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TEXTRON Lycoming

Williamsport Plant
Textron Lycoming/
Subsidiary of Textron Inc.

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Williamsport, PA 17701
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May 2, 1989

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Mr. Eugene Dennis (3HW17)
Remedial Project Manager
SARA Special Sites Section
U. S. Environmental Protection Agency
841 Chestnut Building
Philadelphia, Pa 19107

Dear Mr. Dennis:

Please find enclosed the revised Work Plan for the Remedial Investigation / Feasibility Study as required by the Consent Agreement and Order between the United States Environmental Protection Agency (EPA) and Avco Corporation (Textron Lycoming Williamsport). The revision incorporates response to comments by EPA both prior to and subsequent to the 8 February, 1989 meeting between Textron Lycoming and EPA.

Also to comply with your request, this revised work plan constitutes the SAP (Sampling and Analysis Plan) which includes the site-specific Health and Safety Plan and the Quality Assurance Project Plan (QAPP).

We trust that this document will satisfy your requirements. However, if I can be of assistance or provide clarification, please contact me at 717-327-7343.

Yours very truly,

Lee Trefsger

Lee H. Trefsger
Environmental Engineer

LHT:sl

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REMEDIAL INVESTIGATION FEASIBILITY STUDY WORK PLAN FOR TEXTRON LYCOMING WILLIAMSPORT DIVISION PLANT WILLIAMSPORT, PENNSYLVANIA

23 September 1988

Revision Date:
1 May 1989

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SECTION 1

INTRODUCTION

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In response to the Administrative Consent Order (ACO) executed 27 June 1988 between the United States Environmental Protection Agency (EPA) and Textron Lycoming, Environmental Resources Management, Inc. (ERM), is submitting this Remedial Investigation/Feasibility Study (RI/FS) Work Plan to EPA on behalf of Textron Lycoming for their Williamsport, Pennsylvania, facility.

This final Draft Work Plan presents a summary of the existing environmental data, the proposed technical scope of work, and a schedule for conducting the RI/FS. Incorporated into this document are the EPA's comments on the September 1988 Remedial Investigation Feasibility Study Work Plan. The EPA's comments are documented in two letters sent to Textron on 28 December 1988 and 9 January 1989. The comments were reviewed and discussed with EPA, and the results of these discussions are included in the revisions made to this document. Time was also allotted by EPA to receive comments from the Pennsylvania Department of Environmental Resources (PADER). Since the PADER did not formally submit any comments, Textron was verbally notified on 3 April 1989 by EPA to finalize this document based on EPA's comments. The incorporation of these comments and the addition of both the site specific Health and Safety Plan and the Quality Assurance Project Plan, should qualify this document to be used as the Textron Lycoming Williamsport Plant Sampling and Analysis Plan (SAP).

The RI/FS work proposed is based upon the findings of the investigations already completed at the Textron facility, including results from the ongoing ground water monitoring, and

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evaluation of the active on-site and off-site ground water recovery/treatment systems. These activities were initiated in response to requirements of the PADER.

The proposed RI/FS efforts augment the work done previously and focus on collecting additional information to:

- define possible source areas
- define present and future health and environmental risks
- evaluate potential remedial alternatives that may enhance and speed up presently active remediation efforts and
- collect additional data to comply with the requirements of the National Contingency Plan (NCP).

The proposed RI activities will be performed as a single phase effort and are scheduled as such.

This Work Plan/SAP is organized into six sections. This Section (1) is the introduction. Section 2, Summary of Existing Data, presents an overview of the site with respect to available data compiled from previous investigations. Section 3 presents the RI/FS objectives and the results of the Preliminary Endangerment Assessment/ Feasibility Study work conducted to help plan the remedial investigation. Section 4 describes the task plan for the remedial investigation and provides the rationale for the proposed work. The task plan for the feasibility study is outlined in Sections 5. Section 6 presents the project organization, reporting and scheduling of ACO tasks.

The Quality Assurance Project Plan (QAPP) and the Health and Safety Plan are presented in Appendix D and E respectively.

SECTION 2

SUMMARY OF EXISTING DATA

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2.1 Regulatory Framework

Ground water investigations and remediation previously completed by Textron Lycoming are regulated by conditions in the Consent Order and Agreement (COA) executed on 25 November 1985 between Textron Lycoming and Pennsylvania Department of Environmental Resources (PADER). The consent order directed Textron Lycoming to develop and implement a remedial action plan to clean up contaminated ground water at and near its Williamsport, Pennsylvania, facility. Textron Lycoming has successfully complied with PADER's directive by delineating the on- and off-site shallow ground water contamination, by installing and regularly sampling 47 ground water monitoring wells, and by installing 3 on-site and 2 off-site recovery wells and associated treatment facilities. The recovery systems operate under agreements made between PADER and Textron Lycoming. Monitoring and maintenance of the recovery wells and associated treatment facilities and monitoring of ground water to observe the shape of the shallow contaminant plume and to determine the effectiveness of the recovery systems are continuing. The on-going activities are coordinated with and reported to the PADER.

From January 1986 to June 1988, ground water monitoring was conducted bi-monthly at wells selected by PADER. The recovery wells' influent is checked weekly and effluent concentrations are monitored on a monthly basis and reported to PADER. Textron Lycoming, in the 15 August 1988 quarterly progress report submitted to the PADER, recommended implementation of a quarterly

ground water monitoring and reporting program, beginning in October 1988. The recommended program will use a fixed group of existing wells, consistent analytical parameters and a quarterly reporting frequency. The program will be reviewed and re-evaluated at the end of one year. This proposed quarterly ground water monitoring plan has been approved by PADER. Monthly monitoring of the recovery systems will continue as before. A copy of the 15 August 1988 quarterly report and modified monitoring plan is attached as Appendix A.

Textron Lycoming, in the interest of complying with the requirements of PADER, will continue the quarterly monitoring and reporting as directed by PADER. This activity, while separate from the pending RI/FS requirements, should be considered by the EPA in their evaluation of the proposed RI/FS Scope of Work and ultimately in their decisions for developing a Record of Decision (ROD).

2.2 Site Location and Setting

The Textron Lycoming facility is located in the western portion of Williamsport in Lycoming County, Pennsylvania (Figure 1). A plan sheet (Plate 1) showing the total study area and monitoring well and recovery well locations is included in the pocket at the back of this report. The facility is located on approximately 28 acres near the edge of a residential neighborhood that also contains some light industry. Major topographic features are a steep ridge north of the plant, Lycoming Creek 2,000 feet west of the plant, and the Susquehanna River 5,000 feet south of the plant.

The first buildings on the property were constructed around the turn of the century. The plant has been owned and operated by Textron Lycoming for over 60 years. Historically, plant

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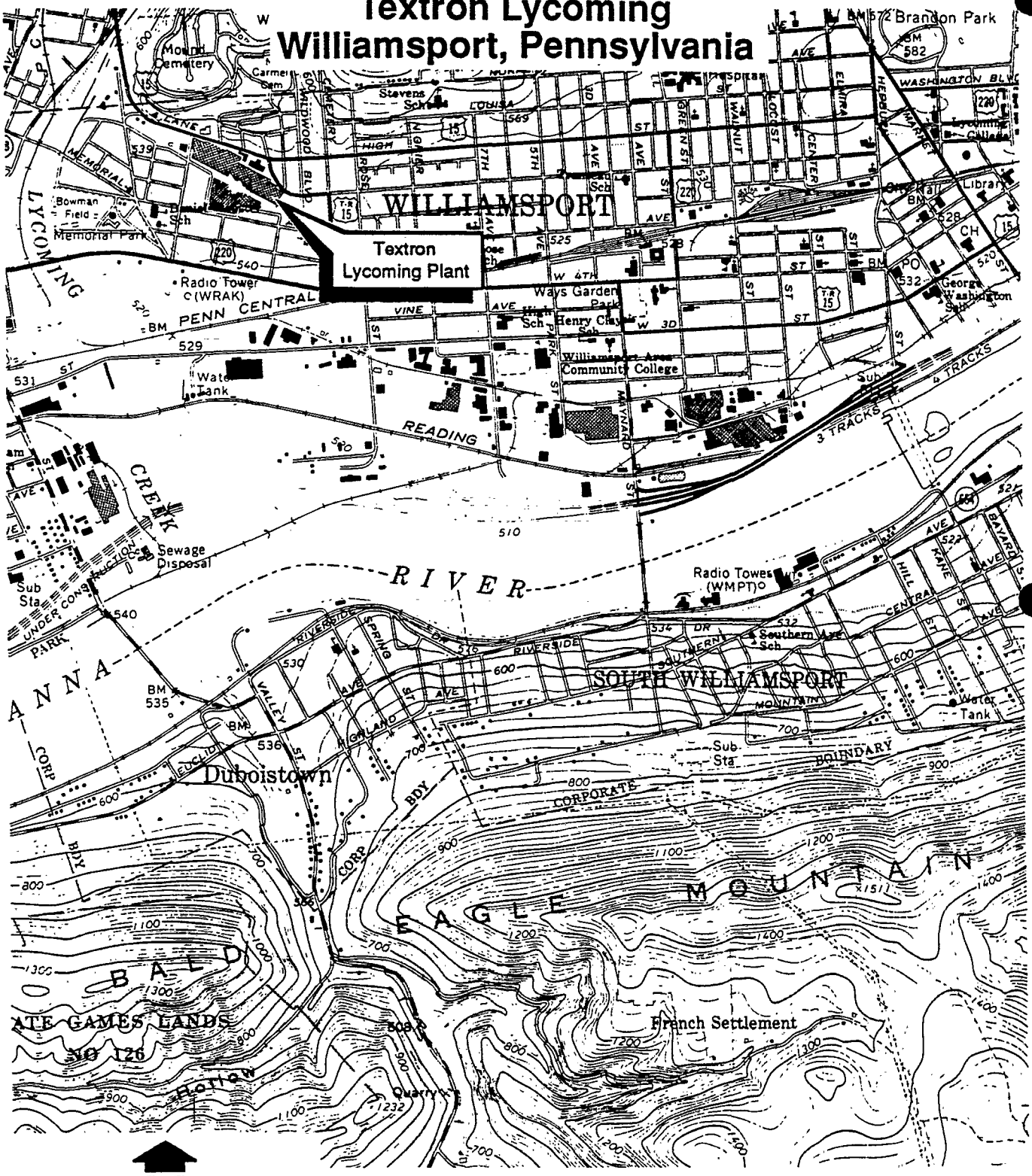
Figure 1
Site Location Map
Textron Lycoming
Williamsport, Pennsylvania



Source: USGS 7.5 Min. Topographic Quadrangle: Williamsport, PA

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operations have centered on the manufacture of aircraft engines. Other processes have included the production of automobile engines, sewing machines, sandpaper and silk. Portions of the facility were used during World War II by other parties. Currently, industrial activities include electroplating, parts manufacturing, engine cleaning, premanufacturing, and assembly of aircraft engines (The Chester Engineers, 1988).

Plant wastes include rinsewater, used solvents, waste oil and grease. Electroplating rinse waters are treated on site at a National Pollutant Discharge Elimination System #PA0007455 (NPDES) permitted treatment facility constructed in the 1950s. Sludges from the wastewater treatment plant, used solvents, and other wastes are transported off site for disposal or reclamation in accordance with state and federal regulations.

Ground water contamination related to the manufacturing processes has been identified beneath the plant property. The principal contaminants detected in the ground water at the plant include total chromium and volatile organic compounds, most notably trichloroethylene (TCE). The TCE has migrated off the property to the south and southwest. Ground water in the valley fill overburden material has been most affected; however, some TCE has been detected in the bedrock underlying the glacial deposits at the plant and, to a limited extent, in the bedrock off the property southwest of the plant.

2.3 Previous Studies

A considerable amount of investigative work has been completed at the Textron Lycoming facility. The following describes the initial finding of contamination and the investigative work completed in response to that event.

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In 1984, the Williamsport Municipal Water Authority (WMWA) detected the presence of volatile organic compounds (VOCs), specifically TCE and 1,2-trans-dichloroethylene (DCE), in the ground water at their emergency backup water supply well field south of Third Street. Subsequently, the Authority analyzed the ground water for an extensive list of parameters including VOCs, acid extractable compounds, and base neutral extractable compounds. The analyses confirmed that TCE and DCE were the primary contaminants of concern.

In November 1984, Textron Lycoming was made aware of the condition. The Chester Engineers, Inc. (Chester) conducted an investigation of possible ground water contamination at the plant, beginning immediately after results of the PADER investigation became known. This investigation revealed that constituents in the shallow ground water aquifer on site were migrating off the plant property in a southerly direction.

In December 1984 and January 1985, the PADER conducted its own investigation. Analysis of ground water samples taken from the WMWA emergency well field, other available area wells, and an abandoned production well on the Textron Lycoming Plant property led DER to suspect that the source of VOC contamination was the Textron Lycoming plant property.

A Remedial Action Plan was developed by Chester to comply with the COA executed 25 November 1985 between Textron Lycoming and the PADER. The objectives of the plan were: (1) to continue the remedial investigation to determine the overall extent of contamination both on-site and off-site, (2) determine the appropriate remedial action (i.e., perform a feasibility study), (3) implement remedial action in contaminated areas, and (4)

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conduct and continue ground water monitoring to define the progress of the remedial activities.

The investigations and remedial action program completed by Chester resulted in the installation of 47 ground water monitoring wells. In addition, three on-site and two off-site recovery wells and associated treatment facilities were installed and remain in operation. The details and results of the investigations can be found in the reports listed on Table 1.

Chester's investigations also included 11 test borings, 13 soil samples analyzed for VOCs, packer testing of two wells, aquifer testing for recovery well installation, and extensive ground water sampling and analysis, which provided a comprehensive data base depicting distribution of VOCs in the ground water system. A small area of total chromium contamination of the shallow ground water was also detected in the vicinity of the on-site industrial wastewater pre-treatment plant. The work conducted by Chester concentrated primarily on identification of the areal extent of the total chromium and TCE and DCE plumes, and the testing, design and implementation of a ground water recovery system to contain the identified plumes. The regulatory agency to which Textron Lycoming and Chester were required to report was the PADER. The PADER became involved under their jurisdiction to enforce the Clean Streams Law of the Commonwealth. The work completed to date by The Chester Engineers, conducted in accordance with the COA between Textron Lycoming and the PADER, complies with the state regulatory requirements.

In the 22 January 1987 Federal Register (52 FR 2492), the EPA proposed the sixth update of the National Priorities List (NPL). AVCO Lycoming Williamsport Division (now Textron Lycoming) was listed as the third entry in Group 7. On 23 March 1987, Textron

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TABLE 1

CHESTER REMEDIAL INVESTIGATION REPORTS

I	4-20 February 1985, Drilling of 10 On-site Monitoring Wells (MW-1, 2, 3, 4, 5, 6, 7, 8, 8D and 9) - Report submitted to DER on 20 March 1985.
II	22 April 1985 to 21 May 1985 - Drilling of 17 On-Site and Off-Site Monitoring Wells (MW-10, 11, 12, 13, 14B, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25 and 26) Plus Recovery Well No. 1 - Report submitted to DER on 8 June 1985.
III	29 July 1985 to 10 August 1985 - Drilling of 13 On-Site and Off-Site Monitoring Wells (MW-28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 41, 46 and 50) Plus Recovery Well No. 2 - Report submitted to DER on 30 August 1985.
IV	January 1986 - Drilling of 4 Off-Site Monitoring Wells (MW-51, 52, 53 and 54) - Report submitted to DER on 8 April 1986.
V	May-June 1986 - Drilling of 4 Off-Site Monitoring Wells (MW-55B, 56, 57 and 58) - Report submitted to DER in July 1986.
VI	25 September 1986 to 15 October 1986 - Drilling of Elm Park (Firehouse) Recovery Wells A, B, and C (South of Fourth Street) - Report submitted to DER in January 1987 as part of the 4th Quarter 1986 Progress Report.
VII	6 to 23 January 1987 - Drilling of the Water Authority Recovery Well (South of Third Street) - Report submitted to DER as part of the 1st Quarter 1987 Progress Report on 15 April 1987.
VIII	Second Quarter Sampling and Data Presentation - Report submitted to DER as part of the 2nd Quarter 1987 Progress Report on 15 July 1987.
IX	Third Quarter Sampling and Data Presentation - Report submitted to DER as part of the 3rd Quarter 1987 Progress Report on 15 October 1987.
X	Fourth Quarter Sampling and Data Presentation - Report submitted to DER as part of the 4th Quarter 1987 Report on 15 January 1988.

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Lycoming formally submitted to EPA a response document, within the 60 day comment period, requesting that the Hazard Ranking System (HRS) Scoring be revised. EPA has not, as yet, responded to this request.

2.3.1 Site Chronology

The following is a modified chronology of key events pertaining to the Textron Lycoming investigations. This chronology was extracted from The Chester Engineers, March 1988, "Summary of Report on Remedial Action Program," and modified to include the events to date.

- 1984 - WMWA discovers the presence of volatile organic compounds (VOCs) in the ground water at their emergency backup water supply well field. WMWA advises the PADER of the situation.

- November 1984 - Textron Lycoming is made aware of the situation and advises its engineering consultant, The Chester Engineers, Inc. (Chester), to initiate a ground water investigation as soon as PADER completes its study.

- December 1984 - January 1985 - PADER samples various points within and upgradient to the WMWA emergency well field. Analytical results reveal the presence of similar contaminants in water from an abandoned production well on the Textron property.

- 4-20 February 1985 - Chester initiates the remedial investigation, drilling ten on-site ground water monitoring wells (MW-1, 2, 3, 4, 5, 6, 7, 8, 8D and 9) - report submitted to PADER on 20 March 1985.

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- 22 April 1985 to 21 May 1985 - Drilling of 17 on-site and off-site ground water monitoring wells (MW-10, 11, 12, 13, 14B, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25 and 26) plus Recovery Well No. 1 - report submitted to PADER on 8 June 1985.

- 29 June 1985 to 10 August 1985 - Drilling of 13 on-site and off-site ground water monitoring wells (MW-28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 41, 46 and 50) plus Recovery Well No. 2 - report submitted to PADER on 30 August 1985.

- 25 November 1985 - Textron Lycoming and PADER execute a COA.

- December 1985 - Plan of study proposed to PADER by Textron Lycoming.

- January 1986 - Drilling of four off-site ground water monitoring wells (MW-51, 52, 53 and 54) - report submitted to PADER on 8 April 1986.

- February 1986 - Ground water monitoring and sampling program submitted to PADER.

- 14 March 1986 - Report on ground water modeling of remedial action alternatives submitted to PADER.

- 15 April 1986 - Remedial action recommendations submitted to PADER.

- May 1986 - PADER approves Remedial Action Plan.

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- May - June 1986 - Drilling of four off-site ground water monitoring wells (MW-55B, 56, 57 and 58) - report submitted to PADER in July 1986.

- 25 September 1986 to 15 October 1986 - Drilling of the Elm Park Recovery Wells A, B, C (South of Fourth Street) - report submitted to PADER in January 1987 as part of the Fourth Quarter 1986 Progress Report.

- 6 January 1987 - 23 January 1987 - Drilling of the Water Authority Recovery Well (South of Third Street) - report submitted to PADER as part of the First Quarter 1987 Progress Report on 15 April 1987.

- 22 January 1987 - Federal Register (52 FR 2392) - EPA lists Textron Lycoming as the third entry in Group 7 on the sixth update of the National Priorities List (NPL).

- 23 March 1987 - Textron Lycoming formally submits a response document to EPA requesting that the Hazard Ranking System (HRS) scoring be revised. This response includes an appreciable amount of support documentation.

- December 1987 - No re-ranking of the site has been proposed. Textron Lycoming is advised that it will be required to conduct a Remedial Investigation/Feasibility Study (RI/FS).

- April 1988 - ERM is retained by Textron Lycoming to assist in preparing for the pending RI/FS activities, and to assume the work required to comply with the PADER requirements.

- 27 June 1988 - Consent Agreement and Order signed between Textron Lycoming and the EPA, Region III.

2.4 Site Characteristics

2.4.1 Topography, Surface Water and Drainage

Williamsport is situated in a valley along the Allegheny Front in the Valley and Ridge Physiographic Province, which is characterized by narrow forested mountain ridges and wide valleys. The Allegheny Front is the separation line between the Valley and Ridge Physiographic Province and the Appalachian Plateaus Physiographic Province.

The primary waterway draining the area is the West Branch of the Susquehanna River, flowing to the east. Lycoming Creek, located west of the Textron Lycoming Plant, is a major tributary to the Susquehanna River and flows to the south. The area topography is primarily mountainous, with northeast to southwest trending ridges and valleys. The elevation of the plant is approximately 545 feet above mean sea level, and the Susquehanna River, 5000 feet south of the plant, is 520 feet above sea level. The surface water drainage from the plant is controlled by storm sewers. Surface water runoff from the western half of the plant is diverted to the Oliver Street storm sewer which subsequently discharges to Lycoming Creek. The surface water runoff from the eastern half of the plant is diverted to storm sewers which discharge to Cemetery Run, (a discharge swale) which drains to the Susquehanna River.

2.4.2 Climate

The Williamsport area is dominated by an atmospheric flow pattern similar to the humid continental regions west of Pennsylvania. The Williamsport area receives approximately 43 inches of precipitation annually in the form of rain and snow. The average

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temperature in the Williamsport area is approximately 72° Fahrenheit in the summer and 28° Fahrenheit in the winter.

Weather conditions at the Textron Lycoming Williamsport Plant will be monitored during the remedial investigation using the weather station closest to the plant, the Williamsport WSO AP weather station operated by the National Weather Service. This station is located approximately 6 miles east of the plant at the Lycoming County Airport. Data available from the station include daily readings of temperature, precipitation, and wind velocity and direction.

2.4.3 Population and Environmental Resources

Williamsport is the county seat and the largest population center of Lycoming County. The population of Williamsport City at the 1980 census was 33,400, and Lycoming County's population was 118,416.

The area surrounding Williamsport is mainly an expanding agricultural area focusing primarily on poultry and dairy products. Williamsport is the main industrial center in Lycoming County. Lycoming County has mineral resources, including some coal production, but primarily limestone and sandstone quarries.

2.4.4 Soils Description

The soils in the vicinity of the Textron Lycoming plant consist of deep, poorly drained soils in the floodplains (Tully and Lindon series), disturbed and urban wetlands (urban land and udorthents), and shallow stony soils on steep slopes (Weikert and Klinesville Soils). The stony steep soils lie to the north of High Street and the alluvial soils are found along Lycoming Creek and the

Susquehanna River to the south of the site. The plant and portions of Williamsport to the east and southeast are situated on Urban lands.

The following paragraphs describe the soil series and land types in the Textron Lycoming plant vicinity. Figure 2 shows the soil boundaries as extracted from the Soil Survey of Lycoming County, Pennsylvania, Soil Conservation Service, 1986.

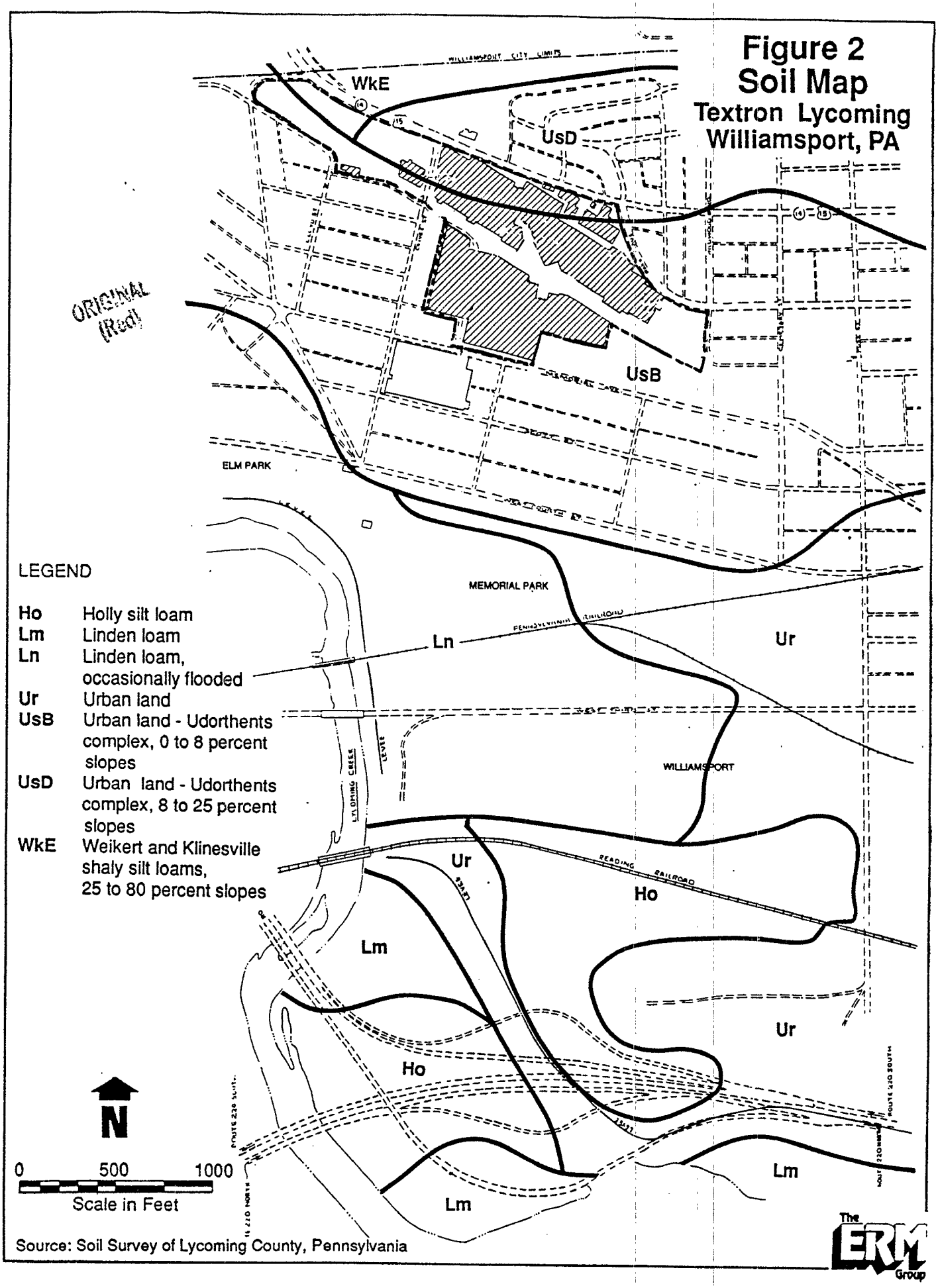
Holly Series

The soils of the Holly series are deep, poorly drained and very poorly drained soils on the floodplains. They formed in alluvium. Slopes range from 0 to 3 percent.

The solum is 20 to 30 inches thick. Bedrock is at a depth of more than 60 inches. Coarse fragments make up 0 to 10 percent of the solum and 0 to 25 percent of the substratum. In unlimed areas, reaction is moderately acid or slightly acid throughout.

In general, soil horizons are layers of soil having distinct characteristics produced by the soil-forming processes. Three major horizons commonly characterized are the A, B and C horizons. The A horizon is the mineral horizon near the surface in which humified organic matter and mineral material are mixed. It also refers to any plowed or disturbed surface layer. The B horizon lies below the A horizon and is commonly characterized by an accumulation of clay, sesquioxides or humus, a structure that is granular, prismatic or blocky and redder or browner colors of soil than the A horizon. The C horizon is little affected by the soil forming processes and does not have the properties of the overlying horizon. The C horizon does not include indurated bedrock. Other horizons also exist but primarily represent

Figure 2
Soil Map
Textron Lycoming
Williamsport, PA



LEGEND

Ho	Holly silt loam
Lm	Linden loam
Ln	Linden loam, occasionally flooded
Ur	Urban land
UsB	Urban land - Udorthents complex, 0 to 8 percent slopes
UsD	Urban land - Udorthents complex, 8 to 25 percent slopes
WkE	Weikert and Klinesville shaly silt loams, 25 to 80 percent slopes

Source: Soil Survey of Lycoming County, Pennsylvania

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subdivisions of these major horizons. The horizons for the Holly Series are characterized as follows:

- The A horizon has a fine earth texture of silt loam or loam.
- The B horizon has a fine earth texture ranging from loam to silty clay loam.
- The C horizon has a fine earth texture of sandy loam, very fine sandy loam, loam, silt loam, and silty clay loam above the IIC horizon.

Linden Series

The soils of the Linden series are deep, well drained soils on floodplains. They formed in alluvial sediment derived mainly from red and brown shale and sandstone. Slopes range from 0 to 3 percent.

The solum is 35 to 50 inches thick. Bedrock is at a depth of more than 60 inches. Coarse fragments make up 0 to 5 percent of the A horizon and the B1 and B2 horizons, 0 to 15 percent of the B3 horizons and the C horizon above a depth of 40 inches, and 0 to 50 percent of the C horizon below a depth of 40 inches. In unlimed areas, reaction ranges from very strongly acid to moderately acid throughout.

- The A horizon has a fine earth texture of loam, silt loam, or fine sandy loam.
- The B horizon has a fine earth texture of silt loam or loamy sand above a depth of 40 inches and ranges from fine sandy loam to sand below a depth of 40 inches.

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Klinesville Series

The soils of the Klinesville series are shallow, well drained soils on low hills and ridges. They formed in material weathered from shale, siltstone, and sandstone. Slopes range from 3 to 80 percent.

The solum is 10 to 15 inches thick. Bedrock is at a depth of 10 to 20 inches. Coarse fragments make up 15 to 75 percent of the A and B horizons and 50 to 90 percent of the C horizon. They average more than 50 percent in the control section. In unlimed areas, reaction ranges from very strongly acid to moderately acid throughout.

- The A horizon has a fine earth texture of silt loam or loam.
- The B horizon has a fine earth texture of silt loam or loam.
- The C horizon has a fine earth texture of silt loam or loam.

Urban Land

This soil unit consists of nearly level to moderately steep areas along the Susquehanna River and its major tributaries and on the hills adjacent to the floodplains. More than 85 percent of the areas are covered by buildings, streets, and other structures. Slopes generally have been smoothed, and range from 0 to 25 percent.

Urban land consists of parking lots, sidewalks, buildings, roads, and other structures.

The soil properties of Urban land differ greatly because of the many different soils underlying the developed areas and because of the amount of alteration done during construction on these areas.

