Carbide?	Describes 22 Pre-RCRA waste units. Information developed from employee interviews. Units described are limited to those utilized from 1966 to 1980. Waste description, years of operation, capacity, investigation plan, etc. are listed.
No date	*Woodbine Plant Offers Unique Blend of History and Environment*/Newspaper article	Site history and usage discussed.
8/27/1986	*Outline - ACL Report*/No author	Landfill history, brief site history
No date	*Hand notes*/No author	SWMU discussion - Risk assessment status
8/8/1991	*Plot Plan Pre-RCRA Disposal Sites Figure*/Law Environmental	SWMUs shown on map with estimated acreage
4/20/1992	*Pre-RFI Debris Characterization and Disposal Scope of Work*/UCC	No specific SWMUs are listed. Description of scope to remove trash, building debris, ordinance, equipment, etc from sites.
4/24/1992	*Woodbine Property Cleanup*/UCC	brief discussion of debris removal in areas where RFI will take place. Mention a piece of equipment that has suspectied CS contamination.
5/11/1992	*UCC&P Contract No. 0511-876094*/UCC	Authorization to Contractor (Law Environmental) to characterize surface debris from SWMUs 3 and 7 and assist in debris disposal
6/3/1992	*Woodbine Pre-RFI Debris Removal*	UCC's acceptance of Law's "revised propooasl" for characterization and disposal work
9/9/1992	*Workplan for Surface Debris Removal Law Environmental Proposal Number 41-2220*/UCC	Authorization to Contractor (Law Environmental) to surface debris removal from SWMUs 3, 5, 6 and 7
8/21/1992	*Proposal for the Implementation of Work Plan for Surface Debris Removal*/Law Environmental	Proposal and estimation for debris removal. Ordnance mentioned. Also, asbestos, haz waste.
Feb-94	*Facility Investigation*/Environmental, Science & Engineering	Prepared for Rhone-Poulenc, site history, description of SWMUs 4, 5,6,7,11,15,16,18,19 and 21. Summarizes investigation and results
Nov-92	*After Action Report for the Surface UXO/OEW and Ordnance Debris Removal*/EOD Technology	Description of Removal - Surface and subsurface removal and clearance at SWMUs 3, 5, 6 and 7
12/11/1992	*Surface Debris Disposal Options*/Law	Describes types and quantities of debris (Scrap metal, ACM, Construction debris, decon water, unknown liquids
1/27/1993	*Surface Debris Disposal*/UCC	Approval to proceed with Scrap metal, ACM and Construction debris disposal. Hold on decon water and unknown liquids

Appendix C
Table 1. Files from UCC-West Virginia Office

DATE	*TITLE*/ AUTHOR	NOTES
2/17/1993	*Arrangements for Waste Disposal Surface Debris Removal*/ Law	Lists solid wastes: inert scrap ordnance, ACM, solidified paint wastes, wood from the air handler and building debris.
3/17/1993	*Profile for Disposition of Solid Wastes*/ Law	Profile to Waste Disposal company for acceptance. Description of ordnance scrap (40 mm practice grenades and flares). Trace CS confirmed in air handler and associated equipment,
7/30/1993	*Proposal for Geophysical Survey and Buried Waste Removal* /Law	Proposed scope for investigate and remove buried ordnance and debris at SWMU 6 and 7, Phase 1 - Geophysical Survey for buried drums and ordnance. SWMU 6 - investigation of potential drums in Former Trench Area #1 and Former Borrow Pit area. SWMU 7 - Burn area. SWMU 7 work requires presence of EOD b/c of UXO potential. Phase II - Excavation, Phase III - Deactivation and Disposal.
11/22/1993	*Woodbine SWMU Cleanup Costs* /UCC	Attaches 10/23/86 Memo estimating $6M max cost for cleanup of 22 Pre-RCRA SWMUs. Most expensive ones are SWMUs 3, 6 and 7 b/c they were used to dispose of CS, aldicarb and ordinance burn. Description attached of SWMU and associated Material Handled.
8/18/1994	*Cost of Investigation of SWMUs* /Rhone-Poulenc Invoice	$91 K, Facility investigation costs only.
9/14/1994	*Woodbine* /UCC	Discussion of RP invoice
6/9/1995	*Proposal for services*/ Apex	Page 2 of 3 only. Discussion of ordnance in SWMU 6 and 7 - not in SWMU 5
11/10/1994	*Review of Analytical Data Related to the Woodbine Landfill and SWMUs*/ UCC	An UCC trip to Savannah Labs to review old data in an attempt to assign contamination to UCC or Thiokol. Trip results "priveleged". MWs from Landfill reviewed. Monitoring well samples were considerably cleaner than soil samples. Describes data reviewed and theorizes Thiokol's contribution
7/28/1995	*Woodbine SWMU RFI Phase II Cost Estimate - memo from UCC*	Apex is Thiokol's contractor. Attached 6/9/95 Apex cost estimate. Questions presense of ordnance at SWMU 6. pages 1 and 3 are attached for full copy of cost estimate
8/10/1995	*NOD - Phase II RFI WorkPlan*/ GA EPD	Makes recommendations for Investigation at SWMUs
9/14/1995	*Cover for Revised Phase II RFI Workplan*	Responds to deficiencies - addresses where each can be found in the revised RFI
9/14/1995	*Phase II RFI Work Plan*/ Apex	Provides background, investigation and results for SWMUs 2 through 7 (Phase I), describes Phase II work at SWMUs 3-7.

Appendix C
Table 1. Files from UCC-West Virginia Office

DATE	*TITLE*/ AUTHOR	NOTES
2/14/1996	*Phase II RFI Letter/Apex*	Describes unexploded 40 mm rounds and portions of 81 mm illumination rounds in SWMU 3 and 7. Geophysical survey at SWMU 3 did not reveal significant anomalies. Anomalies found at SWMU 7. Most anomalies at SWMU 7 were scrap metal and individual decayed drums. However, two significant areas were identified - one containing loose trip flares and one containing trench of drums (with unexploded 40 mm rounds and 81 mm illumination rounds) Drums were removed over 4 week period.
9/18/1996	*After Action Report for the Surface UXO/OEW and Ordnance Debris Removal/EOD Technology*	Description of UXO Recovered/Destroyed at SWMU 3 (none) and SWMU 7
12/10/1997	*Abandoned Underground Soild Rocket Test Silo/* Union Carbide	Discussion of Silo condition and future risks associated with silo as pathway to groundwater contamination (water was present in silo). Mentions destroyed ordnance observed around surrounding surface.
4/6/1998	*Memo - Woodbine, GA site/*UCC	Site history provided. Description of investigation and remediation at SWMUs provided. 2 SWMUs require corrective action.States "substantial amount of ordnance, ordnance related scrap metal, drums and tear gas remain" and property use will be limited in next few years.
8/31/1998	*Woodbine SWMU Investigation/* Cordant Technologies	Waiting for comments from EPD on Phase II RFI report.
11/5/1998	*Woodbine SWMUs/* UCC	Attaches 10/29/98 EPD letter providing comments on Phase II RFI report. Provides regs on Risk Approach to remediation. Describes Phase II RFI activities. Requests Corrective Action Plan for SWMUs 2-7 within 30 days
12/1/1998	*Workplan addendum Additional Investigation and Delineation/* Apex	Proposes additional sampling for SWMU 4, 6 and 7. Proposes additional removal activities for SWMU 7 . A risk based approach to request NFA will be used at SWMUs 2, 3 and 5.
12/10/1998	*Corrective Action Plan Schedule/* Apex	Schedules for upcoming sampling, risk assessment submittals and ordnance removal
12/11/1998	*Corrective Action Plan Investigation and Delineation/ Apex*	Proposes additional sampling for SWMU 4, 6 and 7. Proposes additional removal activities for SWMU 7 . A risk based approach to request NFA will be used at SWMUs 2, 3 and 5.
12/18/1998	*Letter to EPD/* Rhone-Poulenc	Notification of benzene in landfill mw - source undetermined
1/20/1999	*Woodbine SWMU Investigation/* Cordant Technologies	Financial update - optimistic projection of closure of SWMUs in 1999.
2/16/1999	*Woodbine SWMU #6/* Cordant Technologies	Attaches 2/8/99 Apex proposal to conduct soil removal for acetone in SWMU 6 (estimate 90-500 tons of soil) Removal of soils > 100 ppm. thermal treatment of soils >160 ppm.
2/26/1999	*Remediation Schedule/* Apex	Attaches schedule and SWMU layout