Udorthents

Udorthents consist of deep, somewhat poorly drained to excessively drained soils. These soils are a heterogeneous mixture of coarse fragments and soil materials that have been disturbed or stockpiled in mining or construction. They are predominantly on the Allegheny Plateau near surface mines and along the Susquehanna River near Urban land. Slopes range from 0 to 100 percent. These soils range from 30 to 60 inches or more in thickness over bedrock or undisturbed material. The content of coarse fragments ranges from 5 to 80 percent throughout. In unlimed areas, the soils range from extremely acid to strongly acid throughout. They have a fine earth texture ranging from loam to silty clay loam.

Weikert Series

The soils of the Weikert series are loamy-skeletal, mixed, mesic Lithic Dystrochrepts. They are shallow, well-drained soils on narrow ridgetops and on hillsides. They formed in residuum of interbedded, gray and brown, acid shale, siltstone, and in some places, sandstone. Slopes range from 3 to 80 percent.

The solum is 10 to 16 inches thick. Bedrock is at a depth of 10 to 20 inches. Coarse fragments make up 20 to 40 percent of the A horizon, 30 to 50 percent of the B horizon, and 60 to 80 percent of the C horizon. In unlimed areas, reaction ranges from medium acid to very strongly acid throughout.

- The A horizon has a fine earth texture of silt loam or loam.

ORIGINAL (Red)

- The B horizon has a fine earth texture of silt loam or loam.
- The C horizon has a fine earth texture of silt loam or loam.

2.4.5 Geology

The geology in the area of the Textron Lycoming facility consists of unconsolidated valley fill deposits of Quaternary Age and consolidated bedrock deposits of Devonian Age. Understanding the geologic setting of the study area, in particular the thickness and nature of valley fill overburden deposits, has been greatly enhanced by the investigative work completed to date.

2.4.5.1 Unconsolidated Valley Fill Deposits

The Textron Lycoming plant facility is located at the northeastern edge of the glacial floodplain formed along Lycoming Creek and the west branch of the Susquehanna River. The floodplain is underlain by unconsolidated alluvial and glacial deposits, which consist of sand, gravel, cobbles and small boulders with relatively minor amounts of silt and clay, overlying bedrock. Some clayey sands and silts were noted in isolated areas of the northwest portion of the plant during the drilling performed by Chester.

The thickness of the glacial overburden ranges from 23 to 30 feet beneath the Textron Lycoming plant and gradually thickens as the topography slopes toward Lycoming Creek and the Susquehanna River. The maximum thickness of the overburden measured in the monitoring wells is 53 feet in Well MW-23, located on Third Street near the WMWA well field.

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2.4.5.2 Bedrock

Bedrock strata in the study area include the units of the Upper to Middle Devonian; oldest to youngest, the Marcellus Formation, the Mahantango Formation, the Harrell Formation and the Brallier Formation. The Marcellus Formation underlies the lower portion of the WMWA emergency well field, near the northern boundary of the Susquehanna River. The formation consists of carbonaceous shales with thin beds of soft clay. The Mahantango Formation underlies the area east and south of the plant site. With the exception of the Tully member of this formation, the Mahantango Formation is comprised primarily of silty shales and shaly siltstones. The lime-rich units of the Tully member mark the upper 200 feet of the Mahantango Formation and are the units of principal concern in terms of ground water conditions at the site. This unit underlies approximately 60% of the plant property. The Tully member consists of variable thicknesses of interbedded limestone and shale. The Harrell Formation underlies the westernmost portion of the site and is a homogeneous shale which has scattered thin beds of laminated silty shale. The Brallier Formation underlies the area northeast of the plant. This formation consists of interbedded siltstones and silty shales.

Figure 3 shows the structural orientation of bedrock which strikes in east-northeast and west-southwest bands (strike N 80° E, as shown by the Pennsylvania Topographic and Geological Survey Water Resources Report-1981). The bedrock in this area is the northwest flank of the Mosquito Anticlinal structure, which forms Bald Eagle Mountain south of Williamsport. Strike and dip measurements taken from an outcrop adjacent to the Textron Lycoming plant indicate that the bedrock units strike N 55-65° E and dip 18° to the northwest. Major jointing patterns trend N 53-58° E, generally

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Figure 3
Bedrock Geology
Textron Lycoming
Williamsport, PA

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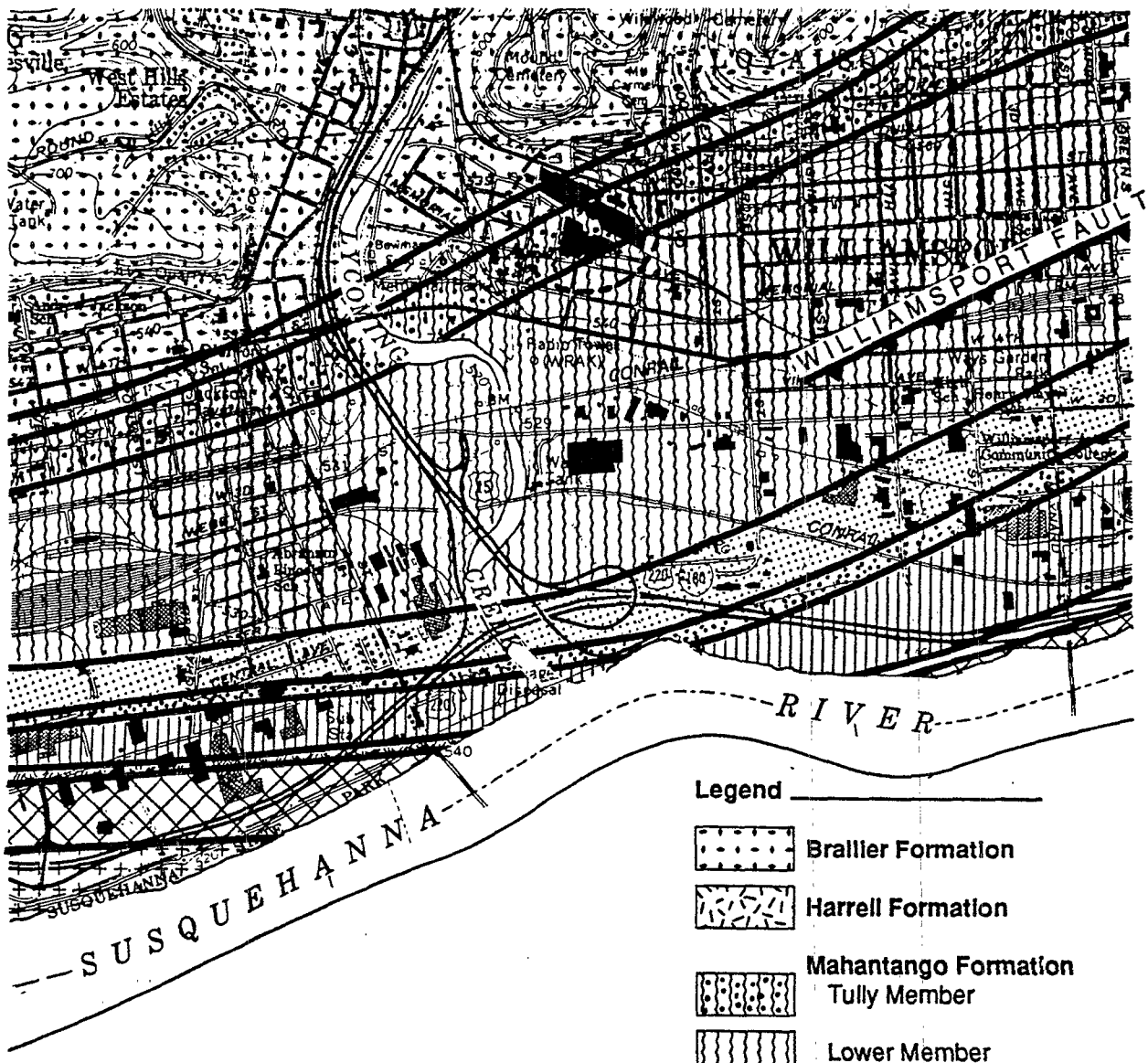

Legend

- Braillier Formation
- Harrell Formation
- Mahantango Formation
  - Tully Member
  - Lower Member
- Marcellus Formation
- Onondaga Formation
- Old Port Formation
- Keyser Formation
- Tonoloway Formation
- Wills Creek Formation

N

2000 0 2000

Scale in Feet

Source:USGS 7.5 Min. Topographic Quadrangles: Williamsport, PA

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paralleling bedrock strata which are North 20-25° West and North 5-8° East.

Figure 4 shows the configuration of the buried bedrock surface as presented by Chester in its March 1988 Report. This surface was delineated using data obtained during the drilling of the shallow wells. The most distinct feature is the presence of a bedrock high, generally oriented parallel to the strike of the limestone in the Tully Member. Soft, black clayey shale overlies the limestone to the northwest, and gray shale is the underlying lithology to the southeast. The bedrock high is apparently the result of the greater resistance to weathering exhibited by the limestone in contrast to the surrounding shales. The buried bedrock surface slopes to the west and southeast from the limestone high. This bedrock configuration is believed to have a subtle influence on shallow ground water and contaminant flow patterns in the valley fill aquifer.

2.4.6 Hydrogeology

There are two primary aquifers in the study area. The shallow aquifer is comprised of the Quaternary unconsolidated deposits, consisting of poorly to well-sorted boulders, cobbles, pebbles, gravel, sand and minor amounts of silt and clay. There are currently 39 wells completed in this aquifer on and off-site.

The underlying bedrock aquifer consists of upper to middle Devonian aged rocks, including shales, siltstones, and limestones. Eight wells have been drilled to intercept the upper portion of the bedrock. A 300-foot-deep abandoned Textron Lycoming plant production well is installed in the bedrock. The physical characteristics of the bedrock are quite different from those of the valley fill aquifer above and, therefore, the mechanisms

Figure 4
Bedrock Surface Map
Textron Lycoming

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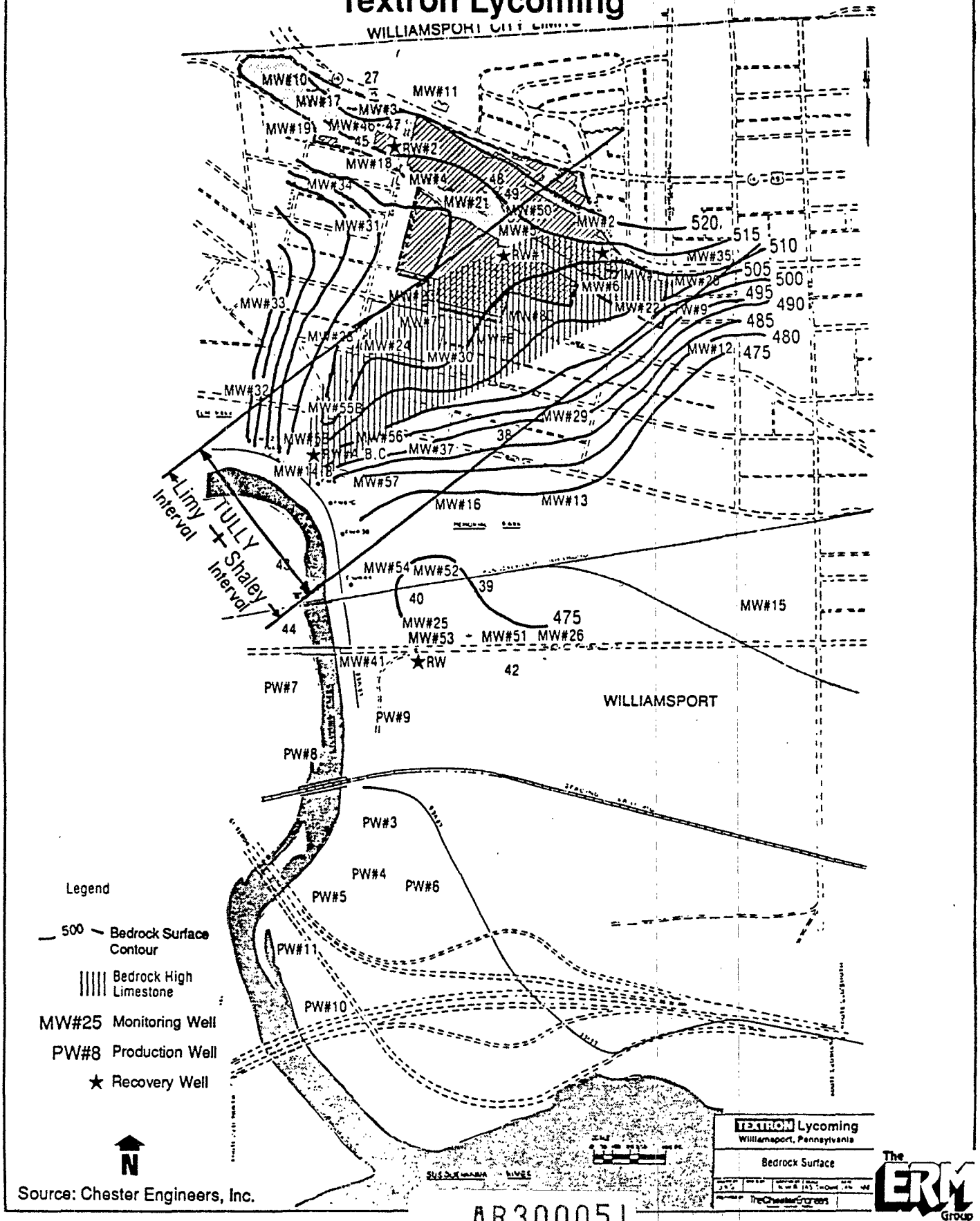

Source: Chester Engineers, Inc.

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governing ground water flow and contaminant migration in each are different. Each aquifer acts as a separate, although probably connected, hydraulic system. The hydrogeology of the shallow aquifer system is well understood from the existing data; a basic understanding of the bedrock aquifer has also been developed from the existing data. Table 2 summarizes the well construction details for the wells completed in the study area. Figure 5 and the plan sheet shows the location of these wells.

2.4.6.1 The Shallow Aquifer

Ground water in the shallow aquifer is unconfined. The depth to ground water ranges from 12 to 15 feet below grade at the plant (October 1988) and 11 to 25 feet off site. The system is recharged by precipitation and snow melt, and large fluctuations have been observed in the ground water table beneath the plant where the unit is thin. Ground water in the shallow aquifer flows through voids and spaces in the sediments, in a direction parallel to the hydraulic gradient. The hydraulic gradient in this area is largely controlled by the surface and underlying bedrock topography. Well yields in the valley fill deposits in the Williamsport region average 300 gallons per minute (gpm). The highest yields, up to 3000 gpm, are obtained from wells drilled near the confluence of south flowing streams and the Susquehanna River, where the deposits are relatively thick (Water Resources Report 51, 1981, PADER). The ground water gradient is relatively steep in the vicinity of the plant, but flattens noticeably in the area south of the bedrock high. The primary ground water flow component in the shallow aquifer is to the south. It is believed this flow system is hydraulically connected with Lycoming Creek and the Susquehanna River.

The ERM Group

TABLE 2

TEXTRON LYCOMING
WILLIAMSPORT PLANT
WILLIAMSPORT, PENNSYLVANIA

Monitoring Well Construction Details

Location	Top of Casing	Ground Surface	Top of Bedrock	Test Boring Depth	Water Table	Lithology		Screened Interval
						Bedrock	Monitored	
MW-1	544.71	541.72	509.72	33.00	526.14	Lime Shale	Overburden	23.0-33.0
MW-2	545.51	542.37	521.37	21.00	535.54	Lime Shale	Overburden	11.0-21.0
MW-3	548.98	546.53	523.53	29.00	533.61	Black Shale	Overburden	18.5-28.5
MW-4	542.20	539.96	<521.96	18.00	529.26	Black Shale	Overburden	8.0-18.0
MW-5	542.10	539.27	512.27	27.50	527.77	Lime Shale	Overburden	17.0-27.0
MW-6	541.43	538.87	508.37	30.50	523.54	Lime Shale	Overburden	19.0-29.0
MW-7	544.35	540.82	513.82	27.00	524.36	Lime Shale	Overburden	17.0-27.0
MW-8	540.30	540.57	508.57	32.00	522.57	Lime Shale	Overburden	22.0-32.0
MW-8D	543.63	540.45	508.45	82.50	519.38	Lime Shale	Bedrock	62.5-82.5
MW-9	541.54	538.62	501.62	38.00	513.37	Lime Shale	Overburden	27.5-37.5
MW-10	546.89	544.64	<521.54	23.50	528.22	Green Grey Shale	Overburden	13.5-23.5
MW-11	555.95	553.26	525.26	28.20	533.51	Black Shale	Overburden	18.25-28.5
MW-12	536.25	536.25	471.92	64.50	512.42	Gray Shale	Overburden	45.58-65.58
MW-13	518.13	515.26	472.26	43.20	509.09	Gray Shale	Overburden	33.25-43.25
MW-14B	522.72	519.72	504.72	25.00	509.01	Limestone	Bedrock	15.0-25.0
MW-15	521.28	521.28	473.28	48.20	509.20	Gray Shale	Overburden	38.25-48.25
MW-16	521.04	518.06	471.56	47.00	509.06	Lime Shale	Overburden	37.0-47.0
MW-17	548.28	544.88	521.80	24.00	533.59	Gray Green Shale	Overburden	14.0-24.0
MW-18	542.63	539.68	514.93	25.00	528.64	Black Shale	Overburden	15.0-25.0
MW-19	544.26	541.13	512.95	28.50	528.30	Gray Green Shale	Overburden	18.5-28.0
MW-20	541.30	541.30	511.55	30.50	520.13	Black Limestone and Shale	Overburden	20.5-30.5
MW-21	541.19	541.19	513.11	28.50	529.19	Black Shale	Overburden	18.5-28.5
MW-22	541.59	538.76	504.76	80.00	513.43	Lime Shale	Bedrock	60.0-80.0
MW-23	543.62	540.69	513.69	79.50	523.69	Lime Shale	Bedrock	59.5-79.5
MW-24	538.61	538.61	510.61	30.00	518.19	Lime Shale	Overburden	20.0-30.0
MW-25	526.00	526.00	473.00	53.50	508.00	Lime Shale	Overburden	43.5-53.5
MW-26	522.39	522.39	476.39	49.00	508.14	Gray Shale	Bedrock/	39.0-49.0
TB-27		N.S.	~=552	5.00	Dry	- -	- -	
MW-28		538.32	513.32	25.00	518.03	Gray Green Shale	Overburden	15.0-25.0
MW-29		534.35	<493.85	40.50	510.51	- -	Overburden	17.0-37.0
MW-30		537.11	513.11	26.50	517.28	Lime Shale	Overburden	16.5-26.5
MW-31		531.44	502.44	30.00	521.19	Black Shale	Overburden	20.0-30.0

All monitoring wells constructed from 2 inch diameter PVC casing.

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TABLE 2 (cont.)

TEXTRON LYCOMING
WILLIAMSPORT PLANT
WILLIAMSPORT, PENNSYLVANIA

Monitoring Well Construction Details

Location	Top of Casing	Ground Surface	Top of Bedrock	Test Boring Depth	Water Table	Lithology: Bedrock	Lithology: Monitored	Screened Interval
MW-32		517.94	498.84	23.00	510.13	Lime Shale	Overburden	13.0-23.0
MW-33		531.76	479.76	53.00	510.07	Black Shale	Overburden	33.0-53.0
MW-34		542.55	513.05	31.00	525.90	Gray Shale	Overburden	21.0-31.0
MW-35		541.14	511.14	30.00	514.56	Gray Shale	Overburden	20.0-30.0
MW-36		546.33	526.03	20.50	530.57	Siltstone/Lime Shale	Overburden	10.5-20.5
MW-37		521.00	496.50	25.00	509.09	Lime Shale	Overburden	15.0-25.0
TB-38		N.S.	- -	14.00	Dry	- -	- -	
TB-39		N.S.	>45'	45.50	- -	- -	- -	
TB-40		N.S.	>20'	20.00	- -	- -	- -	
MW-41		520.25	<499.75	20.50	508.33	- -	Overburden	10.5-20.5
TB-42		N.S.	>20'	20.00	- -	- -	- -	
TB-43		N.S.	>20'	20.50	- -	- -	- -	
TB-44		N.S.	>20'	20.00	- -	- -	- -	
TB-45		N.S.	>19.5'	19.50	- -	- -	- -	
MW-46		542.84	515.33	28.00	529.58	- -	Overburden	18.0-28.0
MW-47		N.S.	>27.5'	28.00	- -	Black Shale	- -	
MW-48		N.S.	- -	24.50	- -	- -	- -	
MW-49		N.S.	- -	24.50	- -	Black Shale	- -	
MW-50		539.3	517.8	23.5	528.63	Black Shale	Overburden	13.5-23.5
MW-51	522.20		475.20	48.50	509.70	Black Shale	Overburden	38.0-48.0
MW-52	518.70		475.70	43.70	510.10	Green Gray Shale	Overburden	33.0-43.0
MW-53	525.73		473.73	70.00	509.63	Gray Shale	Bedrock	58.35-68.35
MW-54	518.93		473.93	47.00	509.53	Black Shale	Overburden	12.5-44.5
MW-55B		527.35	513.05	52.00	514.60	Limestone	Bedrock	42.0-52.0
MW-56		528.38	511.78	24.30	515.13	Limestone	Bedrock	13.7-23.7
MW-57		519.85	480.05	82.00	510.27	Limestone	Bedrock	71.95-81.95
MW-58		520.61	507.61	43.00	510.80	Limestone	Bedrock	33.0-43.0 23.0-53.8
RW-1		528.29	511.96	53.80	527.04	Limestone	Bedrock/ Overburden	
RW-2		541.94	514.44	48.10	531.35	Black Shale	Overburden/ Bedrock	17.46-47.67
Elm Park RW-A, B&C				43.00		Limestone	Bedrock	15.2 - 40.2
Water Authority I	526.28	524.00	474.00	50.00	507.00	Gray Shale	Overburden	20.0-50.0

All monitoring wells constructed from 2 inch diameter PVC casing.

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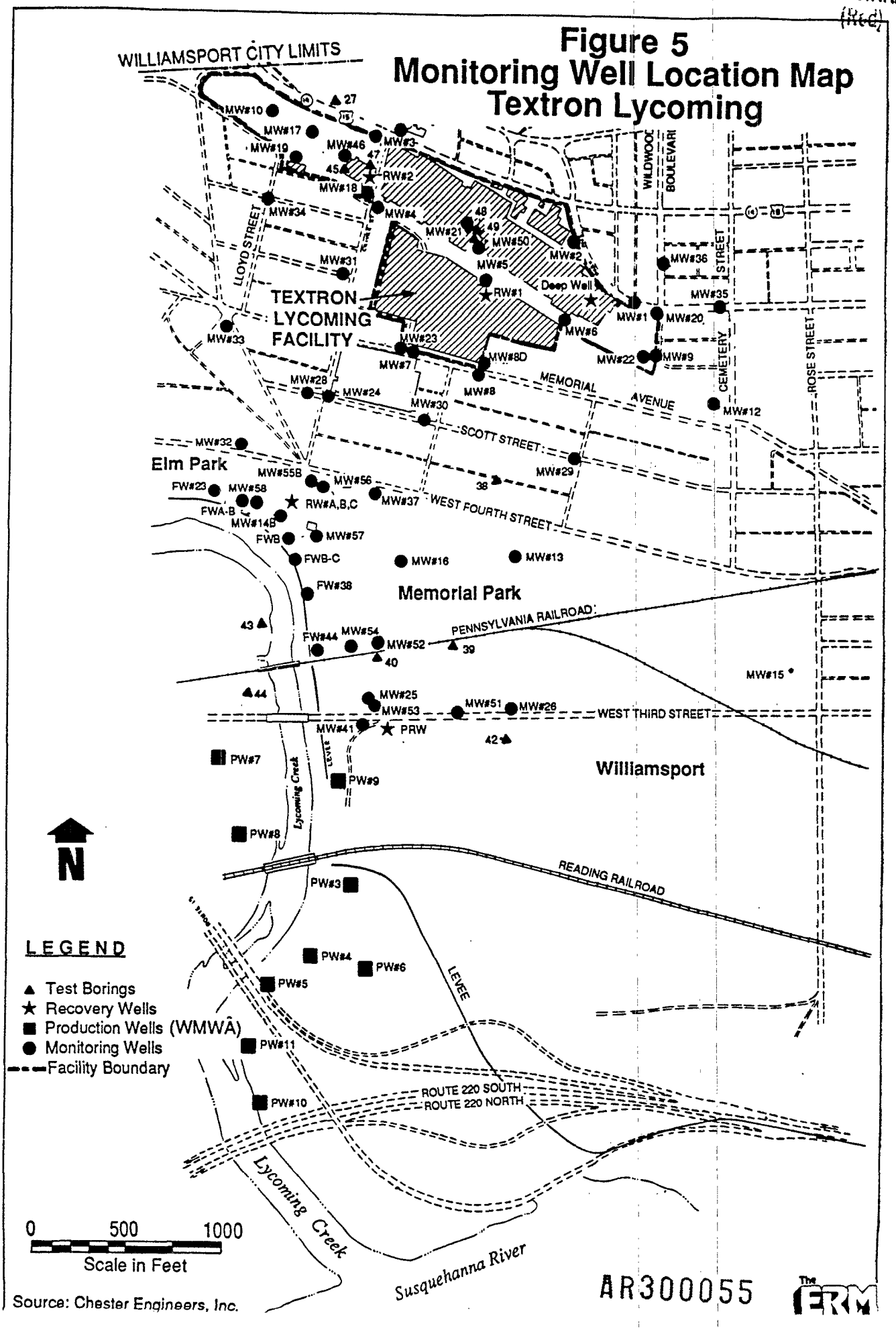
Figure 5
Monitoring Well Location Map
Textron Lycoming



Source: Chester Engineers, Inc.

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The point of lowest hydraulic head in the area is the Susquehanna River. Lycoming Creek and the Susquehanna River are the boundaries of the hydraulic systems and act as points of ground water discontinuity in the regional ground water flow pattern. Ground water in the shallow aquifer moves in a southerly direction. The ground water flow velocity increases as it approaches the Susquehanna River, based on data from recovery well pump testing. Low hydraulic conductivities near the plant probably limit the natural ground water flow rate to less than one foot per day. Hydraulic conductivity increases at the emergency WMWA well field, and natural ground water flow rates are on the order of five to ten feet per day in this area.

2.4.6.2 The Bedrock Aquifer

Ground water flow through the bedrock aquifer is an important consideration in understanding potential contaminant migration in the area. Ground water movement in the bedrock is not controlled by the shallow hydraulic gradients in the valley fill, but is controlled by secondary features such as solutioning, jointing, fracturing and orientation of bedding plans. The depth to ground water for the bedrock wells on-site and off-site (October 1988) ranges from 12 to 25 feet below grade. Area ground water wells drilled in the shales of the Marcellus, Mahantango and Harrell Formations tend to yield moderate supplies of water. These yields range from 12 to 355 gpm, as indicated from industrial and public supply wells; the average being 52 gal/min. The median well depth for these formations is 187 feet (Water Resource Report 51, 1981, PADER). Siltstones, which includes the Brallier Formation, tend to be the area's poorest aquifers, with a median yield of 6 gpm and median depths being 153 for domestic wells and 400 feet for non-domestic.

The Tully member of the Mahantango formation, which underlies the plant site, consists of variable thicknesses of interbedded limestone and calcareous shale. These units are relatively impermeable due to their fine-grained, compact nature. However, the lime-rich units are susceptible to solutioning, especially within the upper weathered zone. This weathered zone exists where the lime-rich units of the Tully contact the overburden. The solutioning present within the Tully member does not occur within the adjacent noncalcareous shale units, but fracturing, jointing and bedding planes in the bedrock can be primary routes of ground water flow.

During the Chester investigations, packer testing was conducted on Boring 55A and MW-14B to determine permeability at varying depths within the upper 50 feet of the limestone bedrock (Tully). These tests indicated that hydraulic conductivities range from 10.0×10^{-3} centimeters per second close to the bedrock surface to less than 1.0×10^{-6} centimeters per second deep in the bedrock. Water levels observed in monitoring wells nested in the overburden and the bedrock aquifer indicate only very slight vertical hydraulic gradients downward to the bedrock aquifer from the overburden.

The bedrock units in the vicinity of the plant are oriented with a north 60° east strike and a dip of 18° to the northwest. It is possible, therefore, that the upper, weathered portion of the Tully member in contact with the overburden may be a pathway for flow toward Lycoming Creek.

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2.5 Environmental Assessment

2.5.1 Ground Water Use

There are currently no private homes or industries using ground water as a primary source of potable water within the study area. The WMWA wells serve only as an emergency back-up to the two primary surface water sources. Ground water from the well field, if needed, would be treated prior to mixing with the primary supply and then distributed to the public. The treatment system is approved and permitted by PADER.

2.5.2 Ground Water Quality

The ground water sampling and analysis conducted during the Chester investigations indicated the presence of certain volatile organic compounds in the ground water. The initial ground water sampling events were for complete Priority Pollutant volatile analysis and select inorganic compounds. The initial analyses were performed by GC/MS methods. The primary components of the VOC contamination are trichlorethylene (TCE) and 1,2-trans-dichlorethylene (DCE). Subsequently, ground water monitoring focused on these compounds. The June 1988 sampling event for the Target Compound List (TCL) of VOCs with Contract Laboratory Data packages, confirmed the original findings. The historical water quality data base including sampling completed in June 1988 for the TCL VOCs, verify that TCE and DCE are the primary contaminants of concern. Table 1 in Appendix A presents the historical water quality data base.

Contamination has been identified in the valley fill aquifer and in the upper part of the bedrock aquifer from the data in the

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ground water monitoring wells. So far only the Tully member bedrock is known to be affected.

Contaminant transport is governed by the different flow mechanisms inherent in the valley fill and bedrock aquifer. Generally, the shallow ground water plume moves southward from the plant site, in the same direction as ground water flow in the shallow aquifer. The highest concentration of TCE and DCE in the shallow contaminant plume is in the area of monitoring well MW-50 and MW-5 in the central portion of the plant. Vinyl chloride and several other organic contaminants are present in this area. An area of high TCE and DCE concentration is also noted in the vicinity of MW-3 and MW-18 on the western portion of the plant. Figure 6 shows the extent of the shallow ground water contamination plume based on the June 1988 sampling data.

Earlier investigations by Chester also detected total chromium contamination in the shallow aquifer. This area is located in the western portion of the plant near Recovery Well 2. The total chromium contamination is possibly associated with activities related to the on-site industrial wastewater pre-treatment system, and/or activities in the former plating area on Oliver Street directly across from the wastewater treatment plant. Drilling and sampling activities to characterize the migration of the chromium revealed that the total chromium concentrations occur in a limited area. The total chromium from this western portion of the shallow plume has not migrated off site based on the available data, and is not likely to affect the WMWA well field. This is ERM's opinion for two reasons: one, no total chromium has been detected in the off-site wells and secondly, the tendency for the chromium species to adsorb onto the surfaces of clay minerals in the soils could limit the extent of its migration. Further investigation

Maybe because insufficient

Figure 6
TCE-DCE Plume, Shallow Aquifer Concentration in ppb Textron Lycoming June 1988

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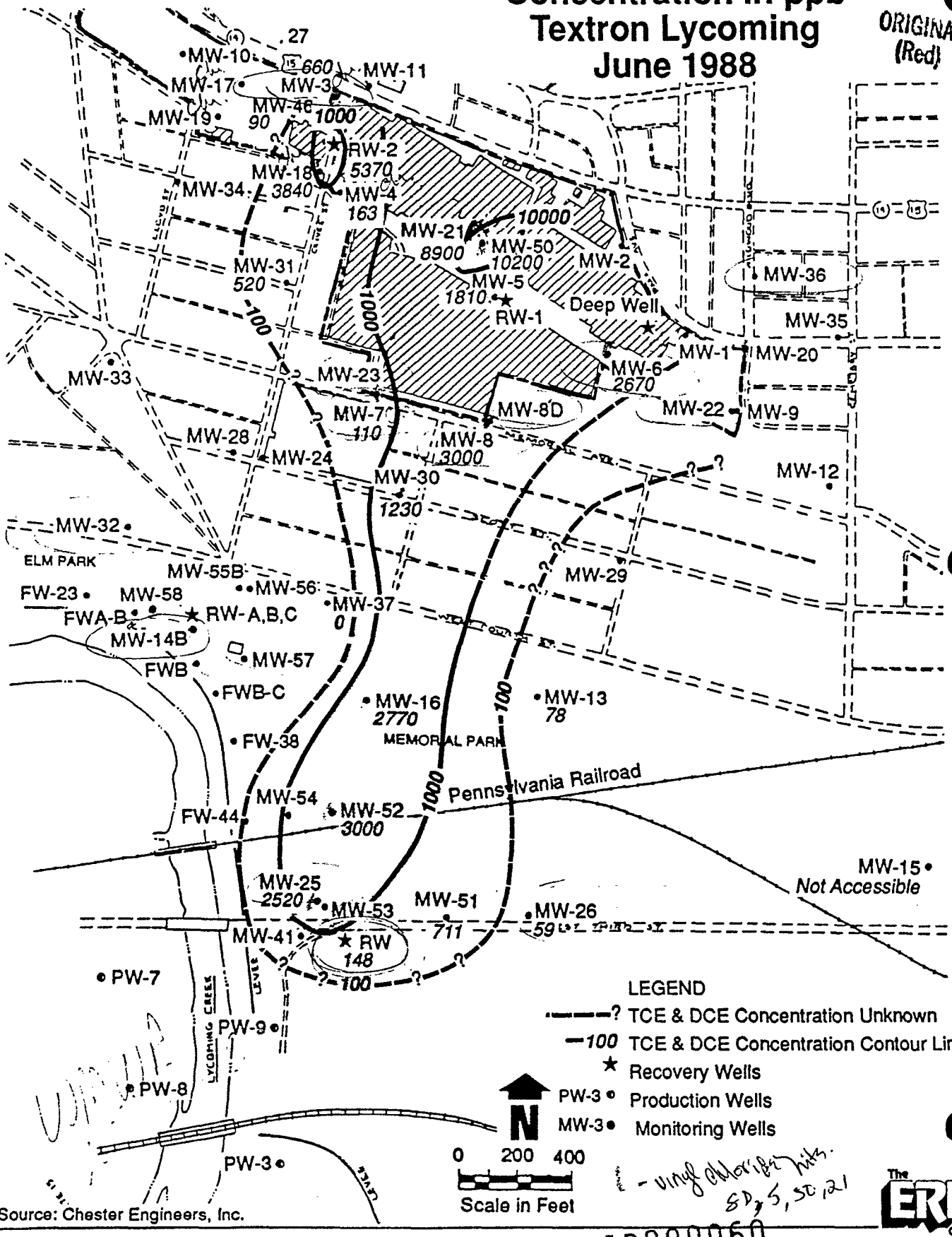

Source: Chester Engineers, Inc.

- vinyl chloride hits. SD, 5, 30, 21

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The ERM Group

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into the activities in this area and additional sampling will better define the extent of total chromium contamination.

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Contamination in the bedrock aquifer is not as clearly defined as the shallow ground water contamination plume. Ground water contamination has been detected in the wells completed in the upper portion of the bedrock at MW-8D, MW-23, MW-55B, MW-58, MW-56, and MW-14B. Bedrock well MW-22 showed trace levels of VOCs only in 1985, and bedrock well MW-57 has not shown any signs of contamination in past analyses.

Ground water flow in the bedrock aquifer is governed by the strike and dip of the beds. This orientation of the rocks allows for the possibility of vertical and horizontal ground water movement in the direction of the strike and dip. Figure 4 shows the bedrock high in the study area that is along the strike of the Tully member. It is likely that the ground water and contaminants discharge from the bedrock high into the adjoining overburden aquifer. More information is needed to better understand the contaminant migration in the bedrock aquifer.

2.5.3 Surface Water Quality

Surface water samples have been collected from three points along the west bank of Lycoming Creek, one from upstream and the other downstream from the Oliver Street storm sewer discharge point, and another downstream by the Pennsylvania railroad tracks. The analytical results from these samples revealed no more than trace amounts of organic contamination at any of the locations. The trace levels of organics are not believed to be associated with the Textron plant. These analytical results are presented as Table 2 in Appendix A. Surface water samples are also collected independently by WMWA. The WMWA surface water sample results

shared with Textron do not indicate the presence of volatile organic compounds.

ORIGINAL (Red)

2.5.4 Soil Quality

During preliminary investigations conducted by Chester at the Textron facility, 13 soil samples were collected from well borings and test borings drilled on the plant property. The samples were collected from various intervals in the borings and analyzed for volatile organic compounds. Only low concentrations of some volatile compounds were detected, including benzene, toluene, ethylbenzene, TCE, DCE, chloroform, and 1,2-dichloroethane. The borings in which contamination was detected are located primarily in the vicinity of monitoring well MW-5, an area that will be further investigated in the RI.

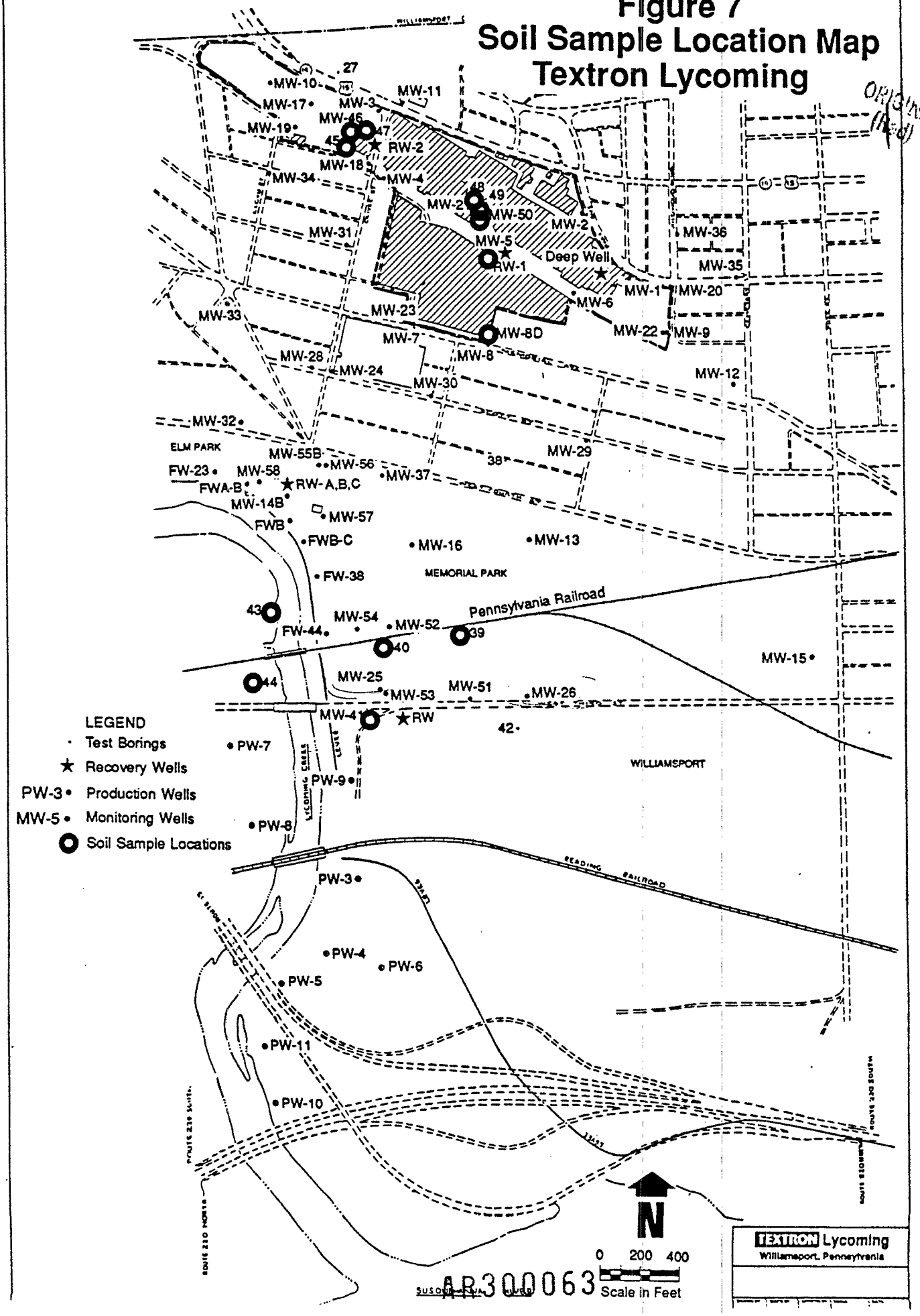
The soil samples were collected during drilling by taking split spoon soil samples every 5 feet, unless directed otherwise by the field geologist. An HNU photo ionization detector (PID) was used to monitor for VOCs in the soil. The HNU-PID measurements provided an indication of total organic vapors in the soils. Table 3 in Appendix A lists the depths at which the soil samples were collected and the organic compounds detected in the soil samples. Figure 7 shows the soil boring locations.

2.6 Remedial Action

The information developed from the Chester remedial investigation activities was used to develop various remedial action alternatives using aquifer analysis and complete simulations of ground water/contaminant movement. As a result of this process, five areas were targeted for ground water recovery and treatment:

Figure 7
Soil Sample Location Map
Textron Lycoming

ORIGINAL (Red)



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three on-site and two off-site. Table 3 summarizes the key information about these wells; Figure 5 shows their location.

2.6.1 On-Site Ground Water Recovery

Three of the ground water recovery areas are within the Textron Lycoming facility property boundaries. Two recovery wells were drilled, one in the central portion of the facility and one on the western side of the facility. These recovery wells extract ground water from the upper portion of bedrock as well as the bedrock-overburden interface and the overburden. The third recovery well is the abandoned plant production well, which is approximately 300 feet deep. It recovers ground water from the bedrock. The pump is set at 100 feet in the well and operates at approximately 17 gallons per minute (gpm).

2.6.2 Off-Site Ground Water Recovery

Two off-site recovery areas were also installed south of Fourth Street: one in Elm Park on Fourth Street and the other on the WMWA's property, south of Third Street.

A cluster of three recovery wells is located in Elm Park on Fourth Street. These wells pump from the bedrock (Tully Member) along the bedrock high. Low recovery rates from these wells confirmed prior evidence that the bedrock inherently exhibits a low transmissivity and low permeability. However, the recovery wells do provide an effective catchment area for contaminants in the area.

The other off-site recovery well, located on WMWA property, was installed to serve as the collection point for the leading edge of contamination and to prohibit contaminant migration farther south

TABLE 3
TEXTRON LYCOMING
GROUND WATER RECOVERY SYSTEM

Recovery Well	Normal Flow Rate (gpd)	Treatment	Date of Start-up	Discharge Point	TCE-DCE Total lbs. Removed*	TCE-DCE lbs. Removed per million gallons	TCE-DCE Average lbs. Removed Daily
Plant Site							
1	7,000	Air Stripping	Aug-85	Cemetery Run-Susquehanna River	610	235	1.1
2	15,000	Air Stripping Chromium Removal	Mar-87**	Lycoming Creek	77	39	0.2
Deep Well	30,000	Air Stripping	Jan-86	Cemetery Run-Susquehanna River	536	50	1
Off-Site							
Elm Park	50,000	Air Stripping	Apr-87	Lycoming Creek	94	13	0.3
WMWA	1,000,000	Air Stripping	May-87	Lycoming Creek	845	4	3
TOTAL	1,102,000				2,162		5.6

Source: Chester Engineers Report, March 1988
* Estimated from values extrapolated through February 1988
**Chromium, Total removed 49 lbs.

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into the WMWA emergency backup well field. This well, the highest yielding recovery well, is capable of yielding up to 1000 gpm, though it presently operates at an average of 900 gpm, and draws ground water from the alluvial/glacial deposits above the bedrock.

Treatment of the recovered ground water at each of the recovery sites is accomplished via air stripping towers. Treated ground water is discharged to Lycoming Creek or the Susquehanna River via Cemetery Run. The one exception is the recovered ground water from the western plume along Oliver Street, which, after air stripping, is treated for chromium removal at Textron Lycoming's Industrial Wastewater Treatment Plant and then discharged to Lycoming Creek. All the discharges from the treatment operations are in accordance with NPDES Permit No. PAD0007455 and PADER Air Quality Permit Nos. 41-330-003 and 41-330-001A.

2.7 Computer Modelling

Several computer modelling exercises were conducted by Chester as part of the contaminant investigation for the Textron Lycoming plant. The Prickett-Lonnquist Aquifer Simulation Model (PLASM) was used to model the contaminant plume in the overburden aquifer between the Textron Lycoming plant and the water authority emergency well field south of Third Street. It was used to track the expected path of contaminant migration from the Textron Lycoming plant facility toward the WMWA well field. Contaminant migration simulation was based on the ground water velocity field as defined by hydraulic simulation in the model. The conclusion of this initial modelling was that contamination originating at the Textron Lycoming facility was capable of reaching the authority well field.

Additional modelling was conducted in the vicinity of the well field to determine where the recovery well should be placed to obtain optimum recovery of contaminated ground water before it reaches the WMWA well field. A Theis well field simulation program, prepared by T. A. Prickett was utilized for this purpose. From these modelling efforts, the placement of the Third Street recovery well was determined. A detailed discussion of the ground water modelling conducted by Chester is presented in their report, Ground Water Modelling of Remedial Action Alternatives, March 14, 1986.

2.8 Summary

The investigative work completed to date has characterized the site geology, aquifer conditions and the horizontal extent of the contaminants in the glacial overburden aquifer. A preliminary investigation of the upper portion of the bedrock aquifer has also been completed, including characterization of the water quality in the shallow bedrock. The investigative program resulted in the implementation and operation of on- and off-site ground water recovery systems to contain the shallow contaminant plume and effectively treat it before discharging it to Lycoming Creek.

The contaminant plume and operating recovery systems are routinely monitored by Textron Lycoming and a quarterly status report submitted to PADER for their review and approval. It is the opinion of ERM and Textron Lycoming that the work completed to date fully satisfies the requirements of a Superfund-type Remedial Investigation and corrective action program. However, a review of the requirements for conducting an RI/FS following SARA and NCP criteria shows that there is some additional data gathering that is required. It is the intent of Textron Lycoming to satisfy these requirements of the EPA. Furthermore, completion of an

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Endangerment Assessment and Feasibility Study will help to clearly identify the risk associated with the facility and potentially identify additional remedial technologies that could be implemented to improve and/or speed up the cleanup of contaminant.

While the additional studies are going on, the existing ground water recovery systems will remain on-line and the quarterly monitoring and reporting will be completed to comply with PADER requirements. The additional quarterly data will be made part of the RI study, and the RI activities scheduled so that field sampling efforts are not duplicated. Textron Lycoming will submit the existing data base to EPA and ask them to consider accepting it as part of the RI/FS process and to add it to the administrative record for the project so that work completed to date can be considered in ultimately developing a Record of Decision for final remediation of the site. The background and objectives for conducting the EPA-required risks are explained in Section 3, and the proposed RI tasks are discussed in detail in Section 4.

SECTION 3

RI/FS OBJECTIVES AND SCOPES

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3.1 Regulatory Framework

The proposed Remedial Investigation/Feasibility Study (RI/FS) is required by the Administrative Consent Order (ACO) entered into between Textron Lycoming and EPA on 27 June 1988. The ACO requires Textron Lycoming to complete a RI/FS following the criteria included in the Superfund Amendment Reauthorization Act (SARA) and the National Contingency Plan (NCP). The ACO is a result of the facility being proposed for placement on the National Priority List (NPL) of federal Superfund sites on 22 January 1987. The proposed listing was announced in the Federal Register (52 FR 2392) and was the third entry in group seven on the sixth update of the NPL.

On 23 March 1987, Textron Lycoming submitted a response to the EPA regarding the HRS score for this facility. The response was also accompanied by a separate formal statement from the Pennsylvania Department of Environmental Resources (PADER) that the facility did not belong on the NPL. No response to these comments or the petition by PADER has been received by Textron Lycoming or PADER as yet. Textron Lycoming intends to complete a supplemental RI and associated feasibility study to expand the existing data so that the requirements of Superfund are met.

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3.2 Development of Site-Specific RI Objectives

3.2.1 Preliminary EA/FS Description

During the Spring of 1988, Textron Lycoming authorized Environmental Resources Management, Inc. (ERM) to conduct a Preliminary Environmental Assessment (EA) and a Preliminary Feasibility Study (FS) for the Williamsport, Pennsylvania, site. Each of these documents provides a review of the past and future site remediation process. Simultaneous development of these preliminary documents allows for efficient integration of the upcoming formal RI, EA and FS. Existing data concerning ground water contamination have been used in organizing the preliminary documents in order to define the data needed to successfully complete the EA and FS that will be submitted to the regulatory agencies. A copy of the Preliminary EA is included as Appendix B, and a copy of the Preliminary FS is included as Appendix C.

3.2.2 Summary of Results of the Preliminary EA

Considerable analytical data for ground water are available for the Textron Lycoming property, the surrounding off-site monitoring wells, and the Williamsport Municipal Water Authority backup supply wells. There are recovery wells and air stripping towers at three locations on site and two locations off site for which influent and effluent data are available. The data were collected from 1984 to 1988. However, Quality Assurance/Quality Control (QA/QC) packages were not available from the various analytical labs at the time when this Preliminary EA study was completed. Because of the unavailability of the QA/QC'd data, ERM selected analyses so the Preliminary EA could be completed. As discussed in Section 2 of the Preliminary EA, four quarterly monitoring reports were selected by ERM from the Chester data during 1987 and

early 1988. Since developing the Preliminary EA, ERM has conducted the 1988 second quarter ground water sampling. The ground water samples were analyzed for the TCL of VOCs. EPA Contract Laboratory Program (CLP) data packages were requested for the data, and a QA/QC review was performed by ERM chemists. This data confirmed that TCE and DCE are the primary contaminants of concern.

A preliminary conceptual model of the site was constructed based on subsurface data from a number of sources to define potential contaminant flow paths. Based on the conceptual model, the direction of ground water flow in the shallow overburden aquifer is to the south. Ground water flow in the bedrock aquifer is controlled by solutioning, jointing, fracturing and orientation of bedding planes. The bedrock near the plant strikes in a northeast-southwest direction and dips to the northwest at approximately 18°. The direction of ground water flow in the bedrock is not fully defined, but it is possible that a component of ground water flow moves in the southwesterly direction along the strike of the Tully Member.

From the available sampling data, TCE, DCE, and chromium were selected as indicator compounds for the Preliminary EA. Generally, volatilization and/or adsorption are the major transport processes for these compounds in the environment. Tables 3-1, 3-2 and 3-3 of the Preliminary EA provide further details on the behavior and toxicology of the selected indicator compounds.

The Textron Lycoming site is an active facility with residences to the east, west and south. Elm and Memorial Parks are recreational parks located directly south of the facility. Lycoming Creek and the Susquehanna River are important surface water bodies that are

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used for recreational purposes. A discussion of the potential exposure pathways for the three contaminants in this area, and preliminary risks, is provided in Section 3.4 of the Preliminary EA.

The exposure pathway that could be evaluated in this Preliminary EA is ground water use. Two hypothetical scenarios involving use of ground water from 1) on-site monitoring wells and 2) off-site monitoring wells were selected. Subchronic and chronic hazard indices for the on-site exposure scenario are greater than unity (1), which is not acceptable under EPA guidelines. For the off-site area, the noncarcinogenic hazard indices were found to be acceptable for the subchronic exposure level, but exceed unity (1) for the chronic exposure pathway.

Applicable or Relevant and Appropriate Requirements (ARARs)

Since the only media considered in this preliminary assessment was ground water, the ARARs were limited to EPA Maximum Contaminant Levels (MCLs) (Pennsylvania has not established ground water standards). Currently, the EPA recognizes drinking water MCLs, national ambient air quality standards (NAAQ), and federally approved state water quality standards developed under the Clean Water Act, as applicable or relevant and appropriate requirements (ARARs). MCL or goals (MCLGs) are available for all of the selected indicator compounds.

The indicator compounds in ground water are TCE, DCE and chromium. TCE is a B2 (possible human) carcinogen via all routes of exposure (oral, dermal, inhalation); chromium is a potential carcinogen via the inhalation pathway only. DCE and chromium (excluding inhalation) are considered as noncarcinogens. The actual concentrations of the compounds in the ground water at the site

exceed the existing applicable MCLs. Off-site concentrations of TCE and DCE also exceed the existing MCLs. Table 3-12 of the Preliminary EA records data and ARARs for comparison.

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Identified Data Gaps

In order for the formal EA to adequately and quantitatively address the potential risks to receptors posed by compounds from the Textron Lycoming site, five specific areas were identified as requiring further investigation.

- Further information regarding the presence and concentrations of other potential contaminants will be developed.
- Chromium analyses will determine the form of contamination (hexavalent chromium is carcinogenic and trivalent chromium is noncarcinogenic).
- Air quality needs to be evaluated. Section 4.3.9 describes the recommended approach to fill this data gap.
- Analyses of aquatic organisms will assess potential risks associated with exposures to bioaccumulated contaminants and environment.
- Ecological assessments of potentially affected areas will include habitat characterization, wetlands classification, and identification of endangered species.

Data requirements and conclusions determined by the Preliminary EA are presented in Section 4 of the document.

3.2.3 Results of the Preliminary Feasibility Study

As stated earlier, Textron Lycoming entered into a COA in November 1985 with PADER to develop and implement a remedial action plan.

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Chester was retained by Textron Lycoming from 1985 to 1988 to study the ground water problem. Their investigations indicated that there are two contaminant plumes on the Textron Lycoming site. A western plume is contaminated with TCE, DCE and Chromium. An eastern plume is contaminated with TCE and DCE, and has travelled off the site in a southward direction. A third plume containing TCE and DCE was found off site in the Elm Park area.

During 1985, recovery wells and air stripping towers were installed at two separate locations on the plant's property, with the air-stripped ground water containing chromium directed to the on-site wastewater treatment plant. In 1986, recovery wells and air stripping towers were installed at a third location on site and at an off-site location in the Elm Park area. During 1986, the WMWA installed a series of air stripping towers on the municipal wells to ensure a back-up water supply that would meet drinking water standards, if the wells were used as a source for drinking water. The above recovery wells and air stripping towers have been operating since their installation.

Textron Lycoming reported the past investigations and remedial actions to the PADER in addition to submitting the quarterly progress reports. Section 2.1 of the Preliminary Feasibility Study (Appendix C) presents a summary of the ground water data recorded for the sampling conducted by Chester during 1985 through early 1988. However, QA/QC packages are not available from the various laboratories for the 1985 through 1988 data. Since developing the Preliminary FS, ERM has conducted the 1988 second quarter ground water sampling. The ground water samples were analyzed for the TCL of VOCs, EPA CLP data packages were requested for the data, and a QA/QC review was performed by ERM chemists. Table 3 provides data on the ground water recovery systems at the five locations.

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Identified Data Gaps

The Preliminary FS focuses the RI efforts so that necessary information is determined and acquired for the appropriate selection of remediation. Following a review of the data collected to date, attention will be directed to the four major concerns described below.

During the investigation of the overall ground water status at the site, a limited study of potential soil contamination was conducted. Additional soil sampling will be needed to help determine the source of contamination and the need for possible remediation measures.

A consistent sampling and analysis program should be implemented so that an accurate picture of the contamination can be developed. This program will aid greatly in evaluating the efforts of the present remedial actions and in keeping track of future remedial actions.

The total extent of the contamination is not clear. Sampling should be conducted at Lycoming Creek (surface) and west of the creek (ground water), and sampling should be conducted north of the plant facility to record background levels to verify the extent of contamination.

Data on the behavior of ground water in the area, in particular on the volume and direction of flow in the bedrock, will be needed to help evaluate the current remedial actions' progress and impacts and to evaluate any additional future plan for remediation. Impacts of the remedial activities on air quality will be studied as required.

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Please refer to the Preliminary FS (Appendix C) for further discussions and conclusions.

3.3 RI/FS Objectives

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As stated in the ACO between EPA and Textron Lycoming, the "mutual objectives of EPA and Respondent are: (1) to investigate the nature and extent of the hazardous substances disposed of at the Site ("Remedial Investigation"); (2) to assess the nature and extent of any threat to the public health or welfare or the environment caused by the release or threatened release of TCE and DCE and any other hazardous substances, from the Site ("Endangerment Assessment"), and (3) to evaluate alternatives for any remedial action that may be required to prevent, mitigate or otherwise respond to or remedy the release or threatened release of TCE and DCE and any other hazardous substances, from the Site ("Feasibility Study")."

EPA has agreed to "use the existing data to the extent possible, and incorporate into the RI and FS to the greatest extent practicable to avoid duplication of effort and resources already expended".

It is the opinion of Textron Lycoming and ERM that the existing work including the remedial action taken, comply with the basic requirements of SARA and the NCP. A preliminary FS and EA, and a review of the existing data were completed to determine any data gaps or data needs to more fully comply with SARA and the NCP. The results of the studies were then used to help plan the supplemental RI. The following are the objectives of the Textron Lycoming Williamsport facility RI based on this work:

- Verify the lateral and vertical extent of TCE and DCE contamination in the ground water at the site.

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- Define the TCE plume limits in the bedrock aquifer.

- Determine the relationship between the surface water and ground water, primarily at Lycoming Creek.

- Evaluate the surface water and stream sediment quality in Lycoming Creek and the Susquehanna river.

- Conduct TCL analysis on selected samples of various environmental media.

- Identify the contaminant source areas at the Textron Lycoming facility.

- Assess the environmental impacts, if any, on Lycoming Creek and the Susquehanna River.

- Provide the data base for defining all migration pathways and receptors of concern.

- Perform a risk assessment for contaminants of potential concern so that objectives for the site remediation can be evaluated and defined.

- Define the data base to support the feasibility study.

- Evaluate present remedial actions and determine what levels and types of additional remedial actions are necessary, if any.

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- Complete treatability studies and additional field studies that may be necessary to aid in determining feasible waste treatment and disposal alternatives and other potential remedial measures. Develop preliminary conceptual engineering design and cost estimates for any additional selected remedial measures.

- Develop the final RI/EA/FS report.

An extensive data base has been collected during previous studies and remedial activities. The existing data base provides an extensive characterization of site conditions and fills many requirements of the RI/FS. Thus, the proposed RI/EA/FS scope of work is considered to be supplemental, or a Phase II, effort.

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SECTION 4

TASK PLAN FOR THE REMEDIAL INVESTIGATION

4.1 Task 1 - Project Planning

4.1.1 Sampling and Analysis Plan

This document is the Sampling and Analysis Plan (SAP) for this project. This plan contains the Work Plan/SAP, a Quality Assurance Project Plan (QAPP) and a site-specific Health and Safety Plan. The purpose of the Work Plan/SAP is to provide a detailed description of all RI/FS sampling and analytical activities to be conducted at the site. The field activities will follow current NCP and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidelines. It is also prepared to ensure that all personnel involved are familiar with the details of the site investigation.

4.1.2 Quality Assurance Project Plan

The QAPP is presented as Appendix D. The purpose of the QAPP is to provide specific guidance for environmental sampling to ensure the integrity of values reported for sample parameters. The QAPP describes in detail activities associated with sample collection, chain of custody, equipment calibration, sample preservation and transportation, analysis, and the reporting data.

The QAPP includes all elements as presented in Appendix B of the EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9355.3-01, Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA, March 1988.

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4.1.3 Health and Safety Plan

The Health and Safety Plan, presented as Appendix E, provides guidance on the level of protection required for site personnel. The Health and Safety Plan is site-specific and developed based on data collected during previous studies and on general site conditions. The Plan specifies action levels based on Organic Vapor Analyzer (OVA) readings and constituents known to be present at the site. Action levels dictate the EPA level of safety apparel and working procedures appropriate for particular site conditions. Occupation Safety and Health Administration (OSHA) 1910.120 regulations were followed in developing the plan.

4.1.4 Community Relations Plan

The EPA is responsible for the development of a Community Relation Plan according to CERCLA guidelines, the NCP, and OSWER Directive No. 9230.0-03-a. The EPA prepared plan will describe the procedures for the following activities:

1) informing the affected community about the site;

2) providing periodic progress reports on the finding of the RI; and

3) eliciting and documenting comments and concerns from citizens, local officials, and community or environmental groups.