Appendix C

Table 2. Storage Index – Hunton & Williams Files

UNION CARBIDE

OFF-SITE STORAGE INDEX

BOX #1	SUBJECT MATTER - ALLOCATION (MISCELLANEOUS DOCUMENTS)
BOX #2	SUBJECT MATTER - ALLOCATION (MISCELLANEOUS DOCUMENTS UNSORTED)
BOX #3	SUBJECT MATTER - ALLOCATION (TEMICK DOCUMENTS)
BOX #4	SUBJECT MATTER - ALLOCATION (OTHER CONTRACTS)
BOX #5	SUBJECT MATTER - ALLOCATION (OTHER CONTRACTS)
BOX #6	SUBJECT MATTER - ALLOCATION (OTHER CONTRACTS)
BOX #7	SUBJECT MATTER - ALLOCATION (OTHER CONTRACTS)
BOX #8	SUBJECT MATTER - ALLOCATION (MISCELLANEOUS DOCUMENTS)
BOX #9	SUBJECT MATTER - ALLOCATION (MISCELLANEOUS DOCUMENTS UNSORTED)
BOX #10	SUBJECT MATTER - ALLOCATION (PRODUCTION INFORMATION)
BOX #11	SUBJECT MATTER - RHONE-POULENC
BOX #12	SUBJECT MATTER - RHONE-POULENC
BOX #13	SUBJECT MATTER - ALLOCATION (SWMU)
BOX #14	SUBJECT MATTER - SWMU
BOX #15	SUBJECT MATTER - ALLOCATION (MISCELLANEOUS DOCUMENTS UNSORTED)
BOX #16	SUBJECT MATTER - ALLOCATION (MISCELLANEOUS DOCUMENTS UNSORTED)
BOX #17	SUBJECT MATTER - ALLOCATION (MISCELLANEOUS DOCUMENTS UNSORTED)
BOX #18	SUBJECT MATTER - RHONE-POULENC (SWMU)
BOX #19	SUBJECT MATTER - LANDFILL CLOSURE
BOX #20	SUBJECT MATTER - LANDFILL CLOSURE
BOX #21	SUBJECT MATTER - LANDFILL CLOSURE
BOX #22	SUBJECT MATTER - ACQUISITIONS
BOX #23	SUBJECT MATTER - GROUNDWATER
BOX #24	SUBJECT MATTER - MAPS
BOX #25	SUBJECT MATTER - MISCELLANEOUS

BOX #26	SUBJECT MATTER - MISCELLANEOUS
BOX #27	SUBJECT MATTER - MISCELLANEOUS
BOX #28	SUBJECT MATTER - MISCELLANEOUS
BOX #29	SUBJECT MATTER - TOLLING AGREEMENTS
BOX #30	SUBJECT MATTER - ORGANIZATION CHARTS
BOX #31	SUBJECT MATTER - SAMPLE DATA
BOX #32	SUBJECT MATTER - SAMPLE DATA
BOX #33	SUBJECT MATTER - STATUTE OF LIMITATIONS
BOX #34	SUBJECT MATTER - MANIFESTS
BOX #35	SUBJECT MATTER - THIOKOL'S ENVIRONMENTAL COMPLIANCE
BOX #36	SUBJECT MATTER - ENVIRONMENTAL AUDITS
BOX #37	SUBJECT MATTER - THIOKOL/AETNA
BOX #38	SUBJECT MATTER - THIOKOL/AETNA
BOX #39	SUBJECT MATTER - DAMAGES
BOX #40	SUBJECT MATTER - DAMAGES
BOX #41	SUBJECT MATTER - NCP
BOX #42	SUBJECT MATTER - NCP
BOX #43	SUBJECT MATTER - NCP
BOX #44	SUBJECT MATTER - NCP
BOX #45	SUBJECT MATTER - NCP
BOX #46	SUBJECT MATTER - NCP
BOX #47	DOCUMENTS PRODUCED BY DIANA HOLLEY FOR WOODBINE (ORIGINAL P12007-P12185)
BOX #48	DOCUMENTS PRODUCED BY DIANA HOLLEY FOR WOODBINE (ORIGINAL P12186-P12404)
BOX #49	DOCUMENTS PRODUCED BY DIANA HOLLEY FOR WOODBINE (ORIGINAL P12405-P13292)
BOX #50	DOCUMENTS PRODUCED BY DIANA HOLLEY FOR WOODBINE (ORIGINAL P13293-P13493)

BOX #51 DOCUMENTS PRODUCED BY DIANA HOLLEY FOR WOODBINE
(COPY P13494-P13590)

BOX #52 JAMES S. BERRY, JR. ORIGINAL PERSONAL FILES
(HE DOES NOT WANT THEM RETURNED)

BOX #53 JAMES S. BERRY, JR. ORIGINAL PERSONAL FILES
(HE DOES NOT WANT THEM RETURNED)

BOX #54 JAMES S. BERRY, JR. ORIGINAL PERSONAL FILES
(HE DOES NOT WANT THEM RETURNED)

BOX #55 JAMES S. BERRY, JR. ORIGINAL PERSONAL FILES
(HE DOES NOT WANT THEM RETURNED)

BOX #56 JOHN C. BUTLER DEPOSITION EXHIBITS NO. 1, 10-12 (VOLUME V)
JOHN C. BUTLER DEPOSITION EXHIBITS NO. 12 (VOLUME VI)
JOHN P. COFFIN DEPOSITION
JOHN P. COFFIN DEPOSITION EXHIBITS
ROY P. COLLIER, SR. DEPOSITION AND EXHIBITS

BOX #57 1ST DEPOSITION OF DAVID B. CUNNINGHAM WITH CONFIDENTIAL EXCERPT (EXHIBIT 13) 4/22/94
1ST DEPOSITION EXHIBITS OF DAVID B. CUNNINGHAM 4/22/94
2ND DEPOSITION OF DAVID B. CUNNINGHAM WITH EXHIBITS 7/28/94
3RD DEPOSITION OF DAVID B. CUNNINGHAM 8/16/94
3RD DEPOSITION OF DAVID B. CUNNINGHAM EXHIBITS 8/16/94 VOLUME I
3RD DEPOSITION OF DAVID B. CUNNINGHAM EXHIBITS 8/16/94 VOLUME II

BOX #58 3RD DEPOSITION OF DAVID B. CUNNINGHAM EXHIBITS 8/16/94 VOLUME III CONFIDENTIAL
ROBERT E. DAVIS DEPOSITION 8/30/94
ROBERT E. DAVIS DEPOSITION EXHIBITS 8/30/94
BRUCE D. FITZGERALD DEPOSITION 7/28/94
BRUCE D. FITZGERALD DEPOSITION EXHIBITS 7/28/94
JOHN A. FITZGERALD DEPOSITION 8/15/94
JOHN A. FITZGERALD DEPOSITION EXHIBITS 8/15/94
KENNETH G. FORD DEPOSITION AND EXHIBITS 8/25/94

BOX #59 JAMES E. GROSS DEPOSITION AND EXHIBITS 4/27/94
FRED C. HART DEPOSITION AND EXHIBITS 8/23/94
DONALD L. HIERMAN DEPOSITION 4/20/94
DONALD L. HIERMAN DEPOSITION EXHIBITS 4/20/94
WALKER HORN DEPOSITION 10/20/94
CALVIN F. HORTMAN DEPOSITION 8/26/94
CALVIN F. HORTMAN DEPOSITION EXHIBITS 8/26/94
BRUCE KEY DEPOSITION AND EXHIBITS 8/18/94
RANDALL KITTRELL DEPOSITION 8/29/94
RANDALL KITTRELL DEPOSITION EXHIBITS 8/29/94

BOX #60

GLEN R. CRAFT DEPOSITION AND EXHIBITS 8/10/94
STEPHEN A. LIND DEPOSITION 7/14/94
STEPHEN A. LIND DEPOSITION EXHIBITS 7/14/94
VAN GALE LONG DEPOSITION 8/18/94
VAN GALE LONG DEPOSITION EXHIBITS 8/18/94
WILLIAM A. LOWENBACH DEPOSITION AND EXHIBITS VOLUME I 8/27/94
ARTHUR M. MCCLAIN DEPOSITION 6/29/94 AND 8/31/94 VOLUME I

BOX #61

ARTHUR M. MCCLAIN DEPOSITION EXHIBITS 1-49 6/29/94 AND 8/31/94 VOLUME 2
ARTHUR M. MCCLAIN DEPOSITION EXHIBITS 50-72 6/29/94 AND 8/31/94 VOLUME 3
ARTHUR M. MCCLAIN DEPOSITION EXHIBITS 73-74, 82-102 6/29/94 AND 8/31/94 VOLUME 4
ARTHUR M. MCCLAIN DEPOSITION EXHIBIT 75 6/29/94 AND 8/31/94 VOLUME 5
ARTHUR M. MCCLAIN DEPOSITION EXHIBIT 76 6/29/94 AND 8/31/94 VOLUME 6
ARTHUR M. MCCLAIN DEPOSITION EXHIBIT 77 6/29/94 AND 8/31/94 VOLUME 7
ARTHUR M. MCCLAIN DEPOSITION EXHIBIT 78 6/29/94 AND 8/31/94 VOLUME 8
ARTHUR M. MCCLAIN DEPOSITION EXHIBIT 79 6/29/94 AND 8/31/94 VOLUME 9

BOX #62

ARTHUR M. MCCLAIN DEPOSITION EXHIBIT 80 6/29/94 AND 8/31/94 VOLUME 10
MICHAEL L. MCMURRAY DEPOSITION AND EXHIBITS 4/28/94
JOHN S. MCREYNOLDS DEPOSITION AND EXHIBITS 8/24/94
ENNIS MITCHELL MIDYETT DEPOSITION AND EXHIBITS 8/24/94
CHARLES E. MOYER, JR. DEPOSITION 8/9/94
CHARLES E. MOYER, JR. DEPOSITION EXHIBITS 8/9/94
WILFRED MUNDY DEPOSITION 8/23/94
WILFRED MUNDY DEPOSITION EXHIBITS 8/23/94