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4.2 Task 2 - Preliminary Investigations

4.2.1 Chester Engineers Data/Review of Literature

ERM has reviewed information and reports prepared by Chester for the Textron Lycoming Williamsport Plant. The work completed to date by Chester provides a substantial data base on the local geology, shallow hydrogeologic system, shallow ground water contamination plume identification, and aquifer characteristics of the upper bedrock, including presence of contaminants and ground water remediation in the study area. The work completed shows an excellent effort to understand the local geology and ground water system, particularly the glacial overburden material, and to track and identify the limits of the contaminant plumes. The following summarizes the remedial investigation conducted by The Chester Engineers to date:

1) 40 overburden wells
2) 8 bedrock monitoring wells
3) 11 test borings
4) 3 on-site recovery wells with associated stripping towers
5) 2 off-site recovery well systems with associated stripping towers
6) 13 soil sample analyses collected from the test borings
7) Approximately 450 water sample analyses
8) Packer tests of wells MW-55B and MW-56
9) Aquifer tests in conjunction with recovery well installation

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10) Computer models to analyze off-site and on-site ground water and contaminant movement, and to evaluate remedial alternatives

All data compiled from these investigations is presented in Appendix A.

A literature and file search was conducted to obtain additional information concerning the site. Files were reviewed from the PADER case files and the WMWA. Literature was obtained from the PADER and the United States Geological Survey (U.S.G.S.) to supplement existing information concerning the geology and hydrogeology of the area.

The June 1988 sampling event that included analysis for TCL VOCs, complete with full CLP data packages, confirmed the primary VOCs of concern.

4.2.2 Plant Personnel Interviews

Interviews were conducted with a dozen long-time plant employees (active and retired) to assist in determining where potential areas of concern (possible source areas) are located on the plant property. Each employee was questioned about the specific area of the plant in which he or she worked and the activities practiced in these areas. The employees were asked to identify areas of chemical storage, describe waste disposal practices, indicate any areas where spills may have occurred, and indicate any areas of potential environmental concern. From these observations, potential areas of concern were delineated for further investigation.

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4.2.3 Plant History and Operations

A detailed review of the Textron plant history and operations will be conducted, incorporating the results of the literature review and the plant personnel interviews. Attention will be focused on past and present manufacturing processes conducted in identified potential areas of concern.

4.2.4 Aerial Photo Chronology/Fracture Trace Analysis

In addition to the long-term Textron Lycoming plant personnel interviews, a search and review of available maps and aerial photography will be used to document historical activities at the plant and surrounding area to the extent possible. This will assist in identifying possible source areas at the plant, and most importantly, will help identify other potential PRPs or old, abandoned industries that may be contributing to the known TCE ground water problem.

A geologic analysis will be conducted on the photographs and bedrock fracture traces mapped. This analysis will identify any fractures that may serve as preferred directions of ground water flow. Since ground water flow in consolidated rocks is primarily governed by planer discontinuities (i.e., bedding planes, joints and fractures), a fracture trace analysis will assist in gaining a better understanding of the mechanics influencing ground water flow in the bedrock aquifer.

4.2.5 Petrex™ Soil Gas Study

Before the initiation and selection of soil sampling activities, a soil gas survey will be conducted over the Textron Lycoming Plant

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property to determine the presence and extent of subsurface contamination. Soil gas studies are useful as a screening tool to determine the presence or absence of subsurface contamination, thus assisting in the selection of soil boring locations for soil sampling. The Petrex™ soil gas method will be employed over the entire Textron Lycoming plant facility. Petrex™ tubes will be placed at 100-foot centers inside and outside of buildings and other structures on the plant. Fifty-foot centers or 25-foot centers will be placed in areas that have been identified as potential areas of environmental concern.

The Petrex™ soil gas method is designed to detect individual VOCs in the natural flux of soil gas emanating from the subsurface to the atmosphere. A glass collector tube is inserted inside a 1-inch-diameter hole placed 18 to 24 inches below the ground surface. The hole is then backfilled and the tube left in place for up to 30 days. The tube consists of a wire coated with an activated absorbent. The organic compounds in the soil diffuse over the 30-day period into the tube and are absorbed onto the wire. The tube is then removed and sent to the laboratory for analysis. The compounds are desorbed from the wire in the laboratory and ionized. Compounds desorbed are separated according to Mass (Mass Spectroscopy), ions of the specific compound are counted, and ion counts are reported for the compound masses.

Ion counts of specific compounds are identified and extracted from the original data file and are then computerized. The ion counts are assigned to a sample location and are plotted on a location map. These are then contoured by hand by a Petrex™ analyst. Though concentrations cannot be determined using the Petrex™ method, an expression of the relative amount of a compound at a given location can be determined, using the relative ion count

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values. Contour maps are prepared to show relative ion concentrations for individual or group compounds. The difference in the relative ion concentration values are used to evaluate the presence of "hot spots" or areas of suspected soil and/or ground water contamination.

On a selected number of holes in the soil gas study, an OVA and a portable gas chromatograph (GC) will be used to provide on-site analysis of the soil gas collected from the shallow borings. All Petrex™ field sample collection and GC analyses will be performed in accordance with strict sampling and analysis procedures.

4.3 Task 3 - Field Investigations

4.3.1 Topographic Mapping/Surveying

It is the intent of Textron Lycoming to use the existing base map of the site for the RI investigation. The scale for this map is 1-inch equals 200 feet. Vertical and horizontal controls have been established, and all wells have been surveyed by a licensed surveyor. Additional wells will also be surveyed. The base map is presented as Plate 1.

4.3.2 Subsurface Soil Sampling

Soil borings will be completed at each of the "hot spots" identified from the Petrex™ soil gas survey. ERM estimates that a total of as many as 20 soil borings may be required as part of the remedial investigation. The number and location will depend on results of the Petrex™ study. The borings will initially be completed on the plant property. Split spoon samples will be taken continuously ahead of the drill bit if possible. Previous drilling activity and split spoon sampling in the overburden has

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been difficult because of the variability in the location and size of glacial debris. Where boulders or rock fragments are encountered in the glacial overburden, the soil sample will be collected above them. If no boulders or rock fragments are encountered, split spoon samples will be taken continuously to the shallow water table or the top of the bedrock, whichever is encountered first. Soil material appearance and texture will be logged for each sample by an experienced ERM geologist.

As soon as a sample has been brought out of the borehole, the split spoon sampler will be opened and screened with a Flame Ionization Detector-Organic Vapor Analyzer (FID-OVA). The FID-OVA readings from each of the split spoon samples from a boring will be recorded. The sample with the highest headspace reading taken above a sample will be placed in a jar and will be submitted to the laboratory for analysis. Where the headspace readings for each sample in a borehole are similar, physical appearance or odor may be used to select the samples for analysis. In some instances, samples showing low or no OVA readings may be selected for analysis as a background check.

Where appropriate, the sample will be divided as quickly as possible and placed in sample containers. In some cases, two subsamples will be required for quality assurance requirements. At most, three subsamples will be required. If the sample appears homogeneous, then samples will be collected from the center of the split spoon. If the samples are heterogeneous, then samples will be composited from different sections of the split spoon. Agitation of the sample will be avoided to prevent the loss of volatile organic compounds. The sample will be divided with a stainless steel or teflon spatula, and the subsamples will be placed in appropriate containers. Following completion of sampling at a location, the borehole will be backfilled with the

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original soil mixed with bentonite. Soils will be placed in the hole in the reverse order from which they were removed during sampling.

Soil boring locations will be finalized after results of the soil gas survey are evaluated. Tentatively, as many as twenty soil samples may be required. Approximately four of these samples will be collected in the area of the waste water treatment plant and analyzed for TCL metals and volatile compounds. Approximately six samples will be located in the areas where oil spraying was conducted in the past, and analyzed for PCBs and volatile organic compounds. The remaining samples will be collected from area's identified as "hot spots" in the soil gas study and analyzed for TCL volatiles. Five of these samples will be selected for analyses of the entire TCL compound list.

4.3.3 Surface Water and Sediment Sampling

The objectives of the surface water and stream sediment sampling program are to define the nature and extent of any site-related compounds in Lycoming Creek and to evaluate if there are other potential sources in the vicinity.

Five surface water and five sediment samples will be collected from Lycoming Creek. ERM will duplicate the sampling locations used by Chester and include several others to improve the data base for surface water and sediment sample data. Samples will be collected upstream from the Textron facility and particularly upstream and downstream from the Oliver Street Storm Sewer Outfall. Surface water samples will be collected first at each station to prevent solids from being introduced into the samples.

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Surface water and sediment sample locations are shown on Figure 8. The sampling locations include all 3 locations used by Chester plus two additional locations, one further upstream as suggested by EPA and one further downstream. Surface water samples will be taken from the east side of Lycoming Creek. The sediment samples will be collected from the same locations as the surface water samples, and will be collected from depositional areas along the stream bed of Lycoming Creek.

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The sediment and surface water samples will be analyzed for the full TCL list of compounds. The surface water samples will be measured for Eh, pH, specific conductance and dissolved oxygen in the field. Additional parameters to be analyzed for in the laboratory will be total suspended solids, alkalinity, hardness, BOD, COD and TOC. Sediment samples will be analyzed for temperature, Eh, pH, specific conductance, and color using the Munsell color chart in the field.

One sample from the storm sewer will also be taken at the outfall from the Textron facility into the storm sewer system that discharges into Cemetery Run. This sample will be analyzed for the full TCL analysis. The location of this outfall, at the intersection of Memorial Avenue and Cemetery Run is indicated on Figure 8.

Surface water elevations of Lycoming Creek and the Susquehanna River will be obtained. A permanent staff gauge or other reference point(s) will be placed at both surface water bodies so that surface water level measurements can be taken in the future. The reference point(s) will be surveyed for horizontal and vertical control by a licensed surveyor. The compilation of these comprehensive water level data will enable ERM to better define

Figure 8
Surface Water and Sediment Sample Locations
Textron Lycoming

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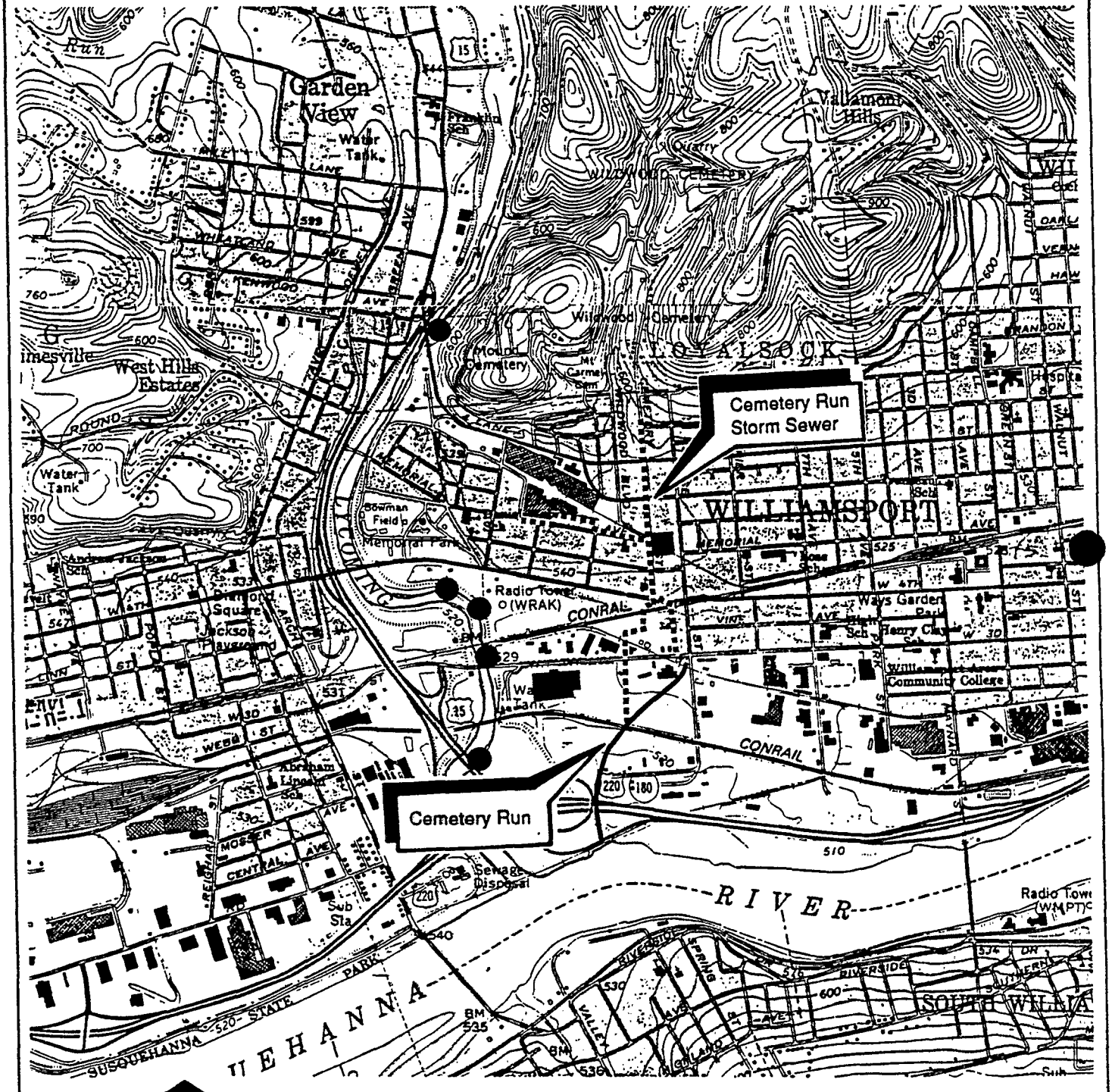

N

2000 0 2000

Scale in Feet

● Surface Water/Sediment Sample Location

■ Storm Sewer Sample Location

▪▪▪▪▪▪▪ Cemetery Run Storm Sewer

USGS 7.5 minute Topographic Quadrangles: Williamsport, PA; Cogan Station, PA.

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the relationship between the surface water bodies and the ground water system.

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Surface water flow data will also be obtained for Lycoming Creek. ERM will conduct a stream flow survey utilizing stream gauges (gurley meters) over the course of Lycoming Creek. The compilation of the stream flow data will be useful in determining whether or not ground water is discharging to, being recharged by, or underflowing Lycoming Creek.

4.3.4 Wetland Reconnaissance and Biota Inventory

The potential presence of endangered species at or near the site will be determined, and the immediate site environs will be surveyed for the presence of wetlands and floodplains as directed in the U.S. EPA Policy on Floodplains and Wetland Assessments for CERCLA Actions. Wetlands will be initially determined based on published wetland maps of the U.S. Fish and Wildlife Surveys (USFWS). Field studies will verify any USFWS identified wetlands as well as determine approximate wetland boundaries. The field studies will also be conducted to identify and map any wetland areas not mapped by the USFWS. Approximate floodplain boundaries will be determined using information from the Federal Emergency Management Agency and other state and federal agencies. The wetland/floodplain data will be used to identify critical habitats and will be utilized in assessing the various remedial alternatives in regard to the previously mentioned policy on floodplains/wetlands.

The Biota Inventory will be completed by establishing benthic macroinvertebrate stations in Lycoming Creek. The stations will be established in the vicinity of the five surface water and sediment sampling locations described in Section 4.3.3.

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The proposed sampling stations were evaluated in the field by an ERM biologist. In general all five stations are relatively deep (depth 1.5 - 3 feet). Three of the five stations are in riffle areas (fast following areas over rocks) and two areas are located in pools. This variation in habitat and water depth will make sampling difficult, at least at stream flows greater than the annual low flow period, (low flow usually late summer, early fall).

Since all areas are not suitable for use of surber samplers due to water depth, quantitative sampling utilizing Hester-Dendy multi-plate samplers and qualitative kick-nets will be conducted. The multi-plate samplers will be placed above the natural substrate. Downstream of the samplers, 3 timed kick-net samples will be collected. Relative abundance of organisms captured in the kick-nets will be recorded in the field. The multi-plate samplers will be allowed to colonize for 4 - 6 weeks, after which they will be retrieved by placing a plastic bag over the sampler, sealing the bag and then pulling the sampler from the substrate. The sampler and contents of the bag will be placed in a jar of preservative and transported to the ERM laboratory. Field techniques will follow the methods detailed by EPA (1973).

Multi-plate sampling has the advantage of providing consistency of sampling at stations with varied habitats. Other sampling techniques may be feasible but the results will reflect habitat differences between the sampling stations. Multi-plate samples provide consistency over the varied habitats. The multi-plate samples will also provide a representative quantitative collection of benthic organisms allowing an evaluation of the health of Lycoming Creek.

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Organisms, with the exception of worms and leaches, will be identified to Genus. Statistical analysis of the benthic invertebrate data will be conducted using standard techniques, such as diversity, richness, and similarity indices. Other appropriate techniques to measure significant differences between samples will be utilized as appropriate. Elliot (1977) and Green (1979) will be used as statistical references.

The PADER has established a water quality network (WQN) station approximately 15 miles upstream of the mouth of Lycoming Creek. A USGS stream gauge is also located there. Water chemistry data and benthic invertebrate data is available from this location. This background data will be useful in comparing the study area to a further upstream location.

Sampling will be conducted as close to low stream flow conditions as allowed by the project schedule. Since the Multi-plate samplers are in-situ devices, six (6) to eight (8) samplers will be placed in each location so that a sufficient number could be expected to be retreived, which will allow for statistical analysis of the results.

Grain size has an important influence on the number and type of benthic invertebrates. A station with a very fine (clay/silt) characteristic would probably support a different assemblage of organisms than a station with a sand/gravel consistency. The discretion of the senior biologist will be used to select the station location(s) and an effort will be made to sample all stations with similar sediment characteristics. Samples for grain size analysis will be submitted from the sampling station as a basis for evaluation.

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4.3.5 New Bedrock Well Installations and Coring

The bedrock study is designed to provide information on the lower portion of the bedrock that has not yet been investigated. Additional deep bedrock wells will be completed within the study area, particularly in the downdip direction in the Tully Member.

Five additional bedrock borings will be drilled. The borings will be installed both upgradient and downgradient from the area identified as containing shallow ground water contamination along the ridge (bedrock high) parallel to strike in the Tully Member. Two of the wells will be completed at deeper depths than the existing bedrock wells. These additional wells will be installed as nested wells near the existing deep bedrock wells, but will be screened at different depths within the bedrock aquifer. The purpose of installing nested wells is to examine a vertical hydraulic gradient within the bedrock aquifer that could be a mechanism for transporting contaminants deep within the bedrock system. The remaining three wells will be located in the downdip section of the Tully Member, to confirm the presence/absence of contaminants deeper in the bedrock, and to delineate the piezometric surface within the Tully member. The approximate locations of the proposed monitoring wells are identified in Figure 9.

The monitoring wells will be installed using a drilling contractor who complies with the recently promulgated OSHA requirements for investigations at hazardous waste sites. All drilling equipment will be decontaminated prior to initiation of the drilling program, between boring locations and prior to leaving the facility. Auger flights, drill stems, and associated downhole tools will be cleaned with high-pressure water and then clean scrubbed with a cloth. As an additional precaution, monitoring

Figure 9
Proposed Bedrock Monitoring Wells
Textron Lycoming

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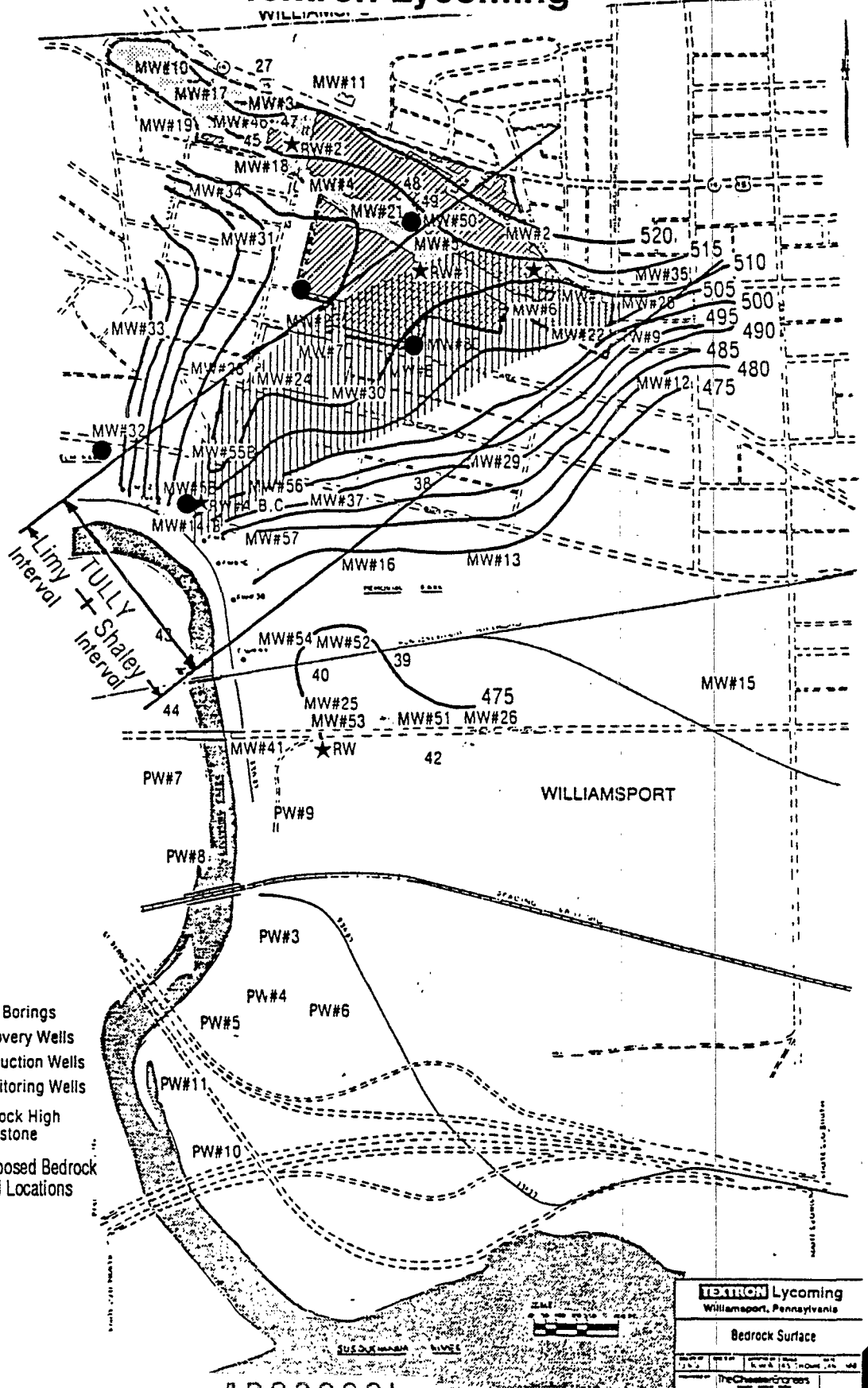

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wells and soil borings will be drilled in order from the anticipated least-contaminated to most-contaminated locations, based on the existing ground water quality data. An on-site source of potable water will be used in all drilling equipment cleaning steps. If deemed necessary, the water source may be sampled for analysis during completion of the project to verify its integrity. An on-site cleaning station will be established for all drilling equipment, including activities.

ERM's on-site geologist will supervise the various aspects of the drilling and well installation operations and will maintain a log of materials encountered, subsurface conditions, and well construction. For each monitoring well installed, a lithologic log will be developed, including water level observations.

The wells will be installed by the open hole procedure. This entails drilling a 10-inch hole, with 6-inch casing grouted at least 5 feet into the bedrock and then the boring advanced below the casing and left as an open hole to intercept ground water. It is anticipated that the deep wells may be cased to a maximum of 100 feet in depth. Two of the wells will be cored before the monitoring wells are constructed to provide a representative profile of the deep bedrock lithology and identify the nature and extent of weathering, or the presence of fractures. At locations where coring will be performed, the boring will be reamed to a 6 inch diameter hole prior to installation of the monitoring well. Upon completion, the newly installed monitoring wells will be developed using the drill rig air compressor. Upon completion, each monitoring well will be provided with a protective steel casing with a lock and a cap with a cement anti-seepage collar. The locations, casing elevations and land surface elevations at all ground water monitoring wells and piezometers will be surveyed and referenced to a common benchmark.

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4.3.6 Ground Water Sampling

ERM proposes that the new wells and only a limited number of existing wells be analyzed for the full TCL. The remaining wells will be analyzed for the identified contaminants of concern (TCE and DCE). The proposed RI ground water sampling will be one of the scheduled quarterly sampling events being done at the direction of PADER. The historical analytical water quality data base for the monitoring wells was used as a basis to determine which wells will and which wells will not require the full TCL analysis. To support this effort, the June 1988 sampling event included a full TCL-VOC analysis with CLP data package deliverables. Based on this additional effort, the following wells are proposed to be sampled for a complete TCL analysis to verify the presence/absence of the contaminants of concern in key areas of the site:

- The 5 proposed bedrock wells;
- Five of the existing bedrock wells; MW-8D, MW-22, MW-23, MW-53, and MW-57.
- Eight wells located in the shallow aquifer; MW-3, MW-6, MW-7, MW-8, MW-32, MW-36, MW-50 and MW-25.

Figure 10 shows the existing wells to be sampled.

ERM proposes to utilize a site-dedicated stainless steel and teflon constructed 2-inch diameter pump to purge the new wells and the existing wells to be sampled. The purging sequence for each group of wells will be from cleanest to dirtiest to further reduce the possibility of cross contamination.

Figure 10
Proposed TCL Analyses
Textron Lycoming
Williamsport, PA

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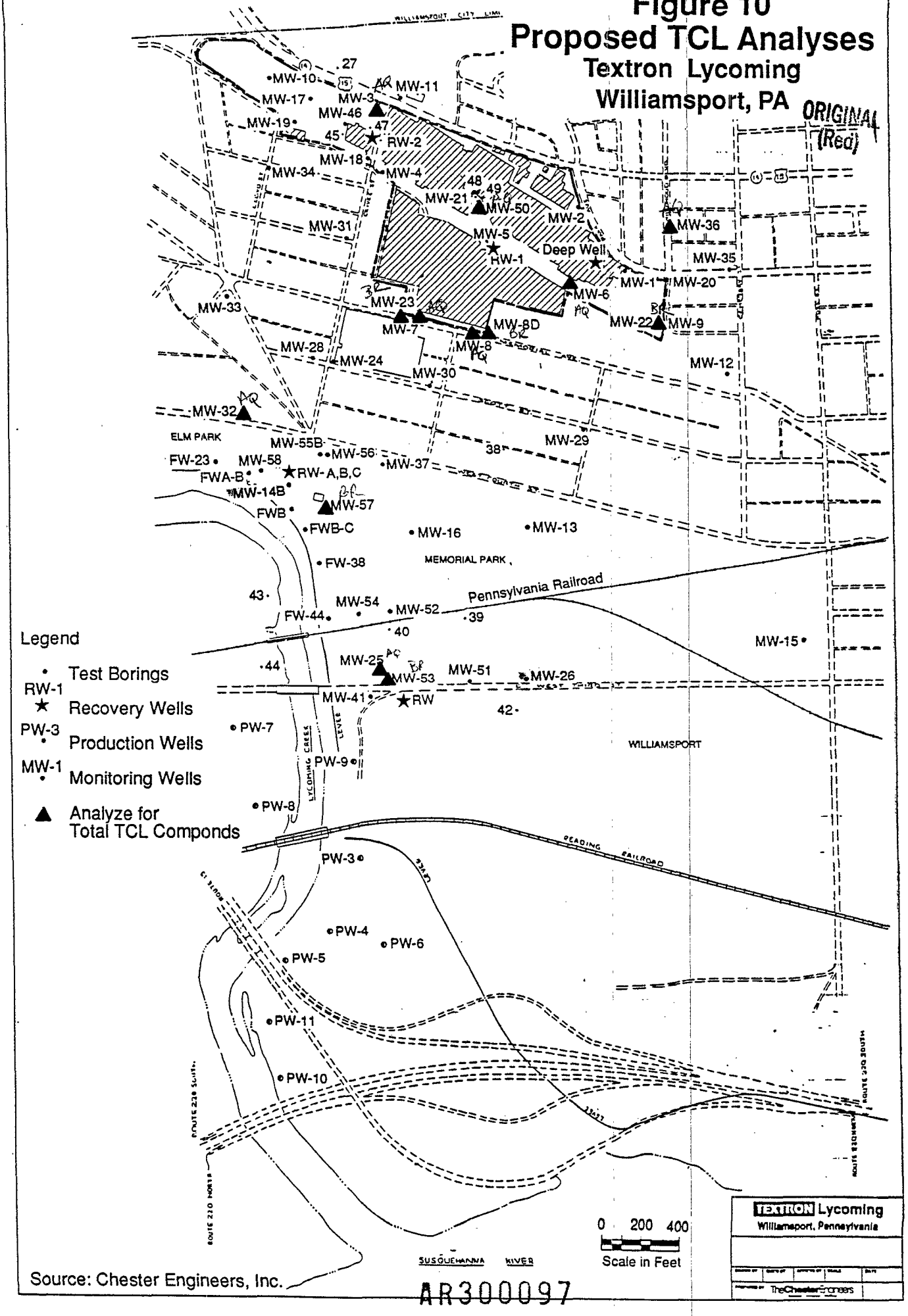

Source: Chester Engineers, Inc.

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For well purging, a minimum of three well volumes of water will be pumped or the well will be pumped dry, whichever occurs first. Pumping until pH, temperature and specific conductivity stabilize as typically specified by EPA may produce large purge volumes on some wells, possibly producing unrepresentative results for that sampling location as more contaminated or less contaminated water is pulled into the well from further away, thus raising or diluting contaminant levels at the well being sampled. Purge water will be collected in 55-gallon drums. The drums will be taken to the plant, where the purge water will be put into the influent line for one of the on-site recovery systems, where it will be treated and discharged with the recovered ground water.

4.3.7 Aquifer Testing

Pump tests and analysis, including computer simulation, have already been completed for the recovery wells in the glacial overburden. The availability of detailed information precludes the need to duplicate it. Packer testing completed in two of the deep wells by Chester indicated that hydraulic conductivities decrease with depth in the bedrock aquifer. The new bedrock and existing bedrock wells will be slug tested by conventional methods. Pump tests are not advised because of the potential for drawing contaminants into other parts of the bedrock aquifer. Slug testing will help further define the hydraulic properties of the bedrock aquifer. The additional slug testing will be conducted during the RI to supplement the information on the bedrock aquifer.

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4.3.8 Air Monitoring

Air work for the Textron Lycoming Williamsport, Pennsylvania Plant will be conducted in two phases. Phase I consists of the following tasks:

- conduct a site visit by ERM's Air Quality Group;
- collect all pertinent information regarding emission rates of compound(s) of concern from the stripper towers;
- examine all existing air permits issued by PADER for the air stripper at the facility;
- gather relevant physical information related to the air strippers and nearby residential areas;
- examine existing data for the air strippers;
- identify all ARARs that are legally enforceable, deemed relevant and appropriate, of to-be-considered materials (TBCs) with PADER and EPA assistance; and
- use the Industrial Source Complex (ISC) or equivalent screening model to evaluate the impact of the air stripper emissions at the nearest residence.

If Phase I screening indicates a potential risk or hazard to the nearby population, then detailed air modeling would be required. Phase II consists of the following tasks:

- stack testing of the air strippers for only the compounds of concern to determine more accurate air emissions; and

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- detailed modeling using ISC and other appropriate models and a year or more of representative meteorological data.

Any required air sampling will be conducted in accordance with US EPA guidelines and/or procedures.

4.4 Task 4 - Sample Analyses and Data Evaluation

All EPA-RI, and PADER-required quarterly sampling will be conducted according to EPA protocols. Analyses for RI samples will be by EPA CLP methods and QA/QC standards. QA/QC analysis will include matrix spike duplicates, method blanks and field blanks. Sampling and analytical plans and QA/QC methods are presented in detail in the QAPP.

The QAPP defines the QA measures necessary to ensure that accurate and precise data are collected during the RI. The plan is tailored to meet the specific requirements for properly characterizing the Textron Lycoming site and the needs of the interdependent RI and FS. At a minimum, the QAPP addresses the following elements:

- Objectives of QA/QC
- QA/QC aspects of measurements, sampling, and analytical procedures
- Equipment decontamination procedures
- Calibration, preview time maintenance, and corrective maintenance

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- Data reduction and interpretation procedures
- Performance audits
- Decontamination and document control for QA/QC
- Personnel responsible for QA/QC task

4.5 Task 5 - Data Evaluation

As the analytical data reviews are completed, the RI, EA, and FS staff will review components of the data base for adequacy. The data will be plotted on site maps to allow construction of isoconcentration maps, ground water configuration maps, and cross sections, where appropriate. The FS and EA team will review the data on ground water, soils, surface water and sediment to determine if any unexpected data gaps exist which would prevent completion of the FS or EA. The RI geologists, hydrologists and other scientists will review the data base to define the geologic, hydrogeologic, and hydrologic frameworks at the site.

The data evaluation process will be on-going throughout the RI tasks. As new data are generated, they will be integrated into the existing base and evaluation continued. To allow for maximum integration with the RI data base, similar methods and formats will be applied to similar data; for example, tabulated data presentation and computerized approaches to data evaluation will be consistent.

4.6 Task 6 - Endangerment Assessment

The Endangerment Assessment Document will be submitted after the submittal of the RI Report. ERM's EA document contains sections

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addressing site background; methodologies; indicator compounds/constituents; exposure evaluation, including fate and transport of the compound/constituents, toxicology evaluation including individual profiles of the compounds of concern; calculation of noncarcinogenic and carcinogenic risk; comparison with ARARs; uncertainty in assumptions and state/federal methodology; environmental EA; and results and discussion.

4.6.1 Phase I EA

There are four evaluations that must be completed in a SARA Phase I EA following EPA procedures and guidelines:

- Identification of indicator compounds/constituents, which are used to represent carcinogenic and noncarcinogenic risk at the site;

- Exposure evaluation, including the calculation of doses to potentially exposed populations, the improvement of the conceptual model developed for the Textron Lycoming Site in the preliminary EA, and the following:

  - Source(s) of compounds/constituents at the site;

  - Potential exposure points for endangerment to humans, terrestrial, and aquatic life;

  - Transport pathways between source(s) and potential exposure points;

  - Air modelling, as outlined in Section 4.3.9, showing the risk of the concentrations of compounds detected in the air to potentially exposed populations; and

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- Potentially exposed populations considered for this site are workers on site, nearby residential areas, and recreational users of the parks as well as aquatic life;

- Toxicity evaluation of the potential carcinogenicity of site indicator compounds/constituents, noncarcinogenic effects and development of environmental standards or ARARS, which includes the following:

  - Identification of regulatory standards, if any, for each compound/constituent detected at the site; and

  - Development of health-based numbers (i.e., action levels) for compounds/constituents which do not have standards; and

- Characterization of the risks to a population caused by exposure to each indicator compound, including the following:

  - Determination of noncarcinogenic risks posed by the compounds/constituents at the Textron Lycoming Site;

  - Determination of carcinogenic risks posed by the site compounds/constituents; and

  - Comparison of concentrations of compounds /constituents detected at the site with ARARs and/or developed health-based numbers.

The first EA task will examine potential risks to receptors due to air emissions from the Textron Lycoming Site to the nearest receptor in the major wind direction. Air sampling proposed at

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the upgradient and downgradient site boundaries will be used to determine background air concentrations and air concentrations leaving the site boundary in the direction of the residential areas. The air concentrations of detected compounds will be dispersed to the residential areas, exposure doses and intakes and subsequently any risks at this receptor will be determined.

The second task involves the determination of soil cleanup levels (SCL), which includes back-calculation from acceptable ground water standards at the site boundary to the soils in the source areas. This back-calculation will employ either or both of the following:

- Organic Leachate Model (OLM) or other soil leaching model for the unsaturated zone, and
- A ground water contaminant migration model.

The source areas at the Textron Lycoming site have not been completely defined at this time. This task will allow the calculation of higher concentrations of contaminants to remain in the soil than would cleaning up to background levels.

4.6.2 Phase I EA Report

The Endangerment Assessment document will be submitted to the U.S. EPA two months after the submission of the Remedial Investigation Report. The level of detail of this document depends upon the results of the RI.

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4.6.3 Phase II EA

The Phase II EA will consist of the following evaluation:

- Assessment of Remedial Alternatives (FS) which compares the risk identified by the site under the no-action alternative (i.e., existing site conditions) to remedial alternatives proposed during the FS. This assessment satisfies the public health and environmental analyses criteria for selection of a remedial alternative under SARA.

The Phase II EA will be a part of the FS and will be necessary only if current site conditions indicate a need to investigate site impacts. The implementation of this phase depends upon the results of the Phase I EA. If the site meets ARARs or has an acceptably low level of risk, then no further action will be taken at the site. For this assessment, it will first be determined if any population (human or non-human) may be affected by the remedial alternatives. If so, a comparison with appropriate and relevant human and/or aquatic/terrestrial life standards will be made.

4.6.4 Environmental EA

The National Contingency Plan (NCP) 300.72 Subpart G and SARA authorized the Secretaries of the Departments of Commerce (DOC) and Interior (DOI) to act as co-trustees for the natural resources at the Textron Lycoming Site.

The results of the RI and the preliminary EA and FS indicate that an environmental EA will be required at the Textron Lycoming Site. If no risks to the aquatic/terrestrial environments are identified during the RI, then the environmental assessment will consist of a

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comparison to ARARs. However, if the data show an impact on the aquatic/terrestrial environment, then an environmental EA will be conducted. An environmental EA for Lycoming Creek, and possibly for the Susquehanna River, will include the following tasks:

- surface water analyses;
- sediment analyses;
- macroinvertebrate population analyses;
- wetlands delineation;
- site walkover by senior biologist to determine:
  - plant species and diversity,
  - animal species and diversity,
  - bird species and diversity, and
  - aquatic life species and diversity;
- endangered species determination;
- regional ecology study;
- protection and uses of surface water bodies in the vicinity of the site; and
- recreational uses of the regional surface water bodies.

The specific tasks for the Textron Lycoming Site environmental EA will depend on the results of the aforementioned phased approach and EPA input. Information collected during the RI and Preliminary EA and FS will be used to the extent possible to eliminate the duplication of field efforts.

4.7 Task 7 - Remedial Investigation Report

The preliminary and final RIs will be prepared and submitted to the EPA for review and comment.

The RI report will present the methods used for and results of tasks and all data collected during the field investigation and will evaluate the data to define the following:

- Site geologic, hydrogeologic and soil conditions;
- Source units and their waste characteristics;
- The pathways of contaminant migration, including ground water, surface water, and soils;
- The nature, extent and dynamics of contaminant presence and migration in each pathway or site medium; and
- Aquifer characteristics at the site, including transmissivity, storage coefficients, specific yields, and ground water flow velocities.

The report will be comprehensive and will include maps, geologic cross sections, water table/piezometric surface maps, isoconcentration maps, geologic and hydrogeologic cross sections and any other graphics that prove valuable to depict or evaluate site conditions. All raw data and calculations made will be presented in appendices.

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SECTION 5

TASK PLAN FOR THE FEASIBILITY STUDY

The Comprehensive FS will be performed in accordance with CERCLA, NCP, and EPA guidances. It will also follow the intent of SARA, promoting the selection of a reasonable remedial alternative that will permanently and significantly reduce the toxicity, mobility, and/or volume of hazardous waste present at the site.

5.1 Remedial Alternatives Screening

5.1.1 Development of Remedial Response Objectives and Response Actions

Site-specific remedial objectives will be identified based on all available information from the RI, the EA, and the preliminary FS. These remedial objectives will identify the areas/media that meet the following criteria:

- are in non-compliance with Applicable or Relevant and Appropriate Requirements (ARARs),
- pose potentially unacceptable risk to public health, and
- are sources of constituent migration to other media or receptors of concern.

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5.1.2 Identification of Applicable Technologies and Assembly of Alternatives

After identification of the areas requiring remediation, the list of the potentially feasible remedial technologies from the preliminary FS will be reviewed and modified as necessary. These remedial technologies address surface water, ground water, soils, and air, as necessary, to meet FS objectives, and include the following:

- Collection and Containment Technologies,
- In Situ Treatment Technologies, and
- On-Site and Off-Site Treatment/Disposal Technologies.

The list of potentially feasible technologies will be screened based on site conditions, waste characteristics, and technical requirements to eliminate or modify those technologies that may prove extremely difficult to implement, will require unreasonable time periods, or will rely on insufficiently developed technologies.

Alternatives will incorporate the available and appropriate remedial technologies, remedial objectives, and other appropriate considerations into a comprehensive, site-specific approach. They will include the following:

- remedial alternatives to meet ARARs;
- remedial alternatives to reduce site risk to acceptable levels, where ARARs do not exist and/or the risk exceeds EPA acceptable levels;

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- remedial alternatives to reduce site risk to acceptable levels, where site conditions prohibit the attainment of ARARs; and

- remedial alternatives to minimize compound migration to other receptor media that exceed ARARs or acceptable risks.

5.1.3 Screening of Remedial Technologies/ Alternatives

The alternative developed will be screened to narrow the scope of alternatives to a workable number for detailed evaluation. To the extent appropriate, those alternatives identified in the preliminary FS will serve as a basis for this process.

In accordance with CERCLA guidance, the initial screening process shall consider environmental and public health criteria, and an "order of magnitude" cost screening. The following factors must be considered:

- Environmental and Public Health Protection - Only those alternatives that satisfy the remedial objectives and contribute substantially to the protection of public health, welfare, or the environment will be considered further. Source control alternatives are those that will achieve adequate control of source materials. Management of migration alternatives will minimize or mitigate the threat of harm to public health, welfare or the environment. In addition, any alternatives that may themselves pose the potential for creating significant adverse environmental effects will be excluded.

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- Cost - An alternative whose cost far exceeds that of other alternatives will usually be eliminated unless other overwhelming significant benefits may also be realized. Total cost will include the cost of implementing the alternatives and the cost of operation and maintenance. The construction and operation and maintenance cost estimates will be developed for comparative purposes only; their accuracy is not suitable for planning capital budgets.

The cost screening will be conducted only after the environmental and public health screenings have been performed, and will thus be conducted only for alternatives satisfying those criteria; thus, cost information will be developed for feasible alternatives only.

5.2 Remedial Alternatives Evaluation

A detailed analysis of the alternatives identified as feasible shall be performed, including the following analyses:

- Public Health Concerns - Each alternative will be assessed in terms of the extent to which it mitigates the potential for long-term exposure and protects public health, both during and after completion of the remedial action. The assessment will describe the levels and characterizations of chemical constituents on site, potential exposure routes, and the potentially affected population, if any. The effects of "no-action" and the other alternatives will be described in terms of short-term effects, long-term exposure, and resulting potential public health impacts. Each remedial alternative will be evaluated to determine the level of potential exposure and the expected reduction over time as a result of its implementation. The relative reduction in public health impacts that would result from each alternative will be

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determined by comparing residual concentrations of compounds associated with each alternative to the ARARs (ground water, surface water) or SCL (soil) determined for the Textron Lycoming site. For source control measures, the comparison will be based on the relative effectiveness of technologies in mitigating exposure potential and/or contaminant migration to other media or receptors. The no-action alternative will serve as the base of comparison for the other alternatives.

- Environmental Impact - An environmental assessment will be performed for each alternative evaluated. The environmental assessment will include, at a minimum, an evaluation of beneficial effects of the response and potential adverse effects of the response, and an analysis of measures to mitigate any adverse effects. The no-action alternative will be fully evaluated to describe the current site situation and anticipated environmental conditions if no actions are taken. The no-action alternative will then serve as the base of comparison for the other alternatives.

- Economics - The cost of each feasible remedial action alternative (and for each phase or segment of the alternative) will be evaluated. The cost will be presented as a present worth cost and will include the total cost of implementing the alternative and the annual operating and maintenance costs. Both monetary costs and associated non-monetary costs will be included. A description of cost over time will be provided.

- Engineering Practicability - This analysis will include the following tasks:

- Describe appropriate treatment, storage, and/or disposal technologies.

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- Discuss how the alternative does (or does not) comply with specific requirements of other environmental programs.

- Provide an outline of the operation, maintenance, and monitoring requirements of other environmental programs.

- Identify and review potential off-site treatment or disposal facilities, if applicable, to ensure compliance with applicable RCRA and other EPA environmental program requirements.

- Describe whether the alternative results in permanent treatment or destruction of the chemical constituents, and, if not, the potential for future contaminant release to the environment.

- Outline safety requirements for remedial implementation (including both on-site and off-site health and safety considerations).

- Determine if and how the alternative could be phased.

- Describe special engineering requirements of the remedy or site preparation considerations.

• Institutional Analysis - Each alternative will be evaluated based on relevant institutional needs. Specifically, Pennsylvania and federal regulatory requirements, permits,

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community relations, and participating agency coordination will be assessed.

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- Evaluation of Cost-Effective Alternatives - Alternatives will be compared using technical, environmental, and economic criteria. At a minimum, the following areas will be used to compare the alternatives:

  - Present Worth of Total Costs - The net present value of capital and operating and maintenance costs will be presented.

  - Health Information - For the no-action alternative, a quantitative statement including an estimated range of maximum risks will be provided. Where quantification is not possible, a qualitative analysis will be provided. The SCL concept will be applied, if appropriate.

  - Environmental Effects - Only the most important effects or impacts will be summarized. The SCL concept will be applied, if appropriate.

  - Technical Aspects of the Remedial Alternatives - The technical aspects of each remedial alternative relative to the others will be clearly delineated. Such information will be based on ERM's professional opinion regarding the site and the technologies comprising the remedial alternatives.

  - Information on the "Extent to Which Remedial Alternatives Meet the Technical Requirements and Environmental Standard of Applicable Environmental Regulations" - This information will be arranged so that

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differences in how remedial alternatives satisfy such standards are readily apparent.

- Information on Community Effects - Information will be provided to address the extent to which implementation of a remedial alternative disrupts the community (i.e., traffic and temporary health risks).

- Other Factors - This category of information will include such things as institutional factors that may inhibit the implementation of a remedial alternative and any other site-specific factors, as identified in the course of the detailed analysis, that may influence which alternative is eventually selected.

5.3 Feasibility Study Report

A comprehensive report describing the FS process and the results will be prepared for submission to the EPA.

SECTION 6

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PROJECT MANAGEMENT APPROACH

6.1 Organization and Approach

The following responsibilities and authorities have been assigned to designated personnel for the RI/FS/EA activities concerning the Textron Lycoming site.

ERM Inc., Principal-in-Charge

Mr. Ronald Landon is the Principal-in-Charge for all facets of the Textron Lycoming site project. Mr. Landon is responsible for the oversight and quality review of the various elements of the total project.

ERM, Inc., Project Director

Dr. Charles Bandoian is the Project Director for the Textron Lycoming project. He provides technical quality assurance review, assists in the coordination of the RI/EA and FS components, participates in meetings and regulatory negotiations, and provides an upper level ERM contact for the client.

ERM, Inc., Project Manager, RI/EA/FS

Mr. Richard Wroblewski will serve as Coordinating Project Manager of the RI/EA/FS and is responsible for oversight and coordination of the various integrated elements of the RI/EA/FS. The project manager will maintain daily contact with the investigation's progress, review project schedules, review all major work elements

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prior to submittal, and maintain routine contact with Textron Lycoming and EPA.

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Textron Lycoming, Project Manager

The person appointed by Textron Lycoming to monitor all services performed by ERM or ERM's designated contractor is Mr. Lee Trefsger, Environmental Manager, Plant Operations.

Various personnel within ERM have been assigned project responsibilities. The project organization chart is illustrated by Figure 11.

6.2 Reporting

6.2.1 Progress Reports

Beginning 30 days after EPA approval of the complete SAP, written progress reports for each 30 day period will be submitted to EPA as required by the ACO. These reports will discuss the following items:

- Status of work and progress to date at the site;
- Update project schedule;
- Preliminary results of sampling and tests;
- Planned activities for the next 30 days;
- Difficulties encountered during the reporting period;

- Summary of field modifications made to intended protocols; and

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- Any proposed expansion of scope that may be determined to be necessary.

6.2.2 RI/EA/FS Reports

The draft and final RI/EA/FS reports will be submitted to EPA for review. Within 30 days of receipt of EPA comments on the draft or final reports, the reports will be amended and re-submitted unless additional field work is recommended.

The RI and EA reports will be submitted together and the FS will be submitted within 60 days of the approval of the RI and EA submission.

6.3 Project Schedule

The schedule for the proposed RI/EA/FS study is presented in Table 4. This figure illustrates the schedule for individual tasks and anticipates timing of meetings and deliverables.

The duration of the project is approximately 138 weeks. This schedule is partially based on the EPA review periods outlined in the ACO dated 25 June 1988. If these review periods are exceeded, subsequent tasks will be extended by at least an equal amount of time. If administrative delays cause field work to be conducted in the winter months, the schedule will need to be expanded. This schedule assumes minimal treatability work is necessary and does not include time for supplemental field activities that are not outlined in this work plan.

FIGURE 11

Project Organization Chart

Textron Lycoming

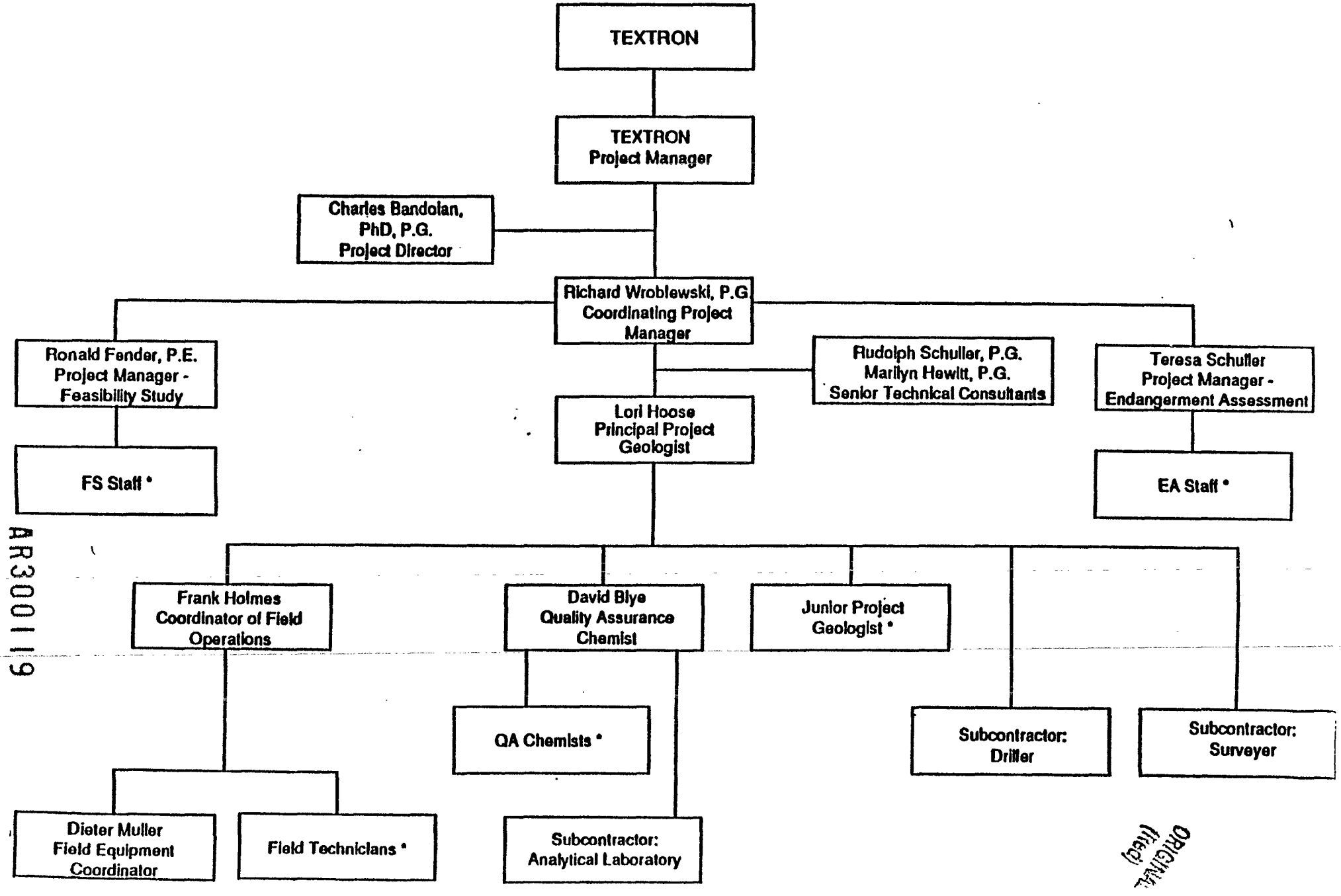

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TABLE 4
TENTATIVE RI/FS PROJECT SCHEDULE
TEXTRON LYCOMING

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Sept. 1988	Draft Scope of Work/Work Plan	90 calendar days after effective date of the administrative Consent Order (ACO)*
Dec. 1988 Jan. 1989	EPA Comments	30 calendar days after receipt of Scope of Work/Work Plan
April 1989	(Authorization to submit revised Work Plan)	
May 1989	Revisions to Scope of Work/ Work Plan	30 calendar days after EPA comments
May 1989	Draft Sampling and Analysis Plan (SAP)	60 calenar days after approval of Scope of Work/Work Plan
	EPA comments	30 calendar days after receipt of Sampling and Analysis Plan (SAP)
	Revisions of SAP	30 calendar days after receipt of SAP
	Initiation of Field Investigation	30 calendar days after EPA approval of SAP
	Monthly Progress Reports	Every 30 days after approval of SAP
	Draft Remedial Investigation (RI) Report	280 calendar days after initiation of field investigation
	EPA Comments	45 calendar days after receipt of RI report
	Revisions of RI Report	45 calendar days after receipt of EPA comments
	Draft Feasiblility Study (FS) Report	180 calendar days after EPA approval RI/EA report
	EPA Comment	45 calendar days after receipt of draft FS of report
	Final FS	45 calendar days after receipt of EPA comments

* Effective Date of ACO - 27 June 1988

The ERM Group

APPENDICES

APPENDICES

AR300121

A

ORIGINAL (Red)

Appendix A

Historical Analytical Data

AR300123

The ERM Group

ORIGINAL (Red)

TABLE 1

GROUND WATER SAMPLE ANALYTICAL DATA

The ERM Group

TABLE 1

TEXTRON LYCOMING
WILLIAMSPORT FACILITY

Analytical Results for Monitoring Wells at the Textron Lycoming Facility, Williamsport, PA.

HIT COMPOUNDS		1,2-Dichloro-ethylene(Total)	Trichloro-ethylene	Benzene	Chloroform	1,1-Dichloro-ethane	1,1-Dichloro-ethylene	Ethylbenzene	Toluene	1,1,1-Trichloro-ethane	Vinyl Chloride	Total Chromium
WELL NUMBER	DATE	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppm
MW-1	2/6/85	120	500	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/5/85	78	1170	<10	<10	<10	<10	<10	<10	21	<10	<.005
	1/31/89	120	2700	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-2	2/6/85	<10	17	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/6/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	0.008
	10/4/88	<5 J	<5 J	<5 J	<5 J	<5 J	<5 J	<5 J	<5 J	<5 J	<10 J	NA
	10/4/88	Tetrachloroethylene = 2 J										
	1/17/89	<1	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-3	2/11/85	850	1460	<10	<10	<10	10	<10	<10	<10	<10	NA
	3/6/85	<10	3379	<10	<10	<10	17	<10	<10	<10	<10	8.1
	1/23/86	3460	3406	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/5/86	2600	3300	<10	<10	<10	<10	<10	<10	<10	504	NA
	9/3/86	118	380	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	242	556	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	652	919	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/30/87	21	135	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	<5	90	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	13	144	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/29/87	26	150	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	356	608	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	1400	4000	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/26/88	12	75	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/21/88	160	500	<5	<5	<5	<5	<5	<5	<5	22	NA
	10/5/88	440	1200	<5	<5	<5	2 J	<5	100 B	<5	32	NA
	1/17/89	1400	3000	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-4	2/7/85	35	904	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/6/85	13	<10	<10	<10	<10	<10	<10	<10	<10	<10	0.09
	5/22/85	10	<10	<10	13	<10	<10	<10	<10	<10	<10	0.03
	1/29/86	150	460	<5	<5	60	<5	<5	<5	<5	<5	NA
	3/5/86	21	30	<10	<10	<10	<10	<10	<10	<10	<10	NA
	9/3/86	6	342	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	20	880	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	28	407	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	19	275	NA	NA	NA	NA	NA	NA	NA	NA	0.03
	4/30/87	19	272	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	9	329	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	11	283	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/29/87	19	180	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	16	149	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	7	135	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/26/88	15	125	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/21/88	13	150	<5	<5	<5	<5	<5	<5	<5	<10	NA

NA = No Analysis
"B" - This result is qualitatively questionable because the compound was detected in method and/or travel blanks at similar concentrations.
"J" - This result is an estimated concentration.

AR300125

ORIGINAL (Red)

TABLE 1 (CONT.)

TEXTRON LYCOMING
WILLIAMSPORT FACILITY

Analytical Results for Monitoring Wells at the Textron Lycoming Facility, Williamsport, PA.

HIT COMPOUNDS		1,2-Dichloro-ethylene(Total)	Trichloro-ethylene	Benzene	Chloroform	1,1-Dichloro-ethane	1,1-Dichloro-ethylene	Ethylbenzene	Toluene	1,1,1-Trichloro-ethane	Vinyl Chloride	Total Chromium
WELL NUMBER	DATE	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppm
MW-5	2/7/85	1900	9360	<10	335	<10	<10	<10	<10	<10	<10	NA
	2/19/85	12621	22928	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/6/85	7137	16274	<10	<10	<10	<10	<10	<10	1567	<10	0.02
	8/9/85	28100	39100	<10	273	<10	111	<10	40	<10	746	NA
	12/10/85	8204	6874	<5	<5	<5	<5	<5	<5	268	<5	NA
	1/10/86	3040	2490	<25	<5	50	58	<5	<5	880	192	NA
	3/5/86	9000	2130	<10	<10	76	114	<10	76	868	418	NA
	9/3/86	2040	706	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	3900	715	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	2430	528	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	4000	572	NA	NA	NA	NA	NA	NA	NA	NA	<0.01
	4/30/87	4060	340	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	1960	285	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	3640	97	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/28/87	3800	390	<10	<10	26	50	<10	<10	112	1100	NA
	12/22/87	2600	600	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	2700	201	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/26/88	2300	320	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/21/88	1400	410	<5	4J	42	40	3BJ	15B	250	130	NA
	6/21/88	1,2-Dichloroethane=1J, Tetrachloroethylene=8, Chlorobenzene=3BJ, Xylene(Total)=21J										
	10/4/88	3600	220	<100	<100	<100	<100	<100	100 B	140	1100	NA
	10/4/88	Methylene Chloride = 22 B, Xylene(total) = 100										
	1/17/89	2200	350	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-6	2/6/85	338	1495	<10	<10	<10	<10	<10	<10	<10	<10	NA
	2/19/85	1061	4948	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/6/85	633	3623	<10	<10	<10	<10	<10	<10	<10	<10	0.01
	1/10/86	625	3540	<100	<100	<100	<100	<100	<100	<100	<100	NA
	3/5/86	484	2900	<10	<10	<10	<10	<10	<10	<10	59	NA
	9/3/86	179	1080	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	253	925	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	400	1640	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	461	1030	NA	NA	NA	NA	NA	NA	NA	NA	<0.01
	4/30/87	470	1430	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	177	861	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	409	1640	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/28/87	330	870	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	486	2190	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	432	2850	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/26/88	385	2000	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/21/88	270	2400	<25	<25	<25	5J	<25	<25	<25	30J	NA
	6/21/88	Tetrachloroethylene = 17J, Methylene Chloride = 10BJ, Acetone = 47BJ										
	10/4/88	3600	4000	2 J	<5	<5	20	<5	<5	2 J	72	NA
	10/4/88	Tetrachloroethylene = 45, Acetone = 81, 1,1,2-Trichloroethane = 45										
	1/17/89	600	2300	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA = No Analysis
"B" - This result is qualitatively questionable because the compound was detected in method and/or travel blanks at similar concentrations.
"J" - This result is an estimated concentration.

AR300126

ORIGINAL (Red)

TABLE 1 (CONT.)

TEXTRON LYCOMING
WILLIAMSPORT FACILITY

Analytical Results for Monitoring Wells at the Textron Lycoming Facility, Williamsport, PA.