BOX #63

FRANK PARKER DEPOSITION AND EXHIBITS 8/26/94
JOHNNY W. POSEY DEPOSITION AND EXHIBITS 4/28/94
KIRT G. ROBINS DEPOSITION AND EXHIBITS 8/31/94
ALBERT PETER ROEPER DEPOSITION AND EXHIBITS 8/29/94
GREGORY R. ROUSH DEPOSITION 7/14/94
GREGORY R. ROUSH DEPOSITION EXHIBITS 7/14/94
JOHN J. SIBLEY DEPOSITION AND EXHIBITS 6/29/94
FRANK J. SKIERMONT DEPOSITION AND EXHIBITS 8/9/94
JAMES S. SMITH DEPOSITION 8/8/94
JAMES S. SMITH DEPOSITION EXHIBITS 8/8/94

BOX #64

JAMES R. STANLEY DEPOSITION AND EXHIBITS 5/24/94
JAMES R. STANLEY DEPOSITION AND EXHIBITS 6/8/94 VOLUME I
JAMES R. STANLEY DEPOSITION AND EXHIBITS 6/8/94 VOLUME II
KRISTEN K. STOUT DEPOSITION AND EXHIBITS 8/22/94
RALPH NEWELL THOMPSON DEPOSITION AND EXHIBITS 8/29/94
RONALD VAN MYNEN DEPOSITION WITH CONFIDENTIAL EXCERPTS AND DEPOSITION EXHIBITS 6/27/94
JAMES R. WALLACE DEPOSITION 4/13/94
JAMES R. WALLACE DEPOSITION EXHIBITS 4/13/94

BOX #65
ROSS A. WALLINGFORD DEPOSITION 8/22/94
ROSS A. WALLINGFORD DEPOSITION EXHIBITS 8/22/94
BRUCE E. WILKES DEPOSITION 9/1/94
BRUCE E. WILKES DEPOSITION AND EXHIBITS 9/1/94
EXTRA COPY OF JAMES S. BERRY, JR. DEPOSITION EXHIBITS 4/2/94
EXTRA COPY OF ARTHUR M. MCCLAIN DEPOSITION EXHIBITS VOLUME 2
EXTRA COPY OF EXCERPTS FROM JOHN J. SIBLEY DEPOSITION 7/29/94
EXTRA COPY OF JAMES S. SMITH DEPOSITION 8/8/94
EXTRA COPY OF JAMES S. SMITH DEPOSITION EXHIBITS 8/8/94

BOX #66
JAMES D. BAKER DEPOSITION AND EXHIBITS 4/14/94
JAMES WALLACE ANDREWS DEPOSITION AND EXHIBITS 8/25/94 VOLUME I
JAMES WALLACE ANDREWS DEPOSITION EXHIBITS 8/25/94 VOLUME II
JAMES WALLACE ANDREWS DEPOSITION EXHIBITS 8/25/94 VOLUME III
JAMES WALLACE ANDREWS DEPOSITION EXHIBITS 8/25/94 VOLUME IV
BERTRAND A. CHIASSON DEPOSITION 8/28/94
AUGUSTINE CELAYA DEPOSITION AND EXHIBITS 8/25/94
WALKER HORN DEPOSITION AND EXHIBITS 10/20/94

BOX #67
THIOKOL EXPERT WITNESSES
MINUSCRIPT AND DEPOSITION TRANSCRIPT OF JAMES S. SMITH.
AUGUST 8, 1994 AND DOCUMENTS AND RELATED DOCUMENTS REFERENCED IN SMITH REPORT
DOCUMENTS AND RELATED DOCUMENTS REFERENCED IN SMITH REPORT, VOLUME 2
JAMES S. SMITH DEPOSITION EXHIBITS AUGUST 8, 1994 INCLUDES EXHIBIT 1, SMITH EXPERT REPORT
NCP COMPLIANCE AND RELATED ON-SITE CONSTRUCTION, VOLUME I
NCP COMPLIANCE AND RELATED ON-SITE CONSTRUCTION, VOL. II
NCP COMPLIANCE AND RELATED ON-SITE CONSTRUCTION, VOL. III

BOX #68
K. DENNIS SISK'S WORKING FILES AND COPIES OF MINUSCRIPTS

BOX #69
DEFENDANTS DOCUMENTS PRODUCED AND COPIED BY TAFT STETTINIUS (P00003 THROUGH P00749)
DEFENDANTS DOCUMENTS PRODUCED AND COPIED BY TAFT STETTINIUS (P00750 THROUGH P01835)
DEFENDANTS DOCUMENTS PRODUCED AND COPIED BY TAFT STETTINIUS (P01837 THROUGH P02599)
DEFENDANTS DOCUMENTS PRODUCED AND COPIED BY TAFT STETTINIUS (P02601 THROUGH P03582)
DEFENDANTS DOCUMENTS PRODUCED AND COPIED BY TAFT STETTINIUS (P03584 THROUGH P04409)

BOX #70
DEFENDANTS DOCUMENTS PRODUCED AND COPIED BY TAFT STETTINIUS (P04461 THROUGH P05383)
DEFENDANTS DOCUMENTS PRODUCED AND COPIED BY TAFT STETTINIUS (P05520 THROUGH P06725)
DEFENDANTS DOCUMENTS PRODUCED AND COPIED BY TAFT STETTINIUS (P06746 THROUGH P07896)
DEFENDANTS DOCUMENTS PRODUCED AND COPIED BY TAFT STETTINIUS (P08541 THROUGH P10026)

BOX #71	DEFENDANTS DOCUMENTS PRODUCED AND COPIED BY TAFT STETTINIUS (P010128 THROUGH P010779)
	DEFENDANTS DOCUMENTS PRODUCED AND COPIED BY TAFT STETTINIUS (P010780 THROUGH P011124) AND LE000897 THROUGH LE000904
	DEFENDANTS DOCUMENTS PRODUCED AND COPIED BY TAFT STETTINIUS (PW00001 THROUGH PW00950)
	DEFENDANTS DOCUMENTS PRODUCED AND COPIED BY TAFT STETTINIUS (PW00951 THROUGH PW01734)
BOX #72	DOCUMENTS PRODUCED - AMM00001 TO 00151
	CUNNINGHAM DOCUMENTS PRODUCED - DBL00001 TO 00340
	THIOKOL'S COPIES OF DBC CALENDARS -- NEVER REQUESTED DURING DEPOSITIONS. NOT PRODUCED (HOLD - RAS-8/16/94)
	DOCUMENTS PRODUCED - DLH00010
	DEFENDANT'S EXHIBITS 35 TO HIERMAN (CONSTRUCTION SPECIFICATIONS FOR SECURITY FENCE HAZARDOUS WASTE LANDFILL AT WOODBINE, GEORGIA PLANT)
	DOCUMENTS PRODUCED E&G 0001 TO 0501
BOX #73	DOCUMENTS PRODUCED - E&G 00502 TO 1055
	DOCUMENTS PRODUCED - E&G 1056 TO 1286
	DOCUMENTS PRODUCED - E&G 1287 TO 1615
	DOCUMENTS PRODUCED - E&G 1616 TO 1659
	DOCUMENTS PRODUCED - E&G 2-00001 TO 00532
	DOCUMENTS PRODUCED - E&G 2-00533 TO 00748
BOX #74	DOCUMENTS PRODUCED - ELK00001 TO 0776
	DOCUMENTS PRODUCED - ELK 2-00001 TO 00077
	DOCUMENTS PRODUCED - EPD 00001 TO 00095
	DOCUMENTS PRODUCED - EPD 00096 TO 00186
	DOCUMENTS PRODUCED - EPA 00001 TO 00149
	DOCUMENTS PRODUCED - JCB 00001 TO 00025
	DOCUMENTS PRODUCED - ANT 00001 TO 00219
	DOCUMENTS PRODUCED - JSB 00001 TO 00133
	DOCUMENTS PRODUCED - JSB 00134 TO 00760
BOX #75	DOCUMENTS PRODUCED - JSB 00761 TO 01419
	DOCUMENTS PRODUCED - JSB 01420 TO 01820
	DOCUMENTS PRODUCED - JSB 01821 TO 02197
	DOCUMENTS PRODUCED - JSB 02198 TO 02877
	DOCUMENTS PRODUCED JSB 02878 TO 03686
BOX #76	DOCUMENTS PRODUCED - JSB 03687 TO 04735
	DOCUMENTS PRODUCED - JSB 04736 TO 05804
	DOCUMENTS PRODUCED - JSB 05805 TO 06660
BOX #77	DOCUMENTS PRODUCED - JSB 06661 TO 07382
	DOCUMENTS PRODUCED - JSB 07383 TO 08161
	DOCUMENTS PRODUCED - JSB 08162 TO 08839
BOX #78	DOCUMENTS PRODUCED - JSB 08840 TO 09551
	DOCUMENTS PRODUCED - JSB 09552 TO 10431
	DOCUMENTS PRODUCED - JSB 10432 TO 11440

BOX #79	DOCUMENTS PRODUCED - RP 00001 - 00250
	DOCUMENTS PRODUCED - RP 00251 - 00634
	DOCUMENTS PRODUCED - RP 00635 - 00965
	DOCUMENTS PRODUCED - RP 00966 - 01265
	DOCUMENTS PRODUCED - RP 01266 - 01473
	DOCUMENTS PRODUCED - RP 01474 - 02036
	DOCUMENTS PRODUCED - RP 02037 - 02683
BOX #80	DOCUMENTS PRODUCED - RP 02684 - 03325
	DOCUMENTS PRODUCED - RP 03326 - 03641
	DOCUMENTS PRODUCED - RP 03642 - 04150
	DOCUMENTS PRODUCED - RP 04151 - 04689
	DOCUMENTS PRODUCED - RP 04690 - 05131
BOX #81	DOCUMENTS PRODUCED - RP 05132 - 05825
	DOCUMENTS PRODUCED - RP 05826 - 06222
	DOCUMENTS PRODUCED - RP 06223 - 06878
	DOCUMENTS PRODUCED - RP 06879 - 07223
	DOCUMENTS PRODUCED - RP 07224 - 07567
	DOCUMENTS PRODUCED - RP 07568 - 07854
BOX #82	DOCUMENTS PRODUCED - RP 07875 - 08432
	DOCUMENTS PRODUCED - RP 08433 - 08946
	DOCUMENTS PRODUCED - RP 08947 - 09530
	DOCUMENTS PRODUCED - RP 09531 - 10171
	DOCUMENTS PRODUCED - RP 10172 - 10919
BOX #83	DOCUMENTS PRODUCED - RP 10920 - 11592
	DOCUMENTS PRODUCED - RP 11593 - 12365
	DOCUMENTS PRODUCED - RP 12366 - 13611
	DOCUMENTS PRODUCED - RP 13612 - 14628
BOX #84	DOCUMENTS PRODUCED - RP 14629 - 15267
	DOCUMENTS PRODUCED - RP 15268 - 15627
	DOCUMENTS PRODUCED - RP 15628 - 16164
	DOCUMENTS PRODUCED - RP 16165 - 16875
BOX #85	DOCUMENTS PRODUCED - RP 16876 - 17692
	DOCUMENTS PRODUCED - P 00001 - 00406
	DOCUMENTS PRODUCED - P 00407 - 00706
	DOCUMENTS PRODUCED - P 00707 - 01105
	DOCUMENTS PRODUCED - P 01106 - 01515
	DOCUMENTS PRODUCED - P 01516 - 01848
BOX #86	DOCUMENTS PRODUCED - P 01849 - 02599
	DOCUMENTS PRODUCED - P 02600 - 03582
	DOCUMENTS PRODUCED - P 03583 - 04409
BOX #87	DOCUMENTS PRODUCED - P 04410 - 05383
	DOCUMENTS PRODUCED - P 05384 - 05518
	DOCUMENTS PRODUCED - P 05519 - 06055
	DOCUMENTS PRODUCED - P 06056 - 06725

BOX #88
DOCUMENTS PRODUCED - P 06726 - 07097
DOCUMENTS PRODUCED - P 07100 - 07230
DOCUMENTS PRODUCED - P 07231 - 07359
DOCUMENTS PRODUCED - P 07360 - 07896
DOCUMENTS PRODUCED - P 07897 - 08098
DOCUMENTS PRODUCED - P 08099 - 08532
DOCUMENTS PRODUCED - P 08533 - 09326

BOX #89
DOCUMENTS PRODUCED - P 09327 - 10104
DOCUMENTS PRODUCED - P 10105 - 10253
DOCUMENTS PRODUCED - P 10254 - 10467
DOCUMENTS PRODUCED - P 10468 - 11124
DOCUMENTS PRODUCED - P 11125 - 11176
DOCUMENTS PRODUCED - P 11177 - 11541

BOX #90
DOCUMENTS PRODUCED - P 11542 - 12006
DOCUMENTS PRODUCED - P 12007 - 12026
DOCUMENTS PRODUCED - PW 00001 - 00248
DOCUMENTS PRODUCED - PW 00249 - 00548
DOCUMENTS PRODUCED - PW 00549 - 00950
DOCUMENTS PRODUCED - PW 00951 - 01252
DOCUMENTS PRODUCED - PW 01253 - 01734

BOX #91
DOCUMENTS PRODUCED - PW 1735 - 2352
DOCUMENTS PRODUCED - PW 2353 - 2992
DOCUMENTS PRODUCED - PW 2993 - 3192
DOCUMENTS PRODUCED - PW 3193 - 3341
DOCUMENTS PRODUCED - PW 3342 - 3702
DOCUMENTS PRODUCED - PW 3703 - 3981

BOX #92
DOCUMENTS PRODUCED - PW 3982 - 4309
DOCUMENTS PRODUCED - PW 4310 - 4511
DOCUMENTS PRODUCED - PW 4512 - 5083
DOCUMENTS PRODUCED - PW 5084 - 5242
DOCUMENTS PRODUCED - PW 5243 - 5657
DOCUMENTS PRODUCED - PW 5658 - 5919
DOCUMENTS PRODUCED - PW 5920 - 6363

BOX #93
DOCUMENTS PRODUCED - PW 6364 - 6723
DOCUMENTS PRODUCED - PW 6724 - 7101
DOCUMENTS PRODUCED - PW 7102 - 7214
DOCUMENTS PRODUCED - PW 7255 - 7734
DOCUMENTS PRODUCED - PW 7735 - 8270
DOCUMENTS PRODUCED - PW 8271 - 8448

BOX #94
DOCUMENTS PRODUCED - PW 08449 - 09099
DOCUMENTS PRODUCED - PW 09100 - 09696
DOCUMENTS PRODUCED - PW 09697 - 10492
DOCUMENTS PRODUCED - PW 10493 - 10537A

BOX #95

DOCUMENTS PRODUCED - PW 10538 - 11005
DOCUMENTS PRODUCED - PW 11006 - 11401
DOCUMENTS PRODUCED - PW 11402 - 11724
DOCUMENTS PRODUCED - PW 11725 - 12483
DOCUMENTS PRODUCED - PW 12484 - 13245

BOX #96

DOCUMENTS PRODUCED - SAL 00001 - 00489
DOCUMENTS PRODUCED - SL 00000001 - 00000489
DOCUMENTS PRODUCED - SL 00490 - 00956
DOCUMENTS PRODUCED - TUC 000001 - 000185
DOCUMENTS PRODUCED - TUC 000185A - 000218 AND TUC 000548 - 000694
DOCUMENTS PRODUCED - TUC 000219 - 000548
DOCUMENTS PRODUCED - TUC 000695 - 000991
DOCUMENTS PRODUCED - TUC 000992 - 001151
DOCUMENTS PRODUCED - TUC 001152 - 001408

BOX #97

DOCUMENTS PRODUCED - TUC 001409 - 001743
DOCUMENTS PRODUCED - TUC 001744 - 001844
DOCUMENTS PRODUCED - TUC 001845 - 002339
DOCUMENTS PRODUCED - TUC 002341 - 002547
DOCUMENTS PRODUCED - TUC 002548 - 002551
DOCUMENTS PRODUCED - TUC 002552 - 002813
DOCUMENTS PRODUCED - TUC 002814 - 003200
DOCUMENTS PRODUCED - TUC 003201 - 003291
DOCUMENTS PRODUCED - TUC 003292 - 003466
DOCUMENTS PRODUCED - TUC 003467 - 003724
DOCUMENTS PRODUCED - TUC 003725 - 004056
DOCUMENTS PRODUCED - TUC 004057 - 004483
DOCUMENTS PRODUCED - TUC 004484 - 004609

BOX #98

DOCUMENTS PRODUCED - TUC 004610 - 005230
DOCUMENTS PRODUCED - TUC 005231 - 005975
DOCUMENTS PRODUCED - TUC 005976 - 006198
DOCUMENTS PRODUCED - TUC 006199 - 006213
DOCUMENTS PRODUCED - TUC 006214 - 006353
DOCUMENTS PRODUCED - TUC 006355 - 006660
DOCUMENTS PRODUCED - TUC 006661 - 006839
DOCUMENTS PRODUCED - TUC 006840 - 006992
DOCUMENTS PRODUCED - TUC 006993 - 007066
DOCUMENTS PRODUCED - TUC 007067 - 007425
DOCUMENTS PRODUCED - TUC 007426 - 007463
DOCUMENTS PRODUCED - TUC 007464 - 007556
DOCUMENTS PRODUCED - TUC 007557 - 007596
DOCUMENTS PRODUCED - TUC 007597 - 007643
DOCUMENTS PRODUCED - TUC 007644 - 007887
DOCUMENTS PRODUCED - TUC 007888 - 008110
DOCUMENTS PRODUCED - TUC 008111 - 008341
DOCUMENTS PRODUCED - TUC 008342 - 008435