HIT COMPOUNDS		1,2-Dichloro-ethylene(Total)	Trichloro-ethylene	Benzene	Chloroform	1,1-Dichloro-ethane	1,1-Dichloro-ethylene	Ethylbenzene	Toluene	1,1,1-Trichloro-ethane	Vinyl Chloride	Total Chromium
WELL NUMBER	DATE	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppm
MW-7	2/19/85	704	1382	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/5/85	<10	596	<10	<10	<10	<10	<10	<10	<10	<10	0.06
	12/10/85	216	1226	<5	<5	<5	<5	<5	<5	<5	<5	NA
	1/16/86	222	900	<10	<10	<10	<10	<10	<10	<10	<1	NA
	3/5/86	66	976	<10	<10	<10	<10	<10	16	<10	<10	NA
	9/3/86	<5	148	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	6	22	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	6	237	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	8.4	446	NA	NA	NA	NA	NA	NA	NA	NA	0.05
	4/30/87	6	307	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	<5	31	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	<5	107	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/29/87	<5	110	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	<5	125	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	<5	128	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	<5	65	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/21/88	2	110	<5	3J	<5	<5	<5	<5	<5	<10	NA
	10/4/88	12	230	<25	<25	<25	<25	<25	<25	<25	<50	NA
	10/4/88	Methylene Chloride = NB										
	1/17/89	<1	20	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-8	2/12/85	15400	16800	<500	<500	<500	<500	<500	<500	<500	<500	NA
	2/19/85	1447	1081	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/5/85	6179	5443	<10	<10	<10	<10	<10	<10	<10	<10	0.01
	12/10/85	9517	4210	<5	<5	19	29	<5	<5	59	<5	NA
	1/16/86	10170	8150	<10	<10	38	66	<10	<10	98	<10	NA
	3/5/86	5800	8500	<10	<10	<10	<10	<10	<10	<10	<10	NA
	9/3/86	1470	1470	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	2570	2000	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	3110	3090	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	1080	799	NA	NA	NA	NA	NA	NA	NA	NA	<0.01
	4/30/87	2510	2260	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	961	842	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	3040	2530	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/29/87	3300	1600	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	2620	1460	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	1800	2000	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	1600	1700	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/21/88	1400	1600	<5	1J	12	13	<5	<5	18	11	NA
	6/21/88	Tetrachloroethylene = 140										
	10/4/88	4200	4900	<25	<25	<25	18 J	<25	<25	26	36 J	NA
	10/4/88	Tetrachloroethylene = 200										
	1/17/89	2500	3500	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA = No Analysis
"B" - This result is qualitatively questionable because the compound was detected in method and/or travel blanks at similar concentrations.
"J" - This result is an estimated concentration.

AR300127

ORIGINAL (Red)

TABLE 1 (CONT.)

TEXTRON LYCOMING
WILLIAMSPORT FACILITY

Analytical Results for Monitoring Wells at the Textron Lycoming Facility, Williamsport, PA.

HIT COMPOUNDS		1,2-Dichloro-ethylene(Total)	Trichloro-ethylene	Benzene	Chloroform	1,1-Dichloro-ethane	1,1-Dichloro-ethylene	Ethylbenzene	Toluene	1,1,1-Trichloro-ethane	Vinyl Chloride	Total Chromium
WELL NUMBER	DATE	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppm
MW-8D	2/15/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	2/20/85	640	807	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/5/85	1219	1220	<10	<10	<10	<10	<10	<10	<10	<10	0.008
	12/10/85	214	2160	<5	59	<5	13	<5	7	<5	<5	NA
	1/16/86	6070	5800	<100	<100	<100	<100	<100	<100	<100	350	NA
	3/5/86	3700	5200	<10	<10	<10	21	<10	<10	<10	212	NA
	9/3/86	5720	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	4710	4680	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	5240	5380	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	4090	3210	NA	NA	NA	NA	NA	NA	NA	NA	<0.01
	4/30/87	4680	4050	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	4610	4160	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	5880	3960	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/29/87	7700	3700	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	5190	3240	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	4000	4600	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	5200	6100	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/88	5400	6000	<100	<100	<100	27J	<100	<100	<100	150J	NA
	6/22/88	Methylene Chloride = 55 BJ										
	10/4/88	5400	6200	<50	<50	<50	23 J	<50	<50	<50	130	NA
	10/4/88	Methylene Chloride = 11 B										
	1/17/89	1600	2100	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-9	2/6/85	38	868	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/5/85	138	1383	<10	<10	<10	<10	<10	<10	<10	<10	0.005
	1/31/89	870	11000	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-10	4/26/85	<10	30	<10	<10	<10	<10	<10	<10	<10	<10	NA
	10/4/88	<1	31	NA	NA	NA	<1	NA	NA	NA	NA	NA
MW-11	4/26/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	10/4/88	<1	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-12	4/26/85	46	93	<10	<10	<10	<10	<10	<10	<10	<10	NA
	4/30/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	10/4/88	<1	0.6	NA	NA	NA	<1	NA	NA	NA	NA	NA
MW-13	5/3/85	<10	25	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/5/86	<10	62	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/3/87	6	62	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	14	64	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/5/88	10	69	<5	<5	<5	<5	<5	<5	<5	<10	NA
	1/18/89	10	95	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA=No Analysis
"B" - This result is qualitatively questionable because the compound was detected in method and/or travel blanks at similar concentrations.
"J" - This result is an estimated concentration.

AR300128

ORIGINAL (Red)

TABLE 1 (CONT.)

TEXTRON LYCOMING
WILLIAMSPORT FACILITY

Analytical Results for Monitoring Wells at the Textron Lycoming Facility, Williamsport, PA.

HIT COMPOUNDS / WELL NUMBER	DATE	1,2-Dichloroethylene(Total) ppb	Trichloroethylene ppb	Benzene ppb	Chloroform ppb	1,1-Dichloroethane ppb	1,1-Dichloroethylene ppb	Ethylbenzene ppb	Toluene ppb	1,1,1-Trichloroethane ppb	Vinyl Chloride ppb	Total Chromium ppm
MW-14B	5/3/85	730	880	<10	<10	<10	<10	<10	<10	<10	<10	0.02
	6/12/85	1365	9560	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/26/85	1167	3845	<10	<10	<10	<10	<10	<10	<10	<10	NA
	8/9/85	1110	3520	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/17/86	1640	3610	<10	<10	<10	<10	<10	<10	<10	<10	NA
	9/3/86	738	272	<5	15	<5	<5	<5	<5	<5	<5	NA
	1/14/87	1060	1790	<5	<5	<5	<5	<5	<5	<5	<5	NA
	4/30/87	369	535	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/3/87	591	1320	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	306	602	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/28/87	300	600	<10	<10	<10	<10	<10	<10	<10	<10	NA
	12/22/87	469	890	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/29/88	498	1260	<5	<5	<5	<5	<5	<5	<5	<5	<5
	2/18/88	313	1000	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	486	1200	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/23/88	470	1200	<25	<25	<25	<25	<25	<25	<25	<50	NA
	6/23/88	Methylene Chloride = 13 BJ										
	10/5/88	290	860	<5	<5	1 J	<5	<5	<5	<5	<10	NA
	10/5/88	Methylene Chloride = 3 B, Acetone = 11 B										
	1/18/89	250	900	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-15	5/3/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MW-16	5/3/85	430	570	<10	<10	<10	<10	<10	<10	<10	<10	NA
	8/15/85	290	1370	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/16/86	671	2538	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/3/87	6	22	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/28/87	560	1600	<10	<10	<10	<10	<10	<10	<10	<10	NA
	12/22/87	536	1870	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/29/88	465	1780	<10	<10	<10	<10	<10	<10	<10	<10	NA
	2/18/88	505	2050	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	518	1800	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/23/88	670	2100	<5	4J	3J	3J	<5	<5	4J	<10	NA
	6/23/88	Tetrachloroethylene = 3 J, Carbon Tetrachloride = 3 J										
	10/6/88	810	2700	<50	24 B	<50	<50	<50	<50	<50	<100	NA
	10/6/88	Methylene Chloride = 25 B, Acetone = 20 B										
	1/18/89	400	1200	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-17	6/10/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	0.07
MW-18	5/9/85	486	37200	<10	<10	<10	<10	<10	<10	<10	<10	15
	6/12/85	456	60400	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/29/86	250	29400	<10	<10	<10	<10	<10	<10	<10	77	NA
	3/5/86	340	29000	<10	<10	<10	<10	<10	<10	<10	99	NA
	9/3/86	106	9780	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	153	9380	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	156	8910	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	159	6790	NA	NA	NA	NA	NA	NA	NA	NA	12
	4/30/87	138	8730	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	165	20800	NA	NA	NA	NA	NA	NA	NA	NA	11
	8/14/87	287	16800	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/29/87	150	7400	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	<10	8700	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	73	8000	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/26/88	107	12600	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/21/88	39	3800	<25	<25	<25	<25	<25	<25	<25	<50	NA
	6/21/88	Methylene Chloride = 13BJ										
	10/4/88	16 J	2500 J	<50	<50	<50	<50	<50	<50	<50	<100	NA
	10/4/88	Methylene Chloride = 10 B										
	1/18/89	50	5500	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA=No Analysis
"B" - This result is qualitatively questionable because the compound was detected in method and/or travel blanks at similar concentrations.
"J" - This result is an estimated concentration.

AR300129

ORIGINAL (Red)

TABLE 1 (CONT.)

TEXTRON LYCOMING
WILLIAMSPORT FACILITY

Analytical Results for Monitoring Wells at the Textron Lycoming Facility, Williamsport, PA.

HIT COMPOUNDS		1,2-Dichloro-ethylene(Total)	Trichloro-ethylene	Benzene	Chloroform	1,1-Dichloro-ethane	1,1-Dichloro-ethylene	Ethylbenzene	Toluene	1,1,1-Trichloro-ethane	Vinyl Chloride	Total Chromium
WELL NUMBER	DATE	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppm
MW-19	5/10/85	<10	680	<10	<10	<10	<10	11	<10	<10	<10	0.06
MW-20	5/10/85	143	1990	<10	<10	<10	22	<10	<10	<10	<10	0.02
	6/26/85	116	1831	<10	35	<10	<10	<10	<10	<10	64	NA
	10/4/88	350	7700	NA	NA	NA	<50	NA	NA	NA	NA	NA
	1/31/89	270	8200	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-21	5/10/85	1750	11100	<10	<10	1560	825	70	<10	15300	<10	0.08
	6/26/85	1744	10560	<10	<10	652	526	<10	14	16590	<10	NA
	8/9/85	116	685	<10	<10	25	10	<10	<10	308	<10	NA
	12/11/85	2980	8802	91	<5	439	466	<5	128	10843	<5	NA
	1/23/86	4090	8590	<10	<10	585	623	<10	<10	11260	<10	NA
	1/29/86	280	8290	<10	<10	500	910	<10	<10	4200	<10	NA
	3/5/86	3340	6300	<20	<20	472	397	<20	<20	12000	<20	NA
	9/3/86	1920	1860	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	5460	3030	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	5480	2440	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	9430	1780	NA	NA	NA	NA	NA	NA	NA	NA	<0.01
	4/30/87	9640	1940	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	9300	1780	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	6150	695	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/28/87	14000	960	<10	<10	290	370	<10	<10	7200	<10	NA
	12/22/87	12000	872	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	5900	1100	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/26/88	11000	1400	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/88	7800	1100	<50	<50	210	180	18BJ	15BJ	6000	320	NA
	6/22/88	Methylene Chloride = 30BJ										
MW-22	5/16/85	<10	<10	16	<10	<10	<10	<10	<10	<10	<10	0.01
	6/26/85	25 ppb of 1,2- Dichloroethane, all other volatiles are below detection limit, <10 ppb.										NA
	10/5/88	26	310	NA	NA	NA	<5	NA	NA	NA	NA	NA
MW-23	5/17/85	631	1010	36	<10	<10	<10	<10	<10	26	<10	<0.01
	6/26/85	60	55	<10	<10	<10	<10	<10	<10	<10	<10	NA
	12/11/85	1705	2320	<5	14	13	10	<5	<5	40	<5	NA
	1/16/86	2785	2117	<10	<10	20	16	<10	<10	62	<10	NA
	3/5/86	1160	1730	<10	<10	<10	<10	<10	<10	31	<10	NA
	9/3/86	20	912	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	224	291	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	1760	2540	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	330	456	NA	NA	NA	NA	NA	NA	NA	NA	0.05
	4/30/87	971	841	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	2.5	355	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	1660	2040	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/29/87	9.3	170	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	15	380	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	5.5	386	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	61	337	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/21/88	32	300	<5	3J	<5	<5	<5	<5	<5	<10	NA
	10/4/88	27	350	<25	<25	<25	<25	<25	<25	<25	<50	NA
	10/4/88	Methylene Chloride = 6 B										
	1/17/89	13	180	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-24	5/7/85	<10	33	<10	<10	<10	<10	<10	<10	<10	<10	NA
	5/17/85	<10	57	<10	24	<10	<10	<10	<10	<10	<10	0.04
	6/12/85	<10	122	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/26/85	<10	77	<10	<10	<10	<10	<10	<10	<10	<10	NA
	2/18/88	<5	9.7	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA=No Analysis
"B" - This result is qualitatively questionable because the compound was detected in method and/or travel blanks at similar concentrations.
"J" - This result is an estimated concentration.

AR300130

ORIGINAL (Red)

TABLE 1 (CONT.)

TEXTRON LYCOMING
WILLIAMSPORT FACILITY

Analytical Results for Monitoring Wells at the Textron Lycoming Facility, Williamsport, PA.

WELL NUMBER	HIT COMPOUNDS / DATE	1,2-Dichloroethylene(Total) ppb	Trichloroethylene ppb	Benzene ppb	Chloroform ppb	1,1-Dichloroethane ppb	1,1-Dichloroethylene ppb	Ethylbenzene ppb	Toluene ppb	1,1,1-Trichloroethane ppb	Vinyl Chloride ppb	Total Chromium ppm
MW-25	5/22/85	213	1580	<10	<10	<10	<10	<10	<10	<10	<10	0.02
	8/15/85	153	1232	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/6/86	229	1180	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/15/87	308	1870	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/16/87	318	1630	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/3/87	312	1990	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	400	2040	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	443	1700	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/28/87	360	1000	<10	<10	<10	<10	<10	<10	<10	<10	NA
	12/22/87	443	1700	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	12	107	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	455	1800	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/88	620	1900	<5	4J	2J	2J	<5	<5	2J	<10	NA
	6/22/88	Carbon Tetrachloride = 45										
	10/6/88	640	1900	<50	31 B	<50	<50	<50	<50	<50	<100	NA
	10/6/88	Methylene Chloride = 21B, Acetone = 74B										
	1/19/89	580	1900	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-26	5/22/85	<10	53	<10	<10	<10	<10	<10	<10	<10	<10	0.48
	8/15/85	---	---	---	---	---	---	---	---	---	---	<.005
	3/6/86	26	152	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/3/87	15	105	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	7	60	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/29/88	7.1	65	<5	<5	<5	<5	<5	<5	<5	<5	NA
	2/19/88	<5	8.6	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	5	46	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/88	6	53	<5	<5	<5	<5	<5	<5	<5	<10	NA
	10/6/88	5	36	<5	<5	<5	<5	<5	<5	<5	<10	NA
	10/6/88	Methylene Chloride = 12B, Acetone = 33B										
	1/19/89	5	29	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-28	8/2/85	<10	18	<10	<10	<10	<10	<10	<10	<10	<10	NA
	8/14/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	2/19/88	<5	5.5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/6/88	<5	19	<5	4 J	<5	<5	<5	<5	<5	<10	NA
	1/18/89	<1	14	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-29	8/8/85	13	28	48	<10	<10	<10	<10	<10	<10	<10	NA
	10/5/88	3	16	NA	NA	NA	<1	NA	NA	NA	NA	NA
MW-30	8/8/85	538	1256	<10	<10	<10	<10	<10	<10	27	<10	NA
	8/15/85	366	872	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/29/88	243	681	<5	<5	<5	<5	<5	<5	<5	<5	NA
	2/19/88	225	638	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	331	853	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/88	390	840	<25	<25	<25	<25	<25	<25	<25	<50	NA
	6/22/88	Methylene Chloride = 15BJ										
MW-31	8/7/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	8/13/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/22/88	10	510	<5	3J	<5	<5	<5	<5	<5	<10	NA
	10/5/88	7	480	NA	NA	NA	<1	NA	NA	NA	NA	NA
MW-32	8/8/85	16	78	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/3/87	7	82	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/5/88	12	41	NA	NA	NA	<1	NA	NA	NA	NA	NA
MW-33	8/8/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	10/5/88	2	25	NA	NA	NA	<1	NA	NA	NA	NA	NA

NA=No Analysis
"B" - This result [illegible] qualitatively questionable because the compound was detected in method and/or travel blanks [illegible] similar concentrations.
"J" - This result [illegible] an estimated concentration.

AR300131

Filed

TABLE 1 (CONT.)

TEXTRON LYCOMING
WILLIAMSPORT FACILITY

Analytical Results for Monitoring Wells at the Textron Lycoming Facility, Williamsport, PA.

WELL NUMBER	HIT COMPOUNDS DATE	1,2-Dichloro-ethylene(Total) ppb	Trichloro-ethylene ppb	Benzene ppb	Chloroform ppb	1,1-Dichloro-ethane ppb	1,1-Dichloro-ethylene ppb	Ethylbenzene ppb	Toluene ppb	1,1,1-Trichloro-ethane ppb	Vinyl Chloride ppb	Total Chromium ppm
MW-34	8/9/85	<10	16	<10	<10	<10	<10	<10	<10	<10	<10	NA
	10/5/88	<1	7	NA	NA	NA	<1	NA	NA	NA	NA	NA
MW-35	8/9/85	<10	35	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/31/89	2	38	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-36	8/9/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	10/5/88	<1	<0.5	NA	NA	NA	<1	NA	NA	NA	NA	NA
	1/31/89	<1	0.6	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-37	8/8/85	<10	17	<10	<10	<10	<10	<10	<10	<10	<10	NA
	8/13/85	<10	27	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/16/86	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/3/87	24	55	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/5/88	<1	0.8	NA	NA	NA	<1	NA	NA	NA	NA	NA
MW-41	8/8/85	<10	40	<10	<10	<10	<10	<10	<10	<10	<10	NA
	8/15/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/6/86	283	394	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/3/87	141	243	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	54	111	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-46	8/2/85	<10	15	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/5/86	<10	30	<10	<10	<10	<10	<10	<10	<10	<10	NA
	9/3/86	<5	24	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	<5	23	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	<5	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	<5	61	NA	NA	NA	NA	NA	NA	NA	NA	<0.01
	4/30/87	<5	81	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	<5	78	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	<5	124	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/29/87	<5	83	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	<5	92	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	<5	104	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/26/88	1600	2500	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/21/88	<5	90	<5	<5	<5	<5	<5	<5	<5	<10	NA
	6/21/88	1,2-Dichloroethane = 2J										
MW-50	8/2/85	67	26	<10	<10	<10	<10	<10	<10	<10	32	NA
	8/9/85	122	63	<10	<10	<10	<10	<10	<10	<10	169	NA
	12/11/85	2271	502	<5	<5	24	8	10	<5	<5	1675	NA
	3/5/86	3690	4680	<10	<10	24	16	<10	<10	14	2340	NA
	9/3/86	478	141	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	3140	1070	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	8240	405	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	15200	3060	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/30/87	22400	2900	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	19900	1980	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	6810	340	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/28/87	38000	15000	<10	<10	<10	<10	<10	<10	<10	<10	NA
	12/22/87	38000	8200	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	22600	2100	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/26/88	48000	2800	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/88	5900	4300	<50	<50	14J	12J	<50	<50	<50	750	NA
	6/22/88	Methylene Chloride = 29BJ										
	10/4/88	1900	5300 J	<100	<100	<100	<100	<100	<100	<100	290	NA
	10/4/88	Methylene Chloride = 22B										
	1/17/89	6200	2400	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA = No Analysis
"B" - This result is qualitatively questionable because the compound was detected in method and/or travel blanks at similar concentrations.
"J" - This result is an estimated concentration.

AR300132

TABLE 1 (CONT.)

TEXTRON LYCOMING
WILLIAMSPORT FACILITY

Analytical Results for Monitoring Wells at the Textron Lycoming Facility, Williamsport, PA.

HIT COMPOUNDS		1,2-Dichloro-ethylene(Total)	Trichloro-ethylene	Benzene	Chloroform	1,1-Dichloro-ethane	1,1-Dichloro-ethylene	Ethylbenzene	Toluene	1,1,1-Trichloro-ethane	Vinyl Chloride	Total Chromium
WELL NUMBER	DATE	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppm
MW-51	1/29/86	384	1480	<5	<5	<5	<5	<5	<5	<5	<5	NA
	3/6/86	56	370	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/3/87	202	762	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/28/87	410	810	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/29/87	170	740	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	100	501	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/29/88	83	410	<5	<5	<5	<5	<5	<5	<5	<5	NA
	2/19/88	<5	12	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	105	606	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-52	1/29/86	657	1600	<5	<5	<5	<5	<5	<5	<5	<5	NA
	3/5/86	310	900	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/15/87	342	1180	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/16/87	251	834	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/23/87	356	1040	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/3/87	433	1730	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/28/87	270	420	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	800	2200	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/6/88	160	410	<25	11 B	<25	<25	<25	<25	<25	<50	NA
	10/6/88	Methylene Chloride = 44B, Acetone = 150 B										
	1/18/89	560	860	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-53	1/31/86	<5	7	<5	<5	<5	<5	<5	<5	<5	<5	NA
	3/6/86	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/15/87	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/16/87	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/23/87	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/3/87	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/6/88	9	20	<5	<5	<5	<5	<5	<5	<5	<10	NA
	1/18/89	4	4.1	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-54	1/31/86	136	217	<5	<5	<5	<5	<5	<5	<5	<5	NA
	3/5/86	230	330	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/15/87	174	173	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/16/87	221	536	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/23/87	606	1930	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/3/87	366	907	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/14/87	434	837	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/14/87	216	1210	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-55B	9/3/86	103	411	<5	411	<5	<5	<5	<5	<5	<5	NA
	4/30/87	88	320	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/3/87	73	244	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/14/87	65	239	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/88	92	380	<5	9	<5	<5	<5	<5	<5	NA	NA

NA = No Analysis
"B" - This result is qualitatively questionable because the compound was detected in method and/or travel blanks at similar concentrations.
"J" - This result is an estimated concentration.

AR300133

TABLE 1 (CONT.)

TEXTRON LYCOMING
WILLIAMSPORT FACILITY

Analytical Results for Monitoring Wells at the Textron Lycoming Facility, Williamsport, PA.

HIT COMPOUNDS		1,2-Dichloro-ethylene(Total)	Trichloro-ethylene	Benzene	Chloroform	1,1-Dichloro-ethane	1,1-Dichloro-ethylene	Ethylbenzene	Toluene	1,1,1-Trichloro-ethane	Vinyl Chloride	Total Chromium
WELL NUMBER	DATE	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppm
MW-56	9/3/86	9	51	<5	8	<5	<5	<5	<5	<5	<5	NA
	4/30/87	5	25	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/3/87	<5	17	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/88	21	130	<5	10	<5	<5	<5	<5	<5	<10	NA
	10/5/88	8	68	<5	18	<5	<5	<5	<5	<5	<10	NA
	1/18/89	6	57	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-57	9/3/86	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	NA
	4/30/87	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/3/87	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/5/88	1 J	3 J	<5	<5	<5	<5	<5	<5	<5	<10	NA
	1/18/89	5	3.5	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-58	9/3/86	38	190	<5	<5	<5	<5	<5	<5	<5	<5	NA
	4/30/87	193	451	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/3/87	88	246	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	35	137	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	507	1300	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/88	200	550	<25	<25	<25	<25	<25	<25	<25	<50	NA
	6/22/88	Methylene Chloride = 10BJ										
	10/6/88	280	930	<5	3 J	<5	<5	<5	<5	1 J	<10	NA
	1/18/89	290	1000	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA = No Analysis
"B" - This result is qualitatively questionable because the compound was detected in method and/or travel blanks at similar concentrations.
"J" - This result is an estimated concentration.

ORIGINAL (Red)

AR300134

ORIGINAL (Red)

TABLE 1
TEXTRON GROUND WATER ANALYSIS SUMMARY TABLE
METALS

Monitoring Well	Sample Date	Aluminum mg/L Al	Cadmium mg/L Cd	Chromium mg/L Cr	Copper mg/L Cu	Iron mg/L Fe	Lead mg/L Pb	Manganese mg/L Mn	Nickel mg/L Ni	Zinc mg/L Zn
MW-1	3/6/85	0.6	0.005	<.005	0.02	1.6	0.01	24	0.02	0.03
MW-2	3/6/85	2.3	<.005	0.008	0.02	5.1	0.03	1.4	0.02	0.14
MW-3	3/6/85	24	4.1	8.1	14	40	0.11	19	0.39	0.88
MW-4	3/6/85	20	0.01	0.09	0.14	14	0.11	6.3	0.01	0.08
	5/22/85	-	<.005	0.03	0.02	-	0.03	-	0.01	0.06
	3/5/87			0.03						
MW-5	3/6/85	1.8	0.005	0.02	0.04	4.3	0.02	7.2	<.01	0.03
	3/5/87			<0.01						
MW-6	3/6/85	2.6	<.005	0.01	0.04	4.8	0.04	4.3	0.01	0.05
	3/5/87			<0.01						
MW-7	3/6/85	7.5	<.005	0.06	0.04	15	0.05	3.6	0.01	0.06
	3/5/87			0.05						
MW-8D	3/6/85	0.8	<.005	0.008	0.02	1.6	<.01	0.07	<.01	0.02
	3/5/87			<.0.01						
MW-8	3/6/85	4.3	<.005	0.01	0.03	9.8	0.03	2	<.01	0.05
	3/5/87			<0.01						
MW-9	3/6/85	1.6	0.005	0.005	0.02	4.4	0.02	5.4	0.02	0.02
MW-14B	5/3/85	-	<0.01	0.02	0.07	-	0.07	-	0.02	0.18
MW-17	5/10/85	-	0.006	0.07	0.11	-	0.11	-	0.18	0.45
MW-18	5/9/85	-	<.005	15	0.12	-	0.04	-	0.13	0.34
	3/5/87			12						
MW-19	5/10/85	-	0.005	0.06	0.1	-	0.11	-	0.08	0.46
MW-20	5/10/85	-	<.005	0.02	0.05	-	0.05	-	0.01	0.19
MW-21	5/10/85	-	0.02	0.08	0.26	-	0.14	-	0.31	0.56
	3/5/87			<0.01						
MW-22	5/16/85	-	<.005	0.01	0.01	-	<.01	-	0.01	0.06
MW-23	5/17/85	-	<.005	<.01	<.01	-	<.01	-	<.01	0.03
	3/5/87			<0.05						
MW-24	5/17/85	-	0.005	0.04	0.1	-	0.11	-	0.13	0.42
MW-25	5/22/85	-	<0.005	0.02	0.03	-	0.06	-	0.04	0.10
MW-26	5/22/85	-	0.02	0.48	0.37	-	0.24	-	0.81	0.47
	6/19/85	-	<.005	<.005	0.008	-	<.01	-	0.006	0.05
MW-46	3/5/87			<0.01						

Source: Compiled from Chester Engineers, Inc. reports.

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(Red)

TABLE 2

SURFACE WATER SAMPLE ANALYTICAL DATA

The ERM Group

Chester Laboratories
A Division Of
The Chester Engineers
P.O. Box 9338
Pittsburgh
Pennsylvania 15225
Phone: (412) 269-5700

ORIGINAL (Red)

Laboratory Analysis Report For

Avco Lycoming
Williamsport, Pennsylvania

Volatile Compounds

Samples Received: 4/23/85
Report Date: 5/08/85

Source	West Bank Lycoming Creek Upstream Tributary	West Bank Lycoming Creek Downstream Tributary
Log No. 85-	3247	3248
Date Collected	4/23/85	4/23/85
Acrolein, ug/L	<10	<10
Acrylonitrile, ug/L	<10	<10
Benzene, ug/L	<10	<10
Bromoform, ug/L	<10	<10
Carbon Tetrachloride, ug/L	<10	<10
Chlorobenzene, ug/L	<10	<10
Chlorodibromomethane, ug/L	<10	<10
Chloroethane, ug/L	<10	<10
2-Chloroethylvinyl Ether, ug/L	<10	<10
Chloroform, ug/L	<10	<10
Dichlorobromomethane, ug/L	<10	<10
1,1-Dichloroethane, ug/L	<10	<10
1,2-Dichloroethane, ug/L	<10	<10
1,1-Dichloroethylene, ug/L	<10	<10
1,2-Dichloropropane, ug/L	<10	<10
cis-1,3-Dichloropropene, ug/L	<10	<10
trans-1,3-Dichloropropene, ug/L	<10	<10
Ethylbenzene, ug/L	<10	<10
Methyl Bromide, ug/L	<10	<10
Methyl Chloride, ug/L	<10	<10
Methylene Chloride, ug/L	<10	13
1,1,2,2-Tetrachloroethane, ug/L	17	16
Tetrachloroethylene, ug/L	18	16
Toluene, ug/L	<10	<10
1,2-Trans-Dichloroethylene, ug/L	<10	<10
1,1,1-Trichloroethane, ug/L	<10	<10
1,1,2-Trichloroethane, ug/L	<10	<10
Trichloroethylene, ug/L	<10	<10
Vinyl Chloride, ug/L	<10	<10

2387-91

- Unless otherwise noted, analyses are in accordance with the methods and procedures outlined and approved by the Environmental Protection Agency and conform to quality assurance protocol.
- "Less-than" (<) values are indicative of the detection limit.