BOX #99	DOCUMENTS PRODUCED - TUC 008436 - 008472
	DOCUMENTS PRODUCED - TUC 008473 - 008501
	DOCUMENTS PRODUCED - TUC 008502 - 008687
	DOCUMENTS PRODUCED - TUC 008688 - 008759
	DOCUMENTS PRODUCED - TUC 008761 - 009772
	DOCUMENTS PRODUCED - TUC 009773 - 010793
	DOCUMENTS PRODUCED - TUC 010794 - 011145
	DOCUMENTS PRODUCED - TUC 011146 - 012147
BOX #100	DOCUMENTS PRODUCED - TUC 012148 - 012509
	DOCUMENTS PRODUCED - TUC 012510 - 012890
	DOCUMENTS PRODUCED - TUC 012891 - 013538
	DOCUMENTS PRODUCED - TUC 013539 - 013743
	DOCUMENTS PRODUCED - TUC 013744 - 014354
	DOCUMENTS PRODUCED - TUC 014355 - 014918
	DOCUMENTS PRODUCED - TUC 014919 - 015502
	DOCUMENTS PRODUCED - TUC 015503 - 015832
BOX #101	DOCUMENTS PRODUCED - TUC 015833 - 016006
	DOCUMENTS PRODUCED - TUC 016007 - 016248
	DOCUMENTS PRODUCED - TUC 016249 - 016655
	DOCUMENTS PRODUCED - TUC 016656 - 016708
	DOCUMENTS PRODUCED - TUC 016709 - 016843
	DOCUMENTS PRODUCED - TUC 016844 - 017118
	DOCUMENTS PRODUCED - TUC 017119 - 017586
	DOCUMENTS PRODUCED - TUC 017587 - 018477
	DOCUMENTS PRODUCED - TUC 018478 - 018629
	DOCUMENTS PRODUCED - TUC 018630 - 018721
	DOCUMENTS PRODUCED - TUC 018722 - 019074
BOX #102	DOCUMENTS PRODUCED - TUC 019075 - 019350
	DOCUMENTS PRODUCED - TUC 019351 - 019533
	DOCUMENTS PRODUCED - TUC 019534 - 019734
	DOCUMENTS PRODUCED - TUC 019735 - 020064
	DOCUMENTS PRODUCED - TUC 020065 - 020447
	DOCUMENTS PRODUCED - TUC 020448 - 020681
	DOCUMENTS PRODUCED - BAC 00001 - 00091
	DOCUMENTS PRODUCED - WAL 00001 - 00323
	DOCUMENTS PRODUCED - LOW 00001 - 00350
BOX #103	INSURANCE DOCUMENTS PRODUCED
BOX #104	INSURANCE DOCUMENTS PRODUCED

BOX #105

EXHIBITS TO THE DEPOSITION OF STEPHEN A. LIND
CHRONOLOGY AND SUPPORTING DOCUMENTS FOR STATUTE OF LIMITATIONS ISSUE
MISCELLANEOUS COPIES OF DOCUMENTS RELATING TO DEFENDANT'S MOTION FOR SUMMARY JUDGMENT AND UNION CARBIDE'S MOTION FOR SUMMARY JUDGMENT
DOCUMENTS ERRONEOUSLY BATES-STAMPED

BOX #106

ALL VARIOUS DRAFTS

BOX #107

MISCELLANEOUS INFORMATION REGARDING PHOTOS
JOHN COFFIN
CORRESPONDENCE
INVOICE DETAILS TO SUBSTANTIATE EXPENDITURES AT WOODBINE
PRETRIAL ORDER FORM
E-MAIL (BLEICHER)
EXTRA SET OF LAW ENVIRONMENTAL DOCUMENTS (LE1411 - 2630)
UNION CARBIDE'S MEDIATION STATEMENT

BOX #108

DEPOSITION OF JAMES S. BERRY, JR.
DEPOSITION OF JAMES R. STANLEY
DEPOSITION OF BRUCE D. FITZGERALD
DEPOSITION OF STEPHEN A. LIND
EXHIBITS TO DEPOSITION OF STEPHEN A. LIND

BOX #109

MEDIATION STATEMENTS: JUDGE ALAIMO
DRAFTS - MEDIATION STATEMENT
RAS COPIES OF MEDIATION STATEMENTS SUBMITTED TO JUDGE INGRAM
UNION CARBIDE'S MEDIATION STATEMENT

BOX #110

LAW ENVIRONMENTAL DOCUMENTS LE02544 - LE02630
LAW ENVIRONMENTAL DOCUMENTS LE02631 - LE02992
LAW ENVIRONMENTAL DOCUMENTS LE02993 - LE03471
DOCUMENTS AT001 - AT051

BOX #111

LAW ENVIRONMENTAL DOCUMENTS LE00001 - LE00317
LAW ENVIRONMENTAL DOCUMENTS LE00318 - LE00645
LAW ENVIRONMENTAL DOCUMENTS LE00647 - LE00917
LAW ENVIRONMENTAL DOCUMENTS LE01107 - LE01410
LAW ENVIRONMENTAL DOCUMENTS LE01411 - LE02017
LAW ENVIRONMENTAL DOCUMENTS LE02018 - LE02543

BOX #112 ~~[PULLED - NOT BEING~~ **SENT OFF-SITE**]

RESEARCH - I. RESPONSE COSTS/107(a)
RESEARCH - II. CONTRIBUTION/113(f)(1)
RESEARCH - III. STATE LAW CLAIMS
NATIONAL CONTINGENCY PLAN (NCP)

BOX #113

SOUTHERN DISTRICT LOCAL RULES
LEGAL MEMORANDUM
MEMORANDUM
EXTRA COPIES OF DOCUMENTS
RESEARCH - KIM BURKE
EPA DOCUMENT INDEX
SUBJECT BINDER - EPD CORRESPONDENCE
SUBJECT BINDER - ENVIRONMENTAL AUDITS
SUBJECT BINDER - PUBLIC NOTICES
SUBJECT BINDER - MAPS
SUBJECT BINDER - BUTLER NCP RESPONSE COST SUMMARY
SUBJECT BINDER - CLOSURE REPORTS
SUBJECT BINDER - LANDFILL
SUBJECT BINDER - GROUNDWATER REPORTS
SUBJECT BINDER - LAW ENVIRONMENTAL REPORTS

BOX #114

SUBJECT BINDER - INVOICES/COSTS, VOLUME I
SUBJECT BINDER - INVOICES/COSTS, VOLUME II
SUBJECT BINDER - SMWUs
SUBJECT BINDER - MEETINGS
SUBJECT BINDER - NEWS CLIPPINGS
SUBJECT BINDER - SAVANNAH LABORATORIES WELLS SAMPLES REPORTS
SUBJECT BINDER - EPD PERMITS
SUBJECT BINDER - EPD/EPA RULES AND REGULATIONS
SUBJECT BINDER - GROUNDWATER ASSESSMENT (MONITORING WELLS)
SUBJECT BINDER - MIC/METHYL ISOCYANATE/BHOPHAL
SUBJECT BINDER - DICHLOROMETHANE/ACETONE
SUBJECT BINDER - CS/TEAR GAS/O-CHLOROBENZYLIDENE MALONONITRITE (LE2018 - 2106)
SUBJECT BINDER - O-CHLORO/MALON/CS
SUBJECT BINDER - PYROTECHNIC ORDINANCE
SUBJECT BINDER - ALDICARB (LE2107 - 2543)
SUBJECT BINDER - THIOKOL PRODUCTS
SUBJECT BINDER - UC/RP LIABILITY ISSUE
SUBJECT BINDER - TEMIK ALDICARB, VOLUME I
SUBJECT BINDER - TEMIK ALDICARB, VOLUME II

BOX 115

Plaintiff's Mediation Statement (January 28, 1994)
Plaintiff's Mediation Statement (March 29, 1994)
Exhibits to Thiokol's Position Paper (January 28, 1994)
Position Paper of Defendants with Exhibits (March 29, 1994)

BOX 116

Min-u-script Depositions Volumes I through IV

BOX 117

Case Law Binders Volumes I through III

BOX 118

RCRA Facility Investigation Report (February 5, 1993) (P12027 to P12503)
RCRA Facility Investigation Report (March, 1992) (Not Bates Numbered)
Thiokol's Response Costs/Damages

BOX 119

Documents organized for the Deposition of Aetna

BOX 120

Mediation Caselaw Notebook
Caselaw Notebook - Defendants' Motion for Summary Judgment Volumes I and II

BOX 121

Original Documents filed with Court
Drafts of Pre-Trial Order
Index to Law Environmental Files
Thiokol Demonstrative Exhibits at Summary Judgment Hearing
Thiokol Exhibit re: Construction of Closure Timeline
Indemnity Under Toll Processing Agreement (I. Stanley)
Transcript - Hearing on Motion for Summary Judgement
Disks - Depositions

BOX 122 (ALSO SEE BOX 126)

Cunningham Witness File

BOX 123

Robins Witness File (ALSO SEE BOX 131)
Frank Parker Witness File
Moyer Witness File (ALSO SEE BOX 124)

BOX 124

Moyer Witness File (ALSO SEE BOX 123)
McReynolds Witness File
McClain Witness File (ALSO SEE BOX 133)
Midyett Witness File
Van Long Witness File

BOX 125

Buchanan Witness File
Coffin Witness File
Contractors Witness File

BOX 126

Cunningham Witness File
Hortman Witness File

BOX 127

Aetna Witness File
Berry Witness File
Baker Witness File

BOX 128

Fitzgerald Witness File
Davis/Roeper/Thompson Witness File
Davis/Roeper/Thompson Witness File

BOX 129

Van Long Witness File
Lind Witness File
Hierman Witness File
Kraft Witness File

BOX 130

Kitrell Witness File
Wilkes Witness File
Collier Witness File

BOX 131

Bruce Key Witness File
Robbins Witness File (ALSO SEE BOX 123)
Greg Roush Witness File

BOX 132

Aquatic Environmental Sciences (AES) Witness File
Mundy Witness File
Walker Horn Witness File
Price Witness File
Dennis Sisk Working File

BOX 133

Bruce Fitzgerald Witness File
Augustince CelAya Witness File
Collier Witness File
Art McClain Witness File (ALSO SEE BOX 124)
Ford Witness File
Wallace Witness File

BOX 134

Skiermont Witness File
Expert Witness Research File (Hart/Smith/Stout)
Fred Smith Witness File

BOX 135

Hart Witness File

BOX 136

Butler Witness File

BOX 137

Wallace Witness File
Stout Witness File

BOX 138

Bertrand A. Chiasson Witness File
William Lowenbach Witness File (ALSO SEE BOX 139)

BOX 139

John Berry Deposition
William Lowenback Witness File (ALSO SEE BOX 138)

BOX 140

Union Carbide's Mediation Statement
Position Paper of Defendant's and Third-Party Plaintiffs Thiokol Corporation, Morton International and Morton Thiokol, Inc. (CAP copy)
Union Carbide's Motion for Partial Summary Judgment, Statement of Material Facts as to Which There is no Genuine Dispute, Memorandum of Law in Support of Motion for Partial Summary Judgment, Affidavit of James S. Berry, Jr., and Affidavit of Arthur M. McClain (CAP copy)
Working Files - Alane Gray
Outside Counsel Guide

BOX 141

CLIENT DOCUMENTS -
Schedules to Union Carbide/Rhone-Poulenc Stock Purchase Agreement
Settlement Agreement Between Union Carbide & Rhone-Poulenc
Raw Materials Used at Woodbine
Important Document file (Documents selected early in case)
Documents received from Gerry Klein on 5/20/93
- Closure of Landfill
- Amendment to Toll Conversion Agreement
- Sale from Thiokol to Union Carbide
- Toll Conversion Agreement
- Note Agreement between Thiokol and Travelers
- Labor Relations
- Chemical Disclosure Agreements
- Agreement between Thiokol and Int. Chemical Workers Union

BOX 142

CLIENT DOCUMENTS -
1986 Union Carbide/Rhone Poulenc Deal "Project Sunrise"
Draft Settlement Agreement
Draft Settlement Agreement sent to client
Settlement Agreement and Releases (fully executed)
Mediation Research (File folder is empty)
Mediation - Correspondence
Mediator Selection File
Mediation - Memorandum (E-mails and Memoranda)
Mediation - Index to Plaintiffs' Mediation Statement
Attorney Notes
Forms from Local Counsel
Conflicts
Local Counsel
Original Discovery

BOX 143

Attorney Notes
Forms from Local Counsel
Conflicts
Local Counsel
Original Discovery
Union Carbide/Rhone Poulenc
- Correpondence Volume I
- Memorandum
- Client Documents
- Drafts

Correspondence Files Volumes I through V

BOX 144

Correspondence Files Volumes VI through X

BOX 145

Correspondence Files Volume XI through XVI

BOX 146

Discovery/Production Correspondence
Discovery/Production Invoices
Invoices
Court Reporter Letters
Litigation Plan & Budget
Hunton & Williams Fees
Draft Voir Dire Questions
E-Mails/Notes
Response Costs/Remediation
Draft Phase II RFI Workplan
Twelfth Semi-Annual Groundwater Monitoring Report
Key Documents Produced by Thiokol

BOX 147

ORIGINAL DEPOSITIONS
- Fred C. Hart
- Robert E. Davis
- Bruce Key
- Kristen K. Stout
- Ralph Newell Thompson
- Albert Peter Roeper

BOX 148

ORIGINAL DEPOSITIONS
- Frank Parker
- Bruce E. Wilkes
- Original Exhibit 3 to Greg Roush Deposition

BOX 149

Pleadings Volume I through III
Union Carbide's Statement of Material Facts As to Which There is No Genuine Dispute

BOX 150

Pleadings Volume IV through VII

BOX 151

Issue Notebooks prepared by Paul Bleicher
- Statute of Limitation
- Law Environmental Reports
- Audit Reports
- Carbide - RP Agreement
- Miscellaneous

BOX 152

Discovery Production - Privilege Logs & Indexes
Privileged/Confidential Documents (copies)
Application for Permit Modification
Report for Alternative Concentration Limit Study

BOX 153

Privileged/Confidential Documents

BOX 154

Copies of Dave Cunningham files

BOX 155

Copies of Dave Cunningham files

BOX 156

Notebooks:

Union Carbide/RP Depositions/3 Volumes
(Andrews - Chiasson)
(Collier - Kittrell)
(Kraft - Wallingford)

Local Rules and Scheduling Orders

BOX 157

Notebooks:

Thiokol Depositions
Thiokol Expert Witnesses
Union Carbide Corporation Litigation Plan and Budget

BOX 158

Notebooks:

Settlement Correspondence
Volume I
Volume II

Miscellaneous Research
Research - Discovery Abuse Sanctions - Judge Alaimo
Research Memo - Defenses, etc.
Info Americall Corporate Records
Additional Mediation Research

BOX 159

Notebooks:

Mundy (EPD), Elkins, Ellis & Gross, Posey

RAS Working Copy
Complaint
Amended Complaint
Answer & Counterclaim
Response to Counterclaim and documents refereced therein

Key & Soisson - Contract Issue

1976 Purchase Agreement

BOX 160

Notebooks:

Discovery 5/93-4/94
Discovery 5/94-7/94
Discovery August 1994
Discovery 9/94 - 1/95

BOX 161

Carbide Research
Costs/Other
Chronologies
Norton Memorandum
Summary Judgment
Triangle Labs/Mitchum
Chemistry
Objections
EPD
Woodbine Site
Privilege Issue
Privilege Issue (Edited)
Privileged Documents (Pulled)
Documents Received from G. Klein May 20, 1993
Response/Cost Summary
SWMU Maps

BOX 162

RAS Working Copies of Motion for Summary Judgment
Summary Judgment Order/Agreements/Motions
Voir Dire
Pre-Trial Order
Butler/Allocation
Costs/Allocation
McClain/EDP/NCP
Thiokol Motion to Strike, Opposition to Carbide and RP Motion for Summary Judgment, and Supplemental Evidence

Appendix C
Table 3. Hunton Williams Files

DATE	*TITLE*/AUTHOR	BATES NO.	NOTES
No date	*RCRA Facility Investigation Plan/*no Author	LE00527 - LE00538	Description of "pre-RCRA" waste units (SWMUs 1-7), attached map, based on employee interviews - no documentation found. Notes nearly identical to 8/1/86 tech memo with "Alleged CERCLA Sites" and RCRA Permit application "Pre-RCRA"sites
8/12/1983	*Business Confidential - August 12, 1983 DRAFT/* "DTM"	P01646 - P01658	Notes of site visit (possibly to inspect hazardous waste areas?) - incinerators, loop road storage, Spray fields, rocket test area,
8/25/1986	*Memo - Map of Pre-RCRA disposal sites/*Dick Faber	PW03031 - PW03032	Lists 22 units - appears to correlate to 8/1/86 tech memo with "Alleged CERCLA Sites" , although 1 additional site is listed
8/12/1988	*RCRA FACILITY ASSESSMENT/*Union Carbide Corporation	P03923- P03953	9 SWMUs discussed, 7 "warrant further investigation"
4/24/1992	*Memo - Woodbine Property Cleanup/*Union Carbide Corporation	P04694 - P04697	Attaches SOW for SWMU debirs removal,
6/23/1993	*Weekly Report of Removal Activities/*Law Engineering	P04613 - P04616	Describes 5/93 removal activities - debris removed from SWMUs 3-7, describes ordnance found at SWMU 3 and SWMU 7 and states that it remains onsite,
6/28/1993	*Woodbine, GA/*Union Carbide Corporation	P04612	Mention of subsurface drums discovered at SWMU 6 and Ordinance at SWMU 7 requiring additional work and increasing costs.
8/3/1976	*Special Hazards at the Georgia Plant/*J.P. Coffin/Thiokol	TUC 015764	discussion of burning and burying of explosives - area not defined.
6/6/1979	*Waste Disposal Site Survey Forms/*UCC	PW08260 - PW08264	Lists Hazardous Waste Disposal sites - descriptions of locations
3/24/1976	*Loss Control Report/*Aetna	TUC002379 - TUC002383	At time of inspection, only 3 products manufactured - TEMIK, Cobex and Silicone caulking material
No date	*Georgia Division White Paper*/No Author	TUC004686 - TUC004687	Status update after 2/3/71 accident, "Major Programs" listed include: 81MM, Trip Flare, 40MM Rework, XM15, Temik
No date	*Thiokol Corporation - Georgia Division - History and Background/*No Author	TUC 003512	Details historical operations for Thiokol's history
~1974		TUC 001748 - TUC 001844	Proposal to US Borax for COBEX toll production. Provides brief history of Thiokol manufacturing
No date	No Title	PW03330 - PW03337	Hand notes of figure showing disposal time frames and contents

Appendix C
Table 3. Hunton Williams Files

DATE	*TITLE*/ AUTHOR	BATES NO.	NOTES
No date	*Past Response costs* /Union Carbide	LE000897 - LE000904	Figures depicting UCC response costs by SWMU
No date	*Plot Plan* / Union Carbide	PW03339	Figure depicting SWMU
No date	*Site Plan*/ Law Environmental	LE00747	Figure depicting SWMU
12/18/1991	*SWMU 18*/ Missimer and Associates	RP03870	CS surface disposal - appears to be BCS property