Chester Laboratories
A Division Of
The Chester Engineers
P.O. Box 9356
Pittsburgh
Pennsylvania 15225
Phone: (412) 269-6700

ORIGINAL
(Red)

Laboratory Analysis Report
For
AVCO-LYCOMING
Williamsport, Pennsylvania

Samples Received: 5/20-5/23/85
Report Date: 6/11/85

Volatile Compounds

Source	Foy Avenue Exit Flood Well	West Bank Lycoming Creek near R.R. Tracks	MW-4	MW-25	MW-26
Log No. 85-	4322	4323	4407	4408	4409
Date Collected	5/21/85	5/21/85	5/22/85	5/22/85	5/22/85
Acrolein, µg/L	<10	<10	<10	<10	<10
Acrylonitrile, µg/L	<10	<10	<10	<10	<10
Benzene, µg/L	<10	<10	<10	<10	<10
Bromoform, µg/L	<10	<10	<10	<10	<10
Carbon Tetrachloride, µg/L	<10	<10	<10	<10	<10
Chlorobenzene, µg/L	<10	<10	<10	<10	<10
Chlorodibromomethane, µg/L	<10	<10	<10	<10	<10
Chloroethane, µg/L	<10	<10	<10	<10	<10
2-Chloroethylvinyl Ether, µg/L	<10	<10	<10	<10	<10
Chloroform, µg/L	<10	<10	13	<10	<10
Dichlorobromomethane, µg/L	<10	<10	<10	<10	<10
1,1-Dichloroethane, µg/L	<10	<10	<10	<10	<10
1,2-Dichloroethane, µg/L	<10	<10	<10	<10	<10
1,1-Dichloroethylene, µg/L	<10	<10	<10	<10	<10
1,2-Dichloropropane, µg/L	<10	<10	<10	<10	<10
cis-1,3-Dichloropropene, µg/L	<10	<10	<10	<10	<10
trans-1,3-Dichloropropene, µg/L	<10	<10	<10	<10	<10
Ethylbenzene, µg/L	<10	<10	<10	<10	<10
Methyl Bromide, µg/L	<10	<10	<10	<10	<10
Methyl Chloride, µg/L	<10	<10	<10	<10	<10
Methylene Chloride, µg/L	<10	<10	<10	69	<10
1,1,2,2-Tetrachloroethane, µg/L	<10	<10	<10	<10	<10
Tetrachloroethylene, µg/L	<10	<10	<10	<10	<10
Toluene, µg/L	<10	<10	<10	<10	<10
1,2-Trans-Dichloroethylene, µg/L	<10	<10	10	213	<10
1,1,1-Trichloroethane, µg/L	<10	<10	<10	<10	<10
1,1,2-Trichloroethane, µg/L	<10	<10	<10	<10	<10
Trichloroethylene, µg/L	<10	<10	<10	1,580	53
Vinyl Chloride, µg/L	<10	<10	<10	<10	<10

2387-90

- Unless otherwise noted, analyses are in accordance with the methods and procedures outlined and approved by the Environmental Protection Agency and conform to quality assurance protocol.
- "Less-than" (<) values are indicative of the detection limit.

ORIGINAL
(Red)

TABLE 3

SOIL SAMPLE ANALYTICAL DATA

The ERM Group

TABLE 3
TEXTRON LYCOMONG, WILLIAMSPORT FACILITY
SOIL ANALYSIS DATA

	MW - 5 10 - 11 FT 2/7/85	MW - 5 25 -26 FT 2/7/85	MW - 8 20 - 21 FT 2/12/85	MW - 8 30 - 31 FT 2/12/85	B - 45 18.5 -19.5 FT 7/30/85	MW - 46 18.0 - 19.6 FT 7/30/85	B-48 0.7 - 2.2 FT 7/30/85	B-48 8.5 - 10 FT 7/30/85
BENZENE ppb	<10	<10	<10	<10	<10	<10	35	<10
CHLOROFORM ppb	<10	<10	<10	<10	<10	<10	28	<10
1,2-DICHLOROETHANE ppb	<10	<10	<10	<10	<10	<10	<10	<10
ETHYLNBENZENE ppb	19	<10	<10	<10	<10	<10	<10	112
METHYLENE CHLORIDE ppb	<10	<10	<10	<10	<10	<10	101	<10
TOLUENE ppb	23	<10	<10	<10	<10	<10	61	<10
1,2-TRANS-DICHLOROETHYLENE ppb	<10	<10	<10	<10	<10	<10	<10	<10
TRICHLOROETHYLENE ppb	<10	<10	<10	<10	<10	<10	35	<10
VINYL CHLORIDE ppb	<10	<10	<10	<10	<10	<10	<10	<10

Source: Chester Engineers Report on soil investigation, May 23 1986.

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TABLE 3 (continued)
TEXTRON LYCOMONG, WILLIAMSPORT FACILITY
SOIL ANALYSIS DATA

	B-40 13.5 - 15.0 FT 8/19/85	B-40 Composite 8/19/85	B-41 13.5 - 15.0 FT 8/19/85	B-41 Composite 8/19/85	B-42 14.0 - 15.5 FT 8/19/85	B-42 Composite 8/19/85	B-43 8.5 - 10 FT 8/19/85	B-43 Composite 8/19/85	B-44 Composite 8/19/85
BENZENE ppb	<10	<10	<10	<10	<10	<10	<10	<10	<10
CHLOROFORM ppb	<10	<10	<10	<10	<10	<10	<10	<10	<10
1,2-DICHLOROETHANE ppb	<10	<10	<10	<10	<10	<10	<10	<10	<10
ETHYLNBENZENE ppb	<10	<10	<10	<10	<10	<10	<10	<10	<10
METHYLENE CHLORIDE ppb	6	<10	<10	<10	<10	<10	<10	<10	33
TOLUENE ppb	<10	<10	<10	<10	<10	<10	<10	<10	<10
1,2-TRANS-DICHLOROETHYLENE ppb	<10	<10	<10	<10	<10	<10	<10	<10	<10
TRICHLOROETHYLENE ppb	17	<10	<10	<10	<10	<10	<10	<10	<10
VINYL CHLORIDE ppb	<10	<10	<10	<10	<10	<10	<10	<10	<10

Source: Chester Engineers Report on soil investigation, May 23 1986.

AR300141

ORIGINAL (Red)

TABLE 3 (continued)
TEXTRON LYCOMONG, WILLIAMSPORT FACILITY
SOIL ANALYSIS DATA

	B-49 0.7 - 2.2 FT 7/30/85	B-49 8.5 -10.0 FT 7/30/85	MW - 50 3.5 - 5.0 FT 7/30/85	MW - 50 13.5 -15.0 FT 7/30/85	B-47 23.5 - 25.0 FT 7/30/85	B-39 19.0 - 20.5 FT 8/19/85	B-39 Composite 8/19/85
BENZENE ppb	<10	<10	<10	<10	<10	<10	<10
CHLOROFORM ppb	<10	<10	30	26	<10	<10	<10
1,2-DICHLOROETHANE ppb	227	<10	<10	<10	<10	<10	<10
ETHYLNBENZENE ppb	<10	<10	<10	<10	<10	<10	<10
METHYLENE CHLORIDE ppb	<10	<10	23	22	<10	13	<10
TOLUENE ppb	<10	<10	<10	<10	<10	<10	<10
1,2-TRANS-DICHLOROETHYLENE ppb	<10	<10	<10	29	<10	<10	<10
TRICHLOROETHYLENE ppb	<10	<10	<10	13	<10	<10	<10
VINYL CHLORIDE ppb	<10	<10	<10	25	<10	<10	<10

Source: Chester Engineers Report on soil investigation, May 23 1986.

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ORIGINAL (Red)

B

ORIGINAL
(Red)

Appendix B
Preliminary Endangerment Assessment

The ERM Group

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PRELIMINARY
ENDANGERMENT ASSESSMENT

Textron Lycoming
Williamsport Plant
Williamsport, Pennsylvania

23 September 1988
Revision Date: 1 May 1989

Prepared For:

Textron Lycoming
Williamsport Plant
Williamsport, Pennsylvania

Prepared By:

Environmental Resources Management, Inc.
855 Springdale Drive
Exton, Pennsylvania 19341

File: 723-01-02-01

The ERM Group

AR300145

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(Red)

SECTION 1

INTRODUCTION

1.1 Site Background

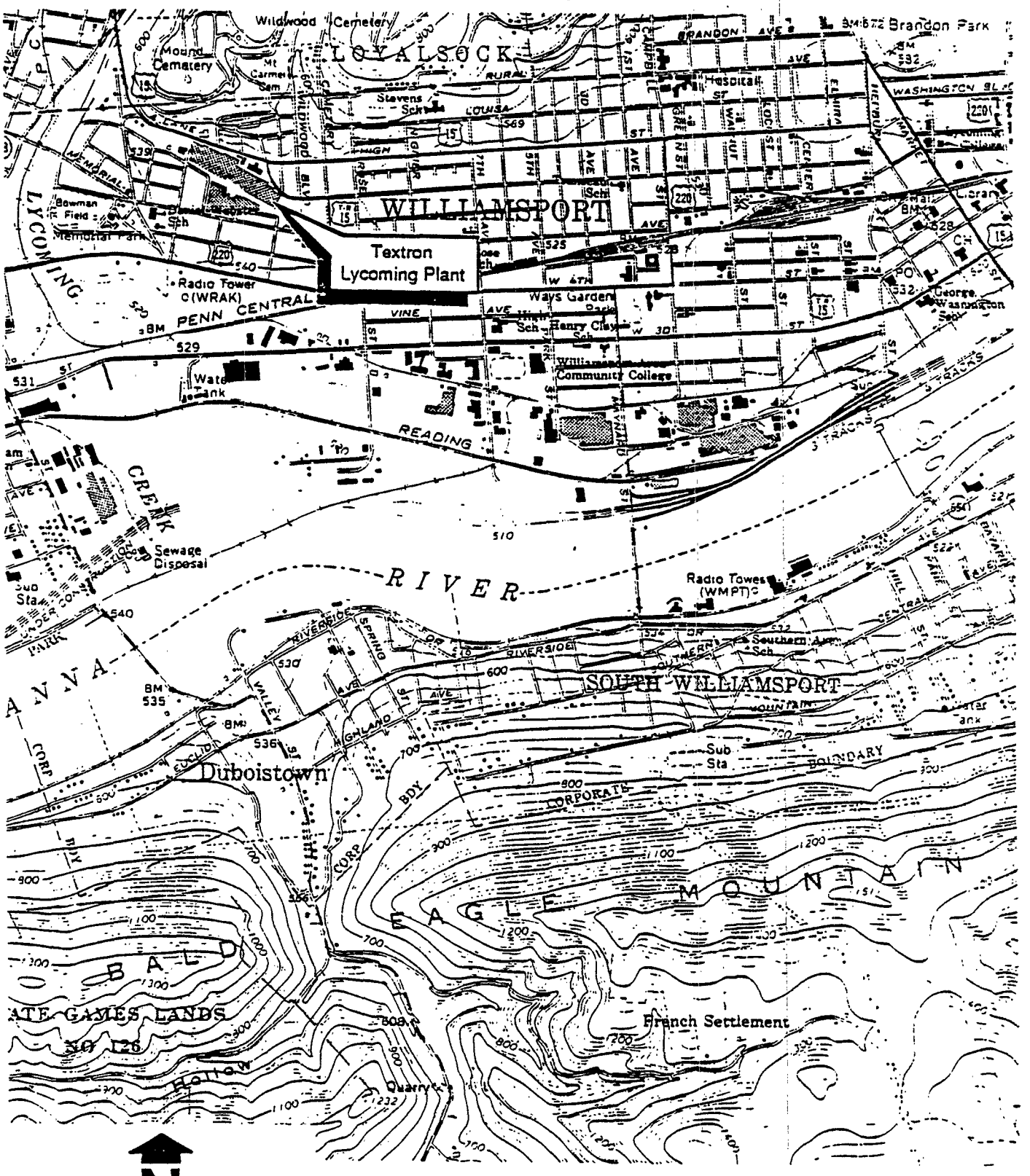
The Textron Lycoming site occupies approximately 28 acres on the south side of High Street on Oliver and approximately 4000 ft north of the Williamsport Municipal Water Authority (WMWA) Emergency Backup Well Field in the western central portion of Williamsport, Pennsylvania (Figure 1-1). A more detailed view of the property and surrounding area is shown in Figure 1-2. The site is bounded to the north by High Street, to the east by Park Avenue, to the west by Oliver Street, and to the south by Memorial Avenue. Other nearby significant features include Lycoming Creek to the west and the Susquehanna River to the south.

The plant was owned and operated previously by AVCO Lycoming and has been operating for over 50 years. Historically, plant operations have centered on the manufacture of aircraft engines. Other processes have included the production of automobile engines, sewing machines, sandpaper and silk. Currently, industrial activities include electroplating, parts manufacturing, engine cleaning, premanufacturing, and assembly of aircraft engines (The Chester Engineers, 1988).

Plant wastes include rinsewater, used solvents, waste oil and grease. Electroplating rinse waters are treated on site at a National Pollutant Discharge Elimination System #PA0007455 (NPDES) permitted treatment facility constructed in the 1950s.

Figure 1-1
Site Map

ORIGINAL
(Red)



Source: USGS 7.5 Min. Topographic Quadrangle; Williamsport, PA

The ERM Group

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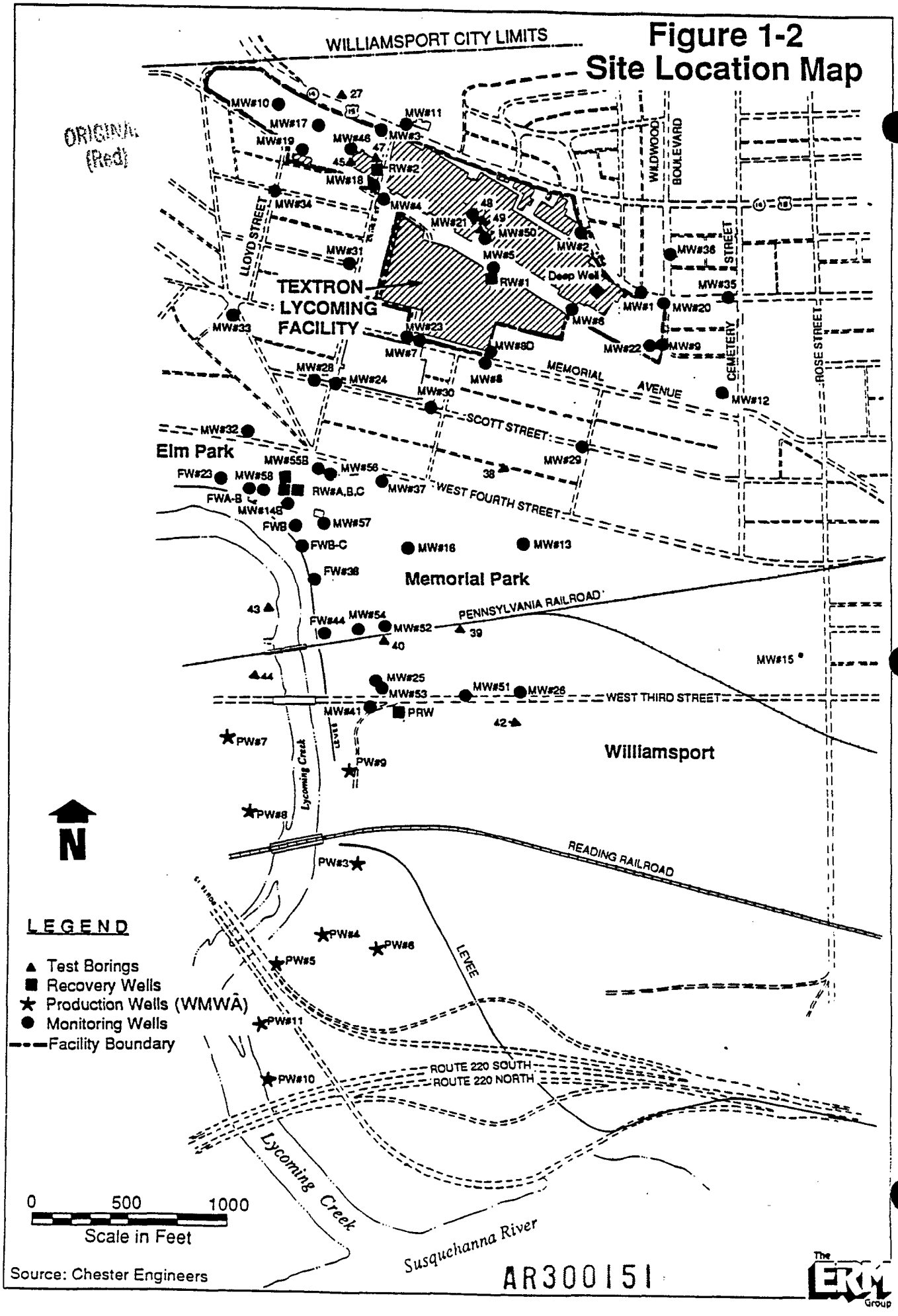
Figure 1-2
Site Location Map



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Sludges from the wastewater treatment plant, used solvents, and other wastes are transported off site for disposal or reclamation in accordance with state and federal regulations.

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The Williamsport Municipal Water Authority (WMWA) in 1984 noted the presence of certain volatile organic compounds, trichloroethylene (TCE) and trans-1,2-dichloroethylene (DCE), in the ground water at their emergency backup supply well field located south of the Textron Lycoming plant. Subsequent analyses performed by the WMWA confirmed that TCE and DCE were the contaminants of greatest concern. Additional testing by the Pennsylvania Department of Environmental Resources (PADER) in late 1984 and January 1985 led the agency to consider the Textron Lycoming plant a potential source of these ground water contaminants (The Chester Engineers, 1988). Textron Lycoming then authorized The Chester Engineers, Inc., to begin a ground water remedial investigation of the plant area. These efforts revealed that "constituents in the shallow ground water aquifer on-site were migrating off the plant property in a southerly direction" (The Chester Engineers, 1988). The Textron Lycoming site has no record of using DCE, and its presence in the ground water has been considered the result of the biological transformation of TCE.

In November 1985, Textron Lycoming entered into a Consent Order and Agreement (COA) with the PADER to develop and implement the current remedial action plan (PADER, 1985). These activities are detailed fully in the following subsection 1.2. Remedial activities were also part of the COA. In addition, the WMWA installed a series of air stripping towers on their wells to ensure a back-up water supply that would meet drinking water standards in the event the WMWA well field was brought into production.

The Chester Engineers Summary Report (March 1988) identified two on-site TCE/DCE contaminated ground water plumes: an eastern and a western. The eastern plume has apparently migrated off site toward the south and has affected the shallow aquifer in the glacially related valley fill deposits and the upper portions of the bedrock (Tully Member). The western plume also has migrated off site in the valley fill aquifer, but is apparently less extensive than the eastern plume. This plume contains an additional contaminant, chromium. It appears that this plume is less extensive at least partially owing to alteration of chromium in surface soils. The Chester Engineers' report (1988), therefore, did not consider chromium to be a major contaminant of concern at the site, nor is there evidence to indicate that there is a threat to the WMWA well field from the localized chromium problem.

TCE/DCE contamination of ground water in an off-site area south of Fourth Street, behind the firehouse, also has been identified. The migration pathway that resulted in this contamination is not clear. The Chester Engineers (1988) has considered pathways such as the Oliver Street storm sewer and/or fracture-controlled migration of ground water along the Tully Member strike. It has been concluded that contaminated ground water discharge from the bedrock aquifer to the overburden in the Tully Member mixes with the shallow aquifer plume before discharging at the west end of the site. The Chester Engineers (1988) also concluded that significant recharge of contaminated ground water to Lycoming Creek is not occurring based on the high TCE/DCE levels noted in the nearby flood relief wells (east of creek) as opposed to trace TCE/DCE levels in and to the west of the creek. Differential hydraulic pressures, the presence of a man-made levee, and the prevailing southerly ground water gradient were offered as

factors supporting the absence of detectable ground water recharge to Lycoming Creek.

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In May 1988, Environmental Resources Management Inc. (ERM), was retained by Textron Lycoming for the development and implementation of a full Remedial Investigation/Endangerment Assessment/Feasibility Study (RI/EA/FS) that will be required under the current Administrative Consent Order (ACO) with EPA, Region III. This preliminary EA is the first step toward implementation of the RI/EA/FS.

1.2 Past Site Investigations

Considerable site investigation efforts have been conducted at the Textron Lycoming site and in the adjoining areas. These activities are presented chronologically as follows:

1. 1984 - WMWA discovers the presence of volatile organic compounds (VOCs) in the ground water at their emergency well field used as backup water supply for Williamsport. WMWA advises PADER of the situation.

2. November 1984 - Textron Lycoming is made aware of the situation and advises its consultant, The Chester Engineers, Inc., to initiate an investigation upon completion of PADER's study.

3. December 1984 to January 1985 - PADER samples various ground water wells within and upgradient from the WMWA emergency well field. Analytical results detected the presence of ground water contaminants similar to those in an abandoned production well on site.

ORIGINAL (Red)

4. 4-20 February 1985 - The Chester Engineers initiates a remedial investigation by drilling 10 on-site monitoring wells (i.e., 9 overburden/shallow and one bedrock, MW-1, 2, 3, 4, 5, 6, 7, 8, 8D, and 9)-report submitted to PADER on 20 March 1985.

5. 22 April 1985 to 21 May 1985 - Seventeen on-site and off-site monitoring wells were drilled (i.e., 12 overburden/shallow, 1 overburden/bedrock, and 4 bedrock MW-10, 11, 12, 13, 14B, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25 and 26)-report submitted to PADER on 8 June 1985.

6. 29 June 1985 to 10 August 1985 - Thirteen overburden/shallow on-site and off-site monitoring wells (MW-28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 41, 46 and 50) were drilled-report submitted to PADER on 30 August 1985.

7. 25 November 1985 - Textron Lycoming and PADER execute a Consent Order and Agreement (COA).

8. December 1985 - Further investigation was deemed necessary to evaluate remedial action alternatives in the area between Fourth Street and the WMWA well field.

9. January 1986 - Four off-site monitoring wells (i.e., 3 overburden and 1 bedrock, MW-51, 52, 53 and 54) were drilled-report submitted to PADER on 8 April 1986.

10. May-June 1986 - Four off-site bedrock monitoring wells (MW-55B, 56, 57 and 58) were drilled-report submitted to PADER in July 1986.

ORIGINAL (Red)

11. 22 January 1987 - Federal Register (52 FR 2392) - U. S. Environmental Protection Agency (US EPA) lists Textron Lycoming as the third entry in Group 7 on the sixth update of the National Priorities List (NPL).

12. 23 March 1987 - Textron Lycoming formally submits a response document to US EPA requesting that the Hazard Ranking System (HRS) scoring be revised.

13. December 1987 - No re-ranking of the site has been proposed by US EPA. Textron Lycoming is advised that it will be required to conduct an RI/EA/FS.

14. May 1988 - ERM selected as RI/EA/FS consultant pending execution of Administrative Consent Order (ACO) with US EPA.

15. ACO between US EPA and Textron Lycoming for the Textron Lycoming Facility in Williamsport, PA, was signed on 27 June 1988.

In summary, 47 ground water monitoring wells have been installed on and around the Textron property. Forty of these are overburden monitoring wells, and seven are bedrock monitoring wells. The Chester Engineers analyses focused primarily on ground water, with 13 soil samples collected and analyzed.

1.3 Remedial Actions

Remedial actions have been underway at Textron Lycoming since Spring 1985. To date, these activities have focused on ground water recovery and treatment. The chronology listed below outlines the key steps in the Remedial Action Program.

ORIGINAL (Red)

1. 22 April 1985 to 21 May 1985 - Drilled on-site Recovery Well No. 1 (RW1) near the center of the plant property and installed treatment facility consisting of an air stripper. RW1 is an overburden/bedrock interface well approximately 54 feet deep (on-line in August 1985).

2. 29 June 1985 to 10 August 1985 - Drilled on-site Recovery Well No. 2 (RW2) in the area of the western plume and installed an air stripper and secondary chromium treatment system for treatment of recovered ground water. RW2 is an overburden/bedrock interface well approximately 48 feet deep (on-line in February 1987).

3. A third recovery well/treatment system was installed at the existing on-site Plant Production Well (approximately 300 ft. deep) in the area of the eastern plume (on-line in January 1986).

4. 14 March 1986 - Submitted report on ground water modeling of remedial alternatives to PADER.

5. 15 April 1986 - Submitted remedial action recommendations to PADER.

6. 25 September 1986 to 15 October 1986 - Installed off-site Recovery Wells A, B, and C located south of Fourth Street. These wells are bedrock wells about 43 feet deep (on-line in April 1987).

7. 6 January 1987 to 23 January 1987 - Installed Water Authority Recovery Well located south of Third Street (on-line in May 1987).

ORIGINAL (Red)

8. 15 April 1987 - Submitted First Quarter Progress Report to PADER including sampling results (The Chester Engineers, 1987a).

9. 15 July 1987 - Submitted Second Quarter Progress Report to PADER including sampling results (The Chester Engineers, 1987b).

10. 15 October 1987 - Submitted Third Quarter Progress Report to PADER including sampling results (The Chester Engineers, 1987c).

11. 15 January 1988 - Submitted Fourth Quarter Progress Report to PADER including sampling results (The Chester Engineers, 1988a).

The purpose of the recovery wells and treatment systems was to prevent further off-site migration of contaminants and to prevent migration of contaminants currently off site from further affecting the WMWA emergency well field. Table 1-1 summarizes pumping rates, treatment techniques, discharge points, total contaminant removal (TCE and DCE), and total and average removal rates (The Chester Engineers, 1988). The Chester Engineers (1988) indicate that the air stripping operations have resulted in a 95-97% removal efficiency of VOCs in ground water.

Ground water pumped from these recovery wells has been undergoing air stripping for 12 to 33 months, depending on the particular treatment system. Once treated, the ground water from all recovery wells, except RW2, has been discharged to Lycoming Creek or Cemetery Run and, subsequently, to the Susquehanna River. Ground water from RW2 has been undergoing air stripping and secondary treatment for chromium at the Textron Lycoming

Table 1-1
Treatment and Discharge Information for Recovery Wells

Recovery Well	Normal Flow Rate (gpd)	Treatment	Date of Start-up	Discharge Point	TCE/DCE Total lbs. Removed (1)	TCE/DCE lbs. Removed per Million Gal.	TCE/DCE Average lbs. Removed Daily
On-Site							
1	7,000	Air Stripping	8/85	Cemetery Run Susquehanna River	610	235	1.1
2	15,000	Air Stripping-Chromium Removal	3/87 (2)	Lycoming Creek	77 (2)	39	0.2
Deep Well	30,000	Air Stripping	1/86	Cemetery Run Susquehanna River	536	50	1
Off-Site							
Elm Park (A,B,C)	50,000	Air/Stripping	4/87	Lycoming Creek	94	13	0.3
WMWA	1,000,000	Air/Stripping	5/87	Lycoming Creek	845	4	3
TOTALS	1,102,000				2,162	341	5.6

(1) Estimated from values extrapolated through February 1988.
(2) Chromium, Total removed 49 lbs.

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Industrial Wastewater Treatment Site, located on the west side of the facility. Following chromium removal, ground water from RW2 also is discharged to Lycoming Creek.

ORIGINAL (Red)

1.4 Purpose and Format of the Preliminary EA

The purpose of the preliminary EA is to focus the Remedial Investigation (RI) by defining data requirements that, once fulfilled, will allow the preparation of a quantitative, formal EA. The format of the preliminary EA for the Textron Lycoming Site includes the following:

- Review of Existing Data,
- Preliminary Endangerment Assessment, and
- Conclusions and Data Requirements.

SECTION 2

ORIGINAL (Red)

REVIEW OF EXISTING DATA

Considerable analytical data for ground water are available for the Textron Lycoming property, the surrounding off-site monitoring wells, WMWA emergency supply wells, and air-stripper influents and effluents from on-site and off-site recovery wells. Limited data for soil (13) and surface water samples are also available. These data have been reported by a variety of groups including The Chester Engineers, the WMWA, PADER, and their support laboratories. These data reports span the period from 1984 to 1987.

Forty-seven ground water monitoring wells have been installed on site and off site at the Textron Lycoming site. Each monitoring well has been sampled at least twice for volatile organic compounds (VOCs) during the period from 1985 to 1988. the primary constituents detected in the ground water samples were trichloroethylene (TCE) and trans-1,2-dichloroethylene (DCE). Other VOCs detected in the ground water include 1,1-dichloroethylene, 1,1-dichloroethane, 1,1,1-trichloroethane, and vinyl chloride. Nine inorganics and limited anion analyses were conducted on ground water samples from selected monitoring wells.

Other media sampled included soils and surface water. Thirteen soil samples were collected from soil borings and monitoring wells and analyzed for VOCs. Low ppb levels of several VOCs

(i.e., TCE, DCE, benzene, toluene, and 1,2-dichloroethane) were detected in these samples. Five surface water samples were collected and analyzed for VOCs. These samples locations are the motor room sump in the plant, West Bank of Lycoming Creek upstream and downstream from the Oliver Street Storm sewer, Foy Avenue Exit Flood well, and the West Bank of Lycoming Creek near the railroad tracks. Analysis of the water from the motor room sump indicated 2 to 20 ppm levels of DCE, TCE, and tetrachloroethylene. The upstream and downstream tributary water samples showed low ppb (<20) levels of VOCs while no VOCs were detected in the remaining water samples.

All available data were reviewed by ERM to determine the nature and extent of contamination in and around the Textron Lycoming facility and to assist with the indentification of data gaps. The data made available to ERM consisted exclusively of raw data. Quality Assurance/Quality Control (QA/QC) packages were not available from the various analytical laboratories.

Several qualifiers were used in the selection of the most reliable ground water data base upon which to formulate the preliminary EA. ERM's QA/QC selection criteria follows:

1) Data should utilize QA/QC data packages, if possible;

2) Data should be as recent as possible to best reflect current site conditions;

3) Data should come from a single source (i.e., laboratory and consultant) to ensure the best possible continuity of analytical procedures, instrumentation, and laboratory QA/QC protocol;

4) Data should be available from as many on-site and off-site wells as possible;

ORIGINAL (Red)

5) Data should represent sampling events over a period of time sufficient to account for seasonal variations; and

6) Data should represent replicate sampling of as many wells as possible.

Of the considerable data available, four quarterly monitoring reports submitted to Textron Lycoming by The Chester Engineers (1987a-c, 1988a) were considered to most closely approach the aforementioned criteria. In addition, a limited soil data base was available from the same laboratory (The Chester Engineers, 1986). Laboratory QA/QC data packages have been requested for each of the selected data sets. Detailed QA/QC review by ERM will commence upon receipt of this information.

The monitoring well data extracted from the aforementioned reports are summarized according to on-site and off-site well locations in Tables 2-1 and 2-2, respectively. All monitoring wells listed as "on site" were positioned either within or near the plant property lines near wells 7, 8, and 30. All other monitoring wells were considered as "off site". This distinction was made to permit future calculations of risks to plant employees as well as residents in the area.