Appendix C
Table 4. CH2M HILL Files

DATE	*TITLE*/ AUTHOR	NOTES
Aug-86	*Woodbine Plant Alleged CERCLA Sites/Union Carbide Corporation*	Identifies potential SWMUs
Jun-92	*Woodbine Pre-RFI Debris Removal*/Union Carbide Corporation	Describes completed pre-RFI surface debris removal
Aug-92	*Workplan for Surface Debris and Removal SWMU 3, 5, 6 and 7*/Law	Describes proposed surface debris removal
Nov-92	*After Action Report for the Surface UXO/OEW and Ordnance Debris Removal*/EOD	Describes EOD support to initial RFI activities including removals at SWMU 3 and 7
Feb-93	*RCRA Facility Investigation Report*/Law	Describes SWMUs, and investigation results
Jul-93	*Proposal for Geophysical Survey and Buried Waste Removal SWMU #6 and #7*/LAW	Not reviewed for this RFA
10/1/1993	*Report of Surface Debris Removal and Disposal*/Law	Describes removal actions at SWMUs 3, 5, 6 and 7
7/29/1994	*Aerial Photographic Analysis Woodbine Plant, Camden County, Georgia*/Environmental Research, Inc.	Photo analysis
9/18/1996	*After Action Report for the Surface UXO/OEW and Ordnance Debris Removal/EOD*	Describes EOD support to Phase II RFI activities including removals at SWMU 3 and 7
9/20/1996	*Report of the Phase II RFI*/Apex	Describes Phase II investigation and removal activities
6/12/1997	*Addendum to the Report of the Phase II RFI*	Additional investigation activities.
10/29/1998	*Addendum to the Phase II RFI Report/Apex*	Describes additional Phase II investigation activities in response to GA EPD comment
2/15/1999	*Screening Level Risk Assessment in Support of Risk-Based Closure of SWMUs 2,3 and 5*/QST Environmental	Justifies risk based closure at SWMUs 2,3 and 5. Provides background, data, etc and compares to residential criteria.
7/10/2000	*Baseline Risk Assessment for SWMUs 4 and 6*/Environmental Science and Engineering	Justifies risk based closure at SWMUs 4 and 6. Provides background, data, etc and compares to residential criteria. Does not mention removal at SWMU 6
11/2/2000	*Baseline Risk Assessment for SWMUs 7*/Environmental Science and Engineering	Verifies additional soil removal - justifies risk based closure at SWMU 7.

APPENDIX D

After Action Report for 40-mm HE Disposal

After Action Report

After Action Report, Open Detonation and Disposal at the Union Carbide Corporation - Woodbine Property

Prepared for CH2M HILL

Prepared by:

USA Environmental, Inc

Tampa, FL

May 21, 2007

CH2M HILL
Mr. William M. Waldron, P.E.
3125 Poplarwood Court, Suite 304
Raleigh, NC 27604

Subject: After Action Report, Open Detonation and Disposal at the Union Carbide Corporation (UCC) - Woodbine Property

Dear Mr. Waldron

On May 9th, 2007, USA Environmental, Inc. (USA) completed the open detonation and disposal of two 40mm M406 Grenades located on the UCC Woodbine Property. The following paragraphs describe the sequence of events and the actions taken.

Introduction:

USA was contracted to dispose of two 40 mm high explosive M series projected grenades (M406). The two grenades were located on property owned or otherwise possessed by the Union Carbide Corporation (UCC) located in Camden County, Woodbine Georgia. See enclosed figures 1 & 2.

Mobilization:

Prior to project mobilization USA submitted a Work Plan on May 2nd, 2007, detailing the MEC support services; the completed work plan was approved by CH2M HILL on May 4th, 2007.

The USA Team, consisting of UXO qualified personnel (one Senior UXO Supervisor (SUXOS), one UXO Technician III and one UXO Technician II) mobilized to Jacksonville, FL on May 8th, 2007. Prior to mobilization all personnel were drug screened. All drug screen results were reported as negative.

Training:

Prior to transporting to the project site, on May 8th, 2007 the USA project team completed the mandated CH2M HILL Woodbine Property Safety training and administrative requirements. The following day (May 9th, 2007), prior to the commencement of open detonation operations, the USA project team completed the mandated Woodbine Plant Safety and Awareness Training, and the UCC Site Specific Safety Training. Additionally, all personnel that entered the site inclusive of vendor delivery personnel were required to attend the Woodbine Plant Safety and Awareness Training.

Personnel:

Table 1 identifies the personnel on site during this event.

TABLE 1: PERSONNEL ON-SITE

Name	Phone Number	Organization	Role
Mr. Bill Waldron	919-875-4311	CH2M HILL	Project Manager
Mr. Ben Redmond	865-483-9032	CH2M HILL	Corporate Observer
Mr. Dan Young	251-962-2963	CH2M HILL	UXOSO
Mr. Keith Ogden	919-875-4311	CH2M HILL	Site Manager
Mr. Dan Miller	813-343-6336	USA	Senior UXO Supervisor
Mr. George Edwards	813-343-6336	USA	UXO Technician III
Mr. Randall Jenkins	813-343-6336	USA	UXO Technician II
Mr. Milton Lynn	912-729-9367	Aerostar	Site Operations
Mr. Billy Hendricks	404-656-2833	Georgia EPD	Regulatory Observer

Open Detonation (OD) Operations:

Equipment checks were completed and safety briefings performed prior to the start of field activities. Both the Tailgate safety Briefing, Demolition Safety Briefing and Standard Operating Procedures review,

were performed. The Demolition Safety Briefing further identified the roles each person played during this event. The Tailgate Safety Briefing and Demolition Safety Briefing are provided as enclosures to this letter.

The project team arrived at the demolition site at approximately 8:50am[1]. Due to the past history of the project site/demolition area with regards to the testing of 40mm projected grenades, an instrument assisted surface sweep of an Ingress and Egress route was established from the safe area to the demolition area for operational foot traffic and in the event of an emergency.

The explosives donor charges and initiating devices were delivered by Dyno Nobel at approximately 11:00 am. Table 1 shows the explosive materials that were delivered to support this effort.

Demolition set-up commenced at 11:30 am. First open detonation event occurred at 12:20 pm. A second open detonation event (clean up detonation) occurred at 1:10pm. All explosive material listed in Table 2 were certified as consumed by the USA UXO Team Leader. Explosive Usage report was reviewed and accepted by the SUXOS.

A general clean up of the area was performed prior to demobilizing from the project site at 2:40pm. At that time the project team and all personnel departed the area.

TABLE 2: EXPLOSIVE MATERIALS DELIVERED & EXPENDED

Material Description	Qty	Units
Trojan 450G 36/CS (1lb PETN Boosters)	3	3
NONEL Starter 500 Ft.	2	2
NONEL MS500 100 Ft. Detonator Assy.	6	6

Demobilization:

All USA Environmental personnel and equipment were demobilized from the project site on May 9th, 2007.

Summary:

USA Environmental, Inc. safely, efficiently, and successfully completed all contract requirements without incident or any accidents and looks forward to future opportunities with CH2M HILL.

Sincerely,

Richard Hanoski
Director of MEC Operations
USA Environmental, Inc.

Enclosures:
Enclosure 1: Figures 1 & 2 (Maps)
Enclosure 2: Tailgate Safety Briefing/Demolition Safety Briefing
Enclosure 3: USA Explosive Usage Report
Enclosure 4: Dyno Nobel Bill of Lading

[1] All times are approximate.

Imagery NAIP 2005

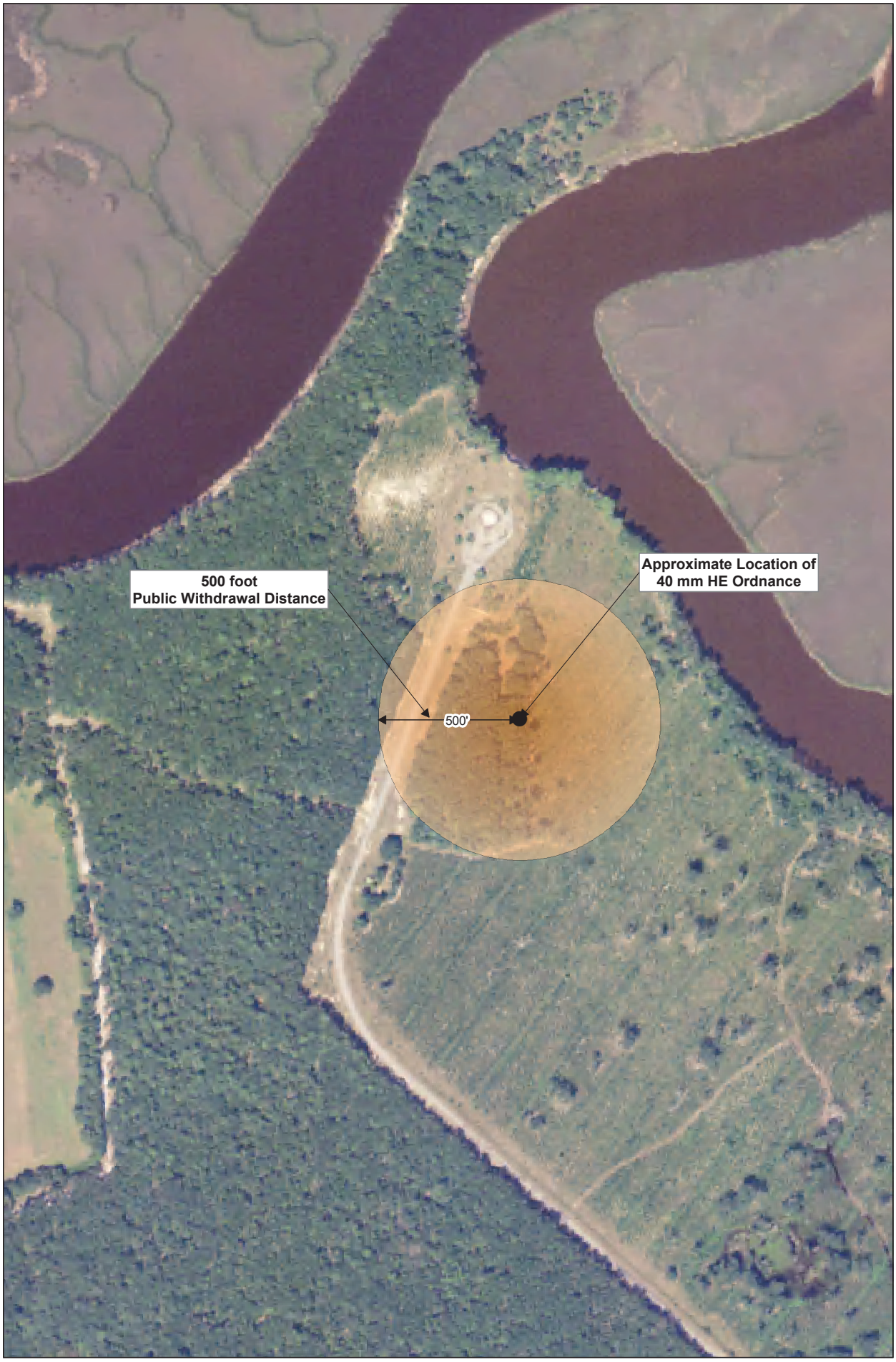
N
W E
S

500 0 500 1,000 Feet

CH2MHILL

UCC - Woodbine, Georgia

\\boomer\H\Projects3\DOW_Woodbine\mxd\NewAerial.mxd JKelly 4/25/2007



Imagery NAIP 2005

500 0 500
Feet

Approximate Location of 40mm HE Ordnance

UCC - Woodbine, Georgia

CH2MHILL

\\boomer\H\Projects3\DOW_Woodbine\mxd\NewAerial_SWMU3.mxd JKelly 5/7/2007

USA Environmental, Inc.

Tailgate Safety Briefing

Date: 5-09-2007 **Location:** UCC Woodbine, GA

Time: 0815 ☒ AM ☐ PM **Team #:** Demolition

1. Reason for Briefing:

✓	Daily Safety Briefing		New Site Procedure
✓	Initial Safety Briefing		New Site Information
	New Task Briefing		Review of Site Information
	Periodic Safety Meeting		Other: (Specify)

2. Personnel Attending:

Name	Signature	Position
George Edwards		UXO Tech III
Randall Jenkins		UXO Tech II

Briefing Given By:

Name	Signature	Position
Daniel Miller		SUXOS

3. Topics: (Check All That Apply)

	Site Safety Personnel	✓	Decontamination Procedures
✓	Site/Work Area Description		Emergency Response/Equipment
✓	Physical Hazards	✓	On-Site Injuries/Illnesses
	Chemical/Biological Hazards		Reporting Procedures
✓	Heat/Cold Stress	✓	Directions to Medical Facility
	Work/Support Zones		Drug and Alcohol Policies
✓	PPE		Medical Monitoring
	Safe Work Practices		Evacuation/Egress Procedures
	Air Monitoring	✓	Communications
	Task Training		Confined Spaces
✓	OE Precautions		Other: (Specify)

4. Remarks:

USA Environmental, Inc.	
Demo Safety Brief	
Date: 5 / 09 / 2007	**Location:** UCC Woodbine, GA Demo Site
Time: 1020 (AM) PM	**Team #:**

Demo Team Assignments:	
Team Leader	George Edwards UXO Tech III
UXO Tech	Randall Jenkins UXO Tech II
UXO Tech	Daniel Miller SUXOS
UXO Safety	Dan Young UXOSO
Perimeter Safety	Bill Waldron
Perimeter Safety	Kieth Ogden
Perimeter Safety	Milton Lyman

Safety Brief		
General:		Phases of operation
✓ Notifications Made		Shot Preparations
✓ Communications Channel 2		UXO/MEC Involved 40 mm M406
✓ Explosive handling/precautions		(BIP) or De-Mil
Caps 50' downwind from explosives		Placement and quantity of charge 1 lb
No radio or cell phone within 20 ft		Donor Explosives
Emergency notification procedures \		Priming
Site specific characteristics		Unnecessary Personnel
Location of safe area		Clear area
Location of vehicle		Request Permission
Location of 1st aid/fire extinguisher		Firing
Wind direction		Prepare Initiator
Personal hygiene		Request Permission
Two man rule		Warning on Radio
Potential trip/fall hazards		Sound 3 3-second Blasts on Vehicle Horn
Post-detonation clean up of site		Sound 3 Verbal "Fire in The Hole"
Other:		When given Permission, Fire Shot
		Clear Shot (Wait 5 Min.)
		Team Leader - Investigate
		Safety – Stand-by at Safe Distance

Misfire procedures: NonEl Firing Systems

Step 1. If the shock tube fails to propagate remove the shock tube from the firing device, cut off six inches of the shock tube, insert a new primer, re-insert the shock tube ensuring that it is properly seated and re-fire. If when you activate the firing device and the shock tube gets blown out of the firing device without activating, cut off six inches of the shock tube, replace the primer and re-insert the shock tube into the firing device.

Step 2. If the primer functioned properly and the shock tube was heard and/or seen to fire, observe the standard one-hour waiting period prior to going downrange.

Step 3. After the one-hour waiting period has passed, proceed downrange and check the first component in the priming train, i.e. splice, bunch block or detonator assembly. Repeat this process till you reach the detonator assembly. As you conduct this inspection and discover the problem, replace the firing train, which malfunctioned with a new one and ensure that all the connections are correct and secure.

Step 4. After the system has been checked and repaired/replaced return to the firing point and repeat the firing process.

EXPLOSIVE USAGE RECORD

Contract Number: 2018-451

Team Number: Demolition Date: 9 May 2007 Project Name: CH2M Hill-UCC Woodbine, GA

Team Leader: George Edwards Work area/Grid Number: Former 40mm Grenade Range

EXPLOSIVES	LOT NUMBER	QUANTITIES						Signatures	
		Issued	Initials	Used	Initials	Returned	Initials	Team Leader	Checker
BOOSTER TROJAN STARTAN, PETN 1 LB.	29MA07J3	3 EA.	[signature]	3 EA.	[signature]	Ø	[signature]	[signature]	[signature]
NONEL STARTER 500FT 8/CS	12MA07W1	2 EA	[signature]	2 EA.	[signature]	Ø	[signature]	[signature]	[signature]
NONEL MS500 100FT 40/CS	22MY06W1	6 EA	[signature]	6 EA	[signature]	Ø	[signature]	[signature]	[signature]

Reviewed and Accepted: [signature] DANIEL MILLER USAE **Date:** 9 MAY 2007

Senior UXO Supervisor

STRAIGHT BILL OF LADING — Non-Negotiable

PURCHASE ORDER NUMBER

na

ORDER NUMBER

CUSTOMER NUMBER

4799

Ship Date

05/09/2007

05/09/2007

SOLD TO

USA ENVIRONMENTAL, INC.
3902 BENJAMIN CENTER DRIVE #101
TAMPA FL 33634

SHIP TO

USA ENVIRONMENTAL, INC.
UNION CARBIDE CORP. (ACC) WOODBINESEW032308
5854 HARRIETTS BLUFF ROAD
WOODBINE GA 31569

DYNO
Dyno Nobel

DYNO NOBEL INC.
110 MCLARTY ROAD
WHITESBURG GA 30185
1-GA-045-20-GK-00136

PROPER SHIPPING NAME					Hazard Class	UN Number	PKG Group	DOT EXEMPTION	Shipment Information		
Qty Returned	UOM	Qty Used	Item Number	Item Description					Batch Number	UOM	Quantity
ROOSTERS				1.1D UN 0042 II NEC: 2.98 lbs						EA	3
	EA		SP0450	TROJAN. SPARTAN 450G 36/CS					29HA07J3	EA	9
DETONATOR ASSEMBLIES, NON-ELECTRIC				1.4B UN 0361 II NEC: 0.01 lbs						EA	8
	EA		DA146N0	NONEL.MS500 100FT/30M 40/CS 1.4					22HY06W1	EA	6
	EA		DJ00500	NONEL.STARTER 500FT/152M 8/CS 1					12HA07W1	EA	2
	EA		NS903	DELIVERY CHARGE $700.00						EA	1
				BLASTING PER TON LMS							
				MILEAGE ROUND TRIP							
				SHOT HOURS							
				MAN HOURS PER DELIVERY							
				LMS PARENT ITEM-THANK-YOU							

Shipping Instructions :

NEC TOTAL: 2.99 lbs

BATF LICENSE NUMBER

SHOT SERVICE

205-681-1999

This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

Shipper:

Buyer assumes all risk and liabilities for results obtained by the use of the materials covered by this order. Buyer acknowledges that there may be Federal and State laws regulating the use and/or possession of the materials covered by this order and buyer assumes full responsibility for compliance with said laws.

Receiver:

Received the above described items in good condition except as noted.

Daniel Miller MSHE

Truck/Trailer Number	Driver

FOR CHEMICAL EMERGENCY Spill, Leak, Fire, Exposure or Accident **CALL CHEMTREC** DAY OR NIGHT **800-424-9300**

ADDITIONAL TERMS AND CONDITIONS ON REVERSE SIDE
CUSTOMER