Table 2.1

Summary of Analytical Results and Descriptive Statistics for On-Site Wells at the Textron Lycoming Facility

On-Site Well	COMPOUNDS / DATE	trans-1,2-Dichloroethene ppb	Trichloroethene ppb	1,1-Dichloroethene ppb	1,1-Dichloroethane ppb	1,1,1-Trichloroethane ppb	Vinyl Chloride ppb	Total Chromium ppm
MW-1	NA							
MW-2	NA							
MW-3	NA							
	4/30/87	21	135	NA	NA	NA	NA	NA
	6/2/87	<5	90	NA	NA	NA	NA	NA
	8/14/87	13	144	NA	NA	NA	NA	NA
	10/29/87	28	150	NA	NA	NA	NA	NA
	12/22/87	350	608	NA	NA	NA	NA	NA
MW-4								
	3/5/87	19	275	NA	NA	NA	NA	0.03
	4/30/87	19	272	NA	NA	NA	NA	NA
	6/2/87	9	328	NA	NA	NA	NA	NA
	8/14/87	11	283	NA	NA	NA	NA	NA
	10/29/87	19	180	NA	NA	NA	NA	NA
	12/22/87	16	149	NA	NA	NA	NA	NA
MW-5								
	3/5/87	4000	572	NA	NA	NA	NA	<0.01
	4/30/87	4080	340	NA	NA	NA	NA	NA
	6/2/87	1980	285	NA	NA	NA	NA	NA
	8/14/87	3640	97	NA	NA	NA	NA	NA
	10/29/87	3800	390	28	50	112	1100	NA
	12/22/87	2600	600	NA	NA	NA	NA	NA
MW-6								
	3/5/87	481	1030	NA	NA	NA	NA	<0.01
	4/30/87	470	1430	NA	NA	NA	NA	NA
	6/2/87	177	661	NA	NA	NA	NA	NA
	8/14/87	409	1640	NA	NA	NA	NA	NA
	10/29/87	330	870	NA	NA	NA	NA	NA
	12/22/87	466	2190	NA	NA	NA	NA	NA
MW-7				NA				
	3/5/87	5.4	446	NA	NA	NA	NA	0.05
	4/30/87	6	307	NA	NA	NA	NA	NA
	6/2/87	<5	31	NA	NA	NA	NA	NA
	8/14/87	<5	107	NA	NA	NA	NA	NA
	10/29/87	<5	110	NA	NA	NA	NA	NA
	12/22/87	<5	125	NA	NA	NA	NA	NA
MW-8								
	3/5/87	1050	799	NA	NA	NA	NA	<0.01
	4/30/87	2510	2280	NA	NA	NA	NA	NA
	6/2/87	961	842	NA	NA	NA	NA	NA
	8/14/87	3040	2530	NA	NA	NA	NA	NA
	10/29/87	3300	1600	NA	NA	NA	NA	NA
	12/22/87	2620	1460	NA	NA	NA	NA	NA
MW-8D								
	3/5/87	4090	3210	NA	NA	NA	NA	<0.01
	4/30/87	4880	4050	NA	NA	NA	NA	NA
	6/2/87	4610	4180	NA	NA	NA	NA	NA
	8/14/87	5880	3960	NA	NA	NA	NA	NA
	10/29/87	7700	3780	NA	NA	NA	NA	NA
	12/22/87	5190	3240	NA	NA	NA	NA	NA
MW-9	NA							
MW-17	NA							
MW-18								
	3/5/87	159	8790	NA	NA	NA	NA	12
	4/30/87	136	8730	NA	NA	NA	NA	NA
	6/2/87	165	20800	NA	NA	NA	NA	11
	8/14/87	287	16800	NA	NA	NA	NA	NA
	10/29/87	150	7400	NA	NA	NA	NA	NA
	12/22/87	<10	8700	NA	NA	NA	NA	NA
MW-19								

NA = No Analysis

Note : All values reported at detection limit (eg. <1) were incorporated into the calculation of average concentrations at one-half the detection limit.

ORIGINAL (Red)

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Table 3.1 (Continued)

Summary of Analytical Results and Descriptive Statistics for On-Site Wells at the Textron Lycoming Facility

On-Site Well	COMPOUNDS / DATE	trans-1,2-Dichloroethene ppb	Trichloroethene ppb	1,1-Dichloroethene ppb	1,1-Dichloroethane ppb	1,1,1-Trichloroethane ppb	Vinyl Chloride ppb	Total Chromium ppm
MW-21								
	3/5/87	9430	1780	NA	NA	NA	NA	<0.01
	4/30/87	8840	1940	NA	NA	NA	NA	NA
	6/2/87	9300	1780	NA	NA	NA	NA	
	8/14/87	6150	695	NA	NA	NA	NA	NA
	10/28/87	14000	960	290	370	7200	<10	NA
	12/22/87	12000	872	NA	NA	NA	NA	NA
MW-22	NA							
MW-23								
	3/5/87	330	456	NA	NA	NA	NA	0.05
	4/30/87	971	641	NA	NA	NA	NA	NA
	6/2/87	25	355	NA	NA	NA	NA	
	8/14/87	1060	2040	NA	NA	NA	NA	NA
	10/29/87	93	170	NA	NA	NA	NA	NA
	12/22/87	15	380	NA	NA	NA	NA	NA
MW-46								
	3/5/87	<5	61	NA	NA	NA	NA	<0.01
	4/30/87	<5	81	NA	NA	NA	NA	NA
	6/2/87	<5	78	NA	NA	NA	NA	NA
	8/14/87	<5	124	NA	NA	NA	NA	NA
	10/29/87	<5	83	NA	NA	NA	NA	NA
	12/22/87	<5	92	NA	NA	NA	NA	NA
MW-50								
	3/5/87	15200	3060	NA	NA	NA	NA	NA
	4/30/87	22400	2900	NA	NA	NA	NA	NA
	6/2/87	19600	1680	NA	NA	NA	NA	NA
	8/14/87	6610	340	NA	NA	NA	NA	NA
	10/28/87	38000	15000	<10	<10	<10	<10	NA
	12/22/87	38000	6200	NA	NA	NA	NA	NA

On-Site Wells	COMPOUNDS	trans-1,2-Dichloroethene	Trichloroethene	1,1-Dichloroethene	1,1-Dichloroethene	1,1,1-Trichloroethane	Vinyl Chloride	Total Chromium
	Minimum	<5	31.9	<10	<10	<10	<10	<.01
	Maximum	38000	20800	290	370	7200	1100	12
	Number	71	71	3	3	3	3	11.
	Average	3849.70	2241.50	197.9	141.7	2439.0	379.0	2.1 ppm

NA = No Analysis
Note : All values reported at detection limit (eg. <5) were incorporated into the calculation of average concentrations at one-half the detection limit.

ORIGINAL (Red)

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Table 2.2

Summary of Analytical Results and Descriptive Statistics for Off-Site Wells at the Textron Lycoming Facility

Off-Site Well	COMPOUNDS DATE	trans-1,2-Dichloroethene ppb	Trichloroethene ppb
MW-11			
MW-12			
MW-13			
	6/3/87	6	62
MW-14B			
	1/14/87	1060	1790
	4/30/87	369	535
	6/3/87	591	1320
	8/14/87	306	602
	10/28/87	300	600
	12/22/87	469	890
MW-15			
MW-16			
	6/3/87	6	22
	10/28/87	560	1600
	12/22/87	536	1870
MW-20	NA		
MW-24	NA		
MW-25			
	1/15/87	308	1870
	1/16/87	318	1630
	6/3/87	312	1990
	8/14/87	400	2040
	12/22/87	443	1700
	10/28/87	360	1000
	12/22/87	443	1700
MW-26			
	6/3/87	15	105
	8/14/87	7	60
MW-28	NA		
MW-29	NA		
MW-30	NA		
MW-31	NA		
MW-32			
	6/3/87	7	82
MW-33	NA		
MW-34	NA		
MW-35	NA		
MW-36	NA		
MW-37			
	6/3/87	24	55
MW-41			
	6/3/87	141	243
	8/14/87	54	111
MW-51			
	6/3/87	202	762
	10/28/87	410	810
	10/29/87	170	740
	12/22/87	100	501

NA = No Analysis

Note : All values reported at detection limit (eg. <5) were incorporated into the calculation of average concentrations at one-half the detection limit.

ORIGINAL (Red)

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Table 2.2 (Continued)

Summary of Analytical Results and Descriptive Statistics for Off-Site Wells at the Textron Lycoming Facility

Off-Site Well	COMPOUNDS / DATE	trans-1,2-Dichloroethene ppb	Trichloroethene ppb
MW-52			
	1/15/87	342	1180
	1/16/87	251	834
	1/23/87	356	1040
	6/3/87	433	1730
	10/28/87	270	420
MW-53			
	1/15/87	<5	<5
	1/16/87	<5	<5
	1/23/87	<5	<5
	6/3/87	<5	<5
MW-54			
	1/15/87	174	173
	1/16/87	221	536
	1/23/87	606	1930
	6/3/87	366	907
	8/14/87	434	837
	8/14/87	216	1210
MW-55B			
	4/30/87	88	320
	6/3/87	73	244
	8/14/87	65	239
MW-56			
	4/30/87	5	25
	6/3/87	<5	17
MW-57			
	4/30/87	<5	<5
	6/3/87	<5	<5
	8/14/87	<5	<5
MW-58			
	4/30/87	193	451
	6/3/87	88	246
	8/14/87	35	137

ORIGINAL (Red)

OFF-Site Well	COMPOUNDS	trans-1,2-Dichloroethene	Trichloroethene
	Sum	12153.0	37183.5
	Minimum	<5	<5
	Maximum	1060	2040
	Number	53	53
	Average	229.3	701.6

NA = No Analysis

Note : All values reported at detection limit (eg. <5) were incorporated into the calculation of average concentrations at one-half the detection limit.

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SECTION 3

PRELIMINARY ENDANGERMENT ASSESSMENT

ORIGINAL (Red)

3.1 Introduction

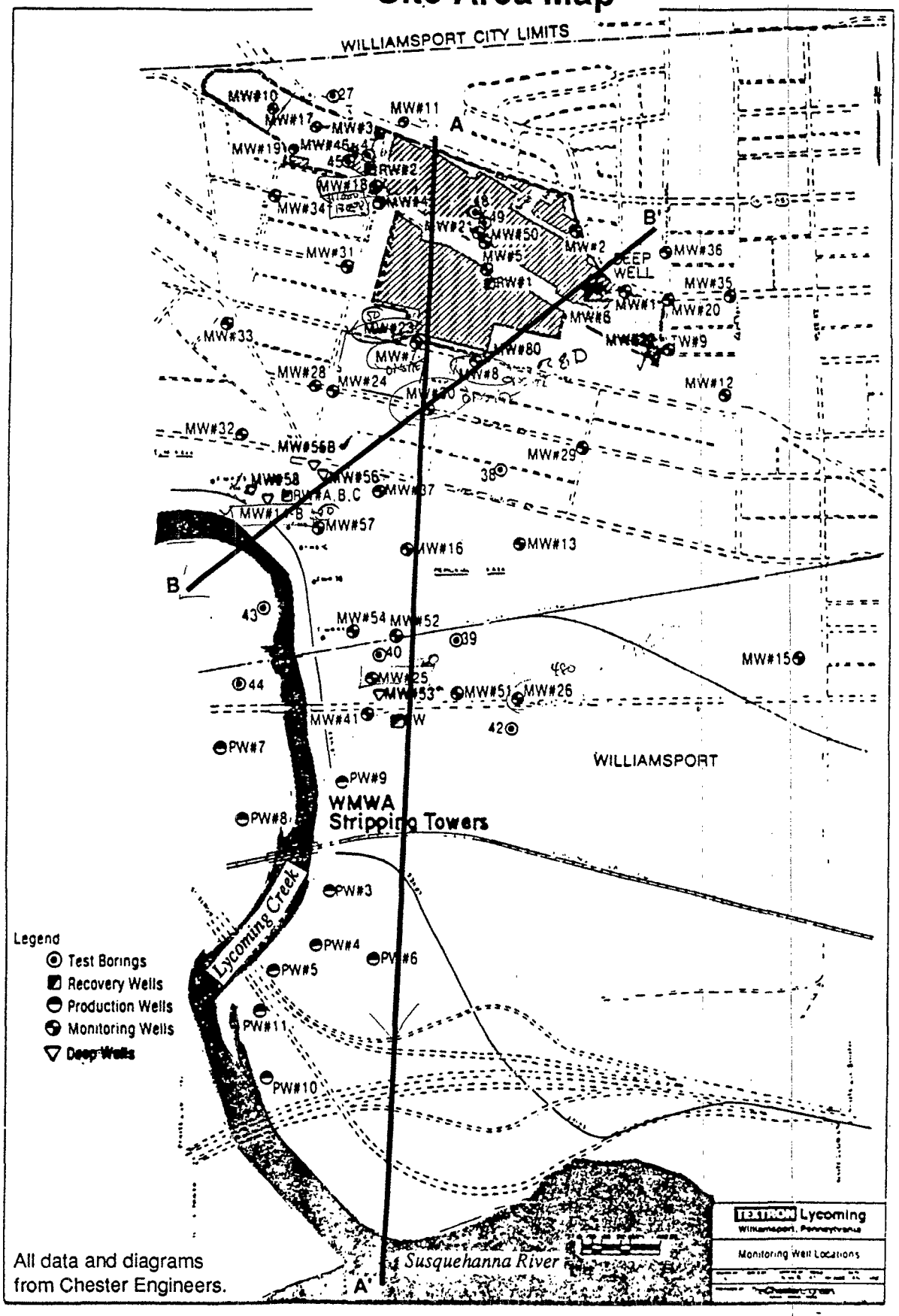
The purpose of the preliminary EA is to focus the RI by defining data requirements that will allow the preparation of a quanititative, formal EA. The steps in this section include the following:

- create a conceptual model of the site,
- identify compounds of concern,
- determine exposure pathways and preliminary risks, and
- compare with applicable or relevant and appropriate requirements.

3.2 Create a Conceptual Model of the Site

A conceptual model of the Textron Lycoming Site was constructed from the subsurface boring descriptions, available well logs, descriptions of WMWA activities, and review of the local and regional hydrogeologic information. This conceptual model was prepared as an aid for defining potential contaminant flow paths. A map of the area is shown in Figure 3-1. Cross section A-A' (Figure 3-2) was selected as representative of geographical features that, based on available data and past history of the site, might influence the preliminary EA. These features include Lycoming Creek, the Susquehanna River, the WMWA production wells, selected monitoring and recovery wells, and residential areas.

Figure 3 -1
Site Area Map



All data and diagrams from Chester Engineers.

ORIGINAL (Red)

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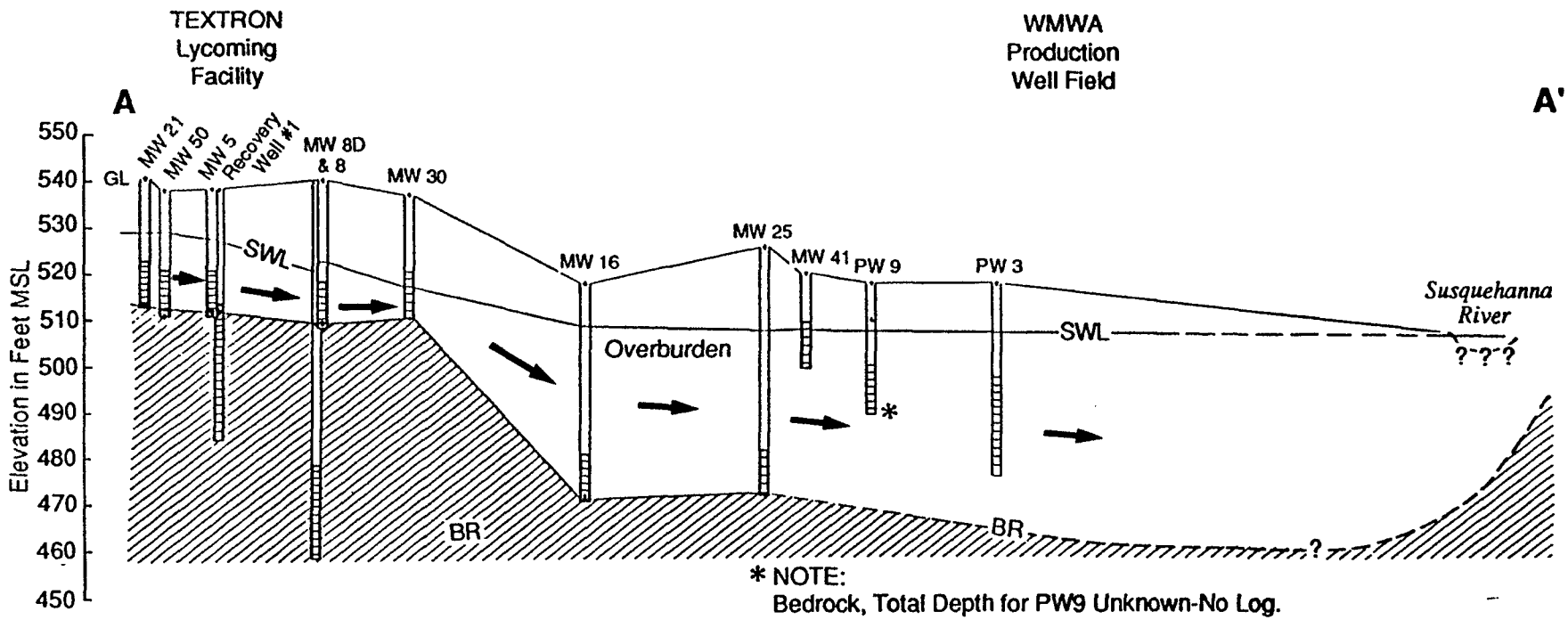
Figure 3-2
Conceptual Model Cross Section A - A'



* NOTE:
Bedrock, Total Depth for PW9 Unknown-No Log.
SWL From Moody, page 51.

LEGEND

- Screened Interval
- GL Ground Level
- SWL Static Water Level
- BR Bedrock
- Shallow Ground Water Flow (Static) August 1987

0 1000
Horizontal Scale in Feet
Vertical Scale: As Shown

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Source: Chester Engineers

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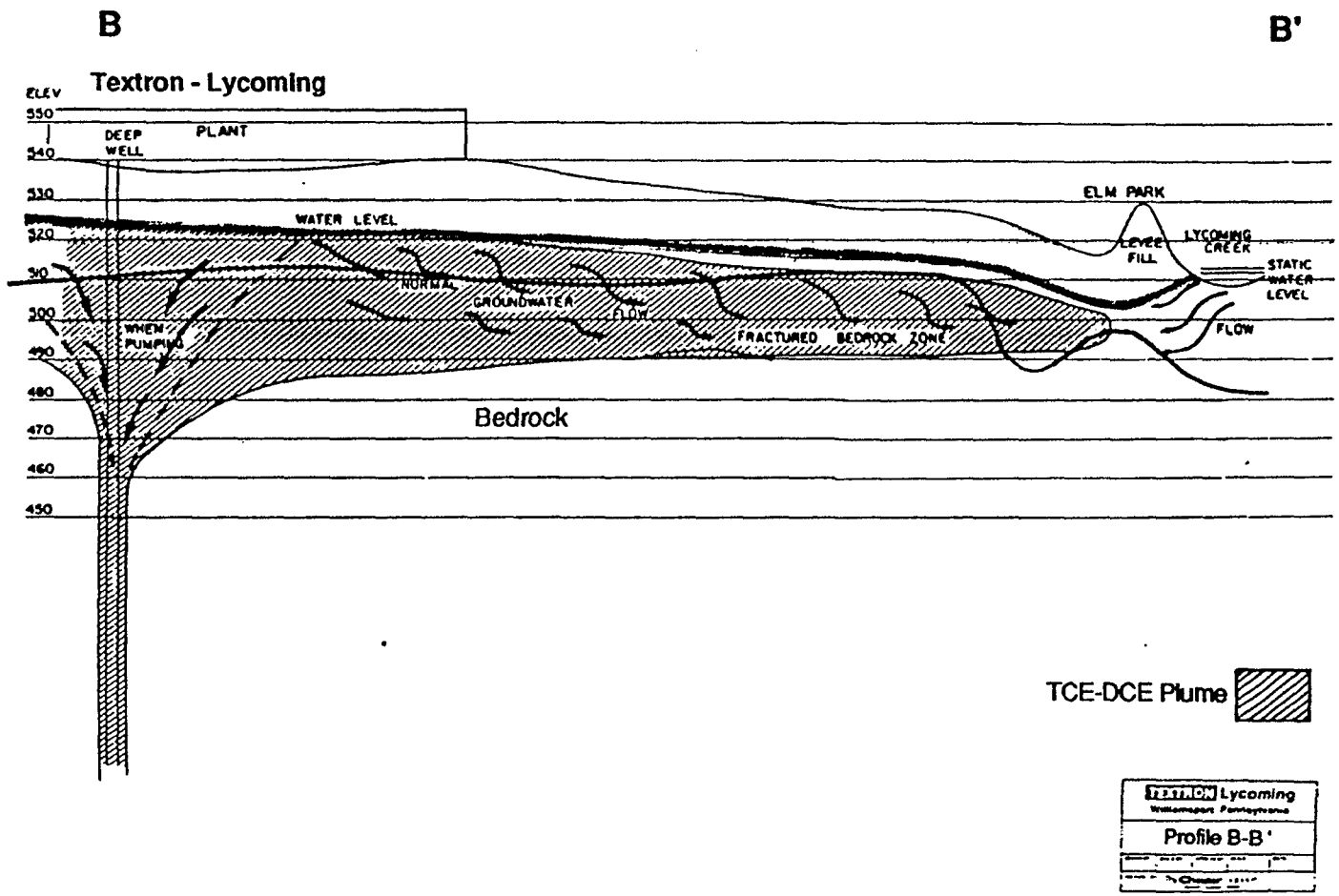
The regional conceptual model was developed to show the position of the water table and prevailing ground water movement. This information were conpiled from shallow flow diagrams, plume diagrams, and cross section profiles developed by The Chester Engineers.

ORIGINAL (Red)

The conceptual model demonstrates that the primary direction of ground water flow in the shallow, overburden aquifer is to the south toward the Susquehanna River. The shallow aquifer's flow is primarily influenced by area topography. Ground water flow in the deep bedrock aquifer's flow is primarily governed by the bedding and structural features (dip, strike, fractures) in the bedrock. The bedrock underlying the Textron Lycoming site is oriented such that horizontal and vertical ground water movement is in the direction of bedrock strike, which is northeast-southwest. It is not certain from the data collected to date whether or not the bedrock aquifer discharges into Lycoming Creek. It is presently believed that the bedrock aquifer may discharge into the sand and gravel overburden aquifer south of Fourth Street, as indicated on cross section B-B' overburden (Figure 3-3). The discharge to the overburden occurs in an area where the bedrock surface drops off rather abruptly and the overburden deposits thicken. Ground water flow is believed to be limited to the upper fractured/weathered portion of the bedrock aquifer.

The Textron Lycoming property is underlain by 20 to 30 feet of overburden, which consists of unconsolidated alluvial and glacial deposits. These deposits are almost entirely covered by concrete and/or asphalt paving at the Textron Lycoming plant. Infiltration of contamination through the soil at the plant is expected to be inhibited by concrete, although surface waters or spills may seep through fractures in the concrete.

Figure 3-3
Conceptual Model
Cross Section B-B'
Along Bedrock High



All data and diagrams from Chester Engineers.

ORIGINAL (Red)

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General interpretations, based on the preliminary conceptual models, are as follows:

ORIGINAL (Red)

1. The primary direction of shallow overburden ground water flow is to the south.

2. The shallow aquifer is comprised of valley fill deposits consisting of unconsolidated alluvial and glacial deposits.

3. The bedrock aquifer consists of interbedded limestone and calcareous shales, the upper portion of which is highly weathered.

4. The ground water in the bedrock flows toward southwest and is controlled by the direction of the plunge and strike of the geologic structure. This is almost perpendicular to the major direction of shallow ground water flow. Based on available information, it is uncertain if either ground water aquifer discharges to Lycoming Creek or the Susquehanna River.

5. Three primary areas of contamination have been identified, based on existing data: the chromium plume; the overburden contaminant plume; and the bedrock contaminant plume.

6. There are three on-site and two off-site ground water recovery wells and associated air stripping treatment facilities located on and off of the Textron Lycoming property.

3.3 Identify Compounds of Concern

ORIGINAL (Red)

The Superfund indicator compound selection process is used to establish a manageable list of compounds during the course of a formal EA (US EPA, 1986). The resulting list of compounds can be used to assess risks conservatively. These compounds would likely drive remediation activities, if they are necessary. In general, indicator compounds meet the following criteria:

- are most prevalent at the site;
- represent the most toxic compounds detected at the site; and
- provide a representative analysis of the site's risk.

For the purposes of the preliminary EA, an approach to selecting indicator compounds using strictly professional judgement was used to meet the aforementioned criteria. Professional judgement is used for selection of indicator compounds for the preliminary EA owing to the limited data bases generally available prior to start of an RI/FS. From the available data, the compounds of concern at this site are trichloroethene, trans-1,2-dichloroethene, and chromium. A justification for the selection of these compounds as indicators is given in Table 3-1. The environmental behavior of the indicator compounds is presented in Table 3-2. Generally, volatilization and/or adsorption are the major transport processes for these compounds in the environment.

The EPA toxicology classifications, available toxicity values, and maximum contaminant levels (MCLs) or goals (MCLGs) of these compounds are presented in Table 3-3. Trichloroethene is a B2

Table 3-1
Indicator Compounds For
Preliminary Endangerment Assessment

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(Red)

INDICATOR COMPOUNDS	JUSTIFICATION
Trichloroethene	Concentrations in ground water at certain wells exceed EPA MCL (0.005 mg/L), trace levels found in shallow soils, and volatilization to the atmosphere via air stripping systems occurs.
trans-1,2-Dichloroethene	Concentrations in ground water at certain wells exceed EPA MCLG (0.07 mg/L).
Chromium (Total)	Concentrations in ground water and in soils at western end of facility at certain on-site wells exceed proposed EPA MCL (0.1 mg/L).

CHP VI AWQC = 50 µg/L for human health

Current MCL

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TABLE 3-2
ENVIRONMENTAL BEHAVIOR OF INDICATOR COMPOUNDS

ORIGINAL (Red)

INDICATOR COMPOUNDS	MAJOR FATE PROCESSES	MAJOR TRANSPORT PROCESSES
Trichloroethene	Volatilization Oxidation Photolysis Biodegradation	Volatilization
trans-1,2-Dichloroethene	Volatilization Oxidation Photolysis Biodegradation	Volatilization
Chromium (Total)	Chemical Speciation Adsorption Bioaccumulation Biodegradation	Chemical Speciation Adsorption

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TABLE 3-3
TOXICOLOGY OF INDICATOR COMPOUNDS

INDICATOR COMPOUNDS	EPA CLASS	CPF (oral) 1/(mg/kg/day)	CPF (inhalation) 1/(mg/kg/day)	AIS (oral) (mg/kg/day)	RfD (oral) (mg/kg/day)	MCL OR MCLG (in ppm)
Trichloroethene	B2	0.011 (IRIS)	0.013 (IRIS)	NA	NA	0.005
trans-1,2-Dichloroethene	Noncarcinogen	NA	NA	0.2 (IRIS)	0.02 (IRIS)	(0.07)
Chromium (VI)	A (inhalation only) Noncarcinogen (oral)	NA	41.0 (IRIS)	0.025 (SPHEM)	0.005 (IRIS)	(0.10)

( ) = proposed
A = known human carcinogen
B2 = indicates that compound is a possible human carcinogen, based on animal data
CPF = Carcinogenic Potency Factor
AIS = Acceptable Subchronic Intake
RfD = Acceptable Chronic Intake
IRIS = Integrated Risk Information System, updated 1/29/89
SPHEM = Superfund Public Health Evaluation Manual

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(possible human) carcinogen via all routes of exposure, while chromium is a potential carcinogen via the inhalation pathway only. Trans-1,2-Dichloroethene and chromium (excluding inhalation) are considered noncarcinogenic. MCLs and/or MCLGs are available for all of the indicator compounds. The actual concentrations of the compounds in the ground water at the site exceed the existing applicable MCLs or MCLGs. At the present time, neither US EPA nor PADER has established soil standards for these compounds.

3.4 Determine Exposure Pathways and Preliminary Risks

Exposure pathways were evaluated to define the various ways in which compounds and constituents originating from the site could affect a potentially exposed population or environment. The Textron Lycoming site is an active facility with residential areas to the east, west, and south. Elm and Memorial Parks are recreational parks located due south of the facility. Lycoming Creek and the Susquehanna River are the important surface water bodies that are used for recreational purposes.

Presently, the Textron Lycoming facility and the surrounding residential areas receive water from two reservoirs located in the mountains. The WMWA emergency backup well field is used to supply water to Williamsport only in cases of drought or lack of sufficient water from the reservoirs. Adequate data for the WMWA well field were not available as the report was being prepared. Therefore, an evaluation of the ground water quality could not be made. Further work will be done to determine the ground quality data for the well field. However, based on information obtained from WMWA officials, the wellfield was used 55 days in 1987, and 7 days in 1988. Therefore, a potentially

exposed population may not exist for the ground water in the vicinity of the Textron Lycoming site.

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The Textron facility is fenced and posted, thus allowing access to workers on site only. Because of the asphalt and concrete paving at the facility, exposure to workers on site is limited to inhalation of VOCs emitted from the stripping towers and manufacturing processes. Local residents downwind of the facility are a potentially exposed population for inhalation of VOCs. No data are available on the concentrations of VOCs in the ambient air; however, the discharges from the air strippers are permitted by PADER.

The exposure pathway that could be evaluated in this preliminary EA is ground water use; however, institutional controls are in effect for this aquifer and no wells are in use, or can be installed other than at the WMWA well field. In order to evaluate a potential risk to compounds detected in the ground water at the property boundary, a hypothetical ground water use scenario was used. A hypothetical well located at the property boundary in the down gradient ground water flow direction (e.g., between wells MW7, MW8, and MW30) would supply a hypothetical adult population with a drinking water supply. This hypothetical exposure pathway and population allows an assessment of the risk from ground water leaving the property boundary. Two hypothetical scenarios involving use of ground water by the above population from 1) on-site monitoring wells and 2) off-site monitoring wells were selected. These scenarios allow a comparison of the risks to on-site versus off-site ground water use.

All of the potential exposure pathways are presented in Table 3-4. An evaluation of the potential exposure pathways for the site

Table 3-4
Potential Exposure Pathways

TRANSPORT MEDIA	CONTAMINATION SOURCE	RELEASE MECHANISM	EXPOSURE POINT	EXPOSURE ROUTE	SELECTED FOR EXPOSURE ANALYSIS
AIR	Soil	Volatilization	On site	Inhalation	No- site paved
			Off site	Inhalation	No data
		Fugitive Dust	On site	Inhalation	No- site paved
			Off site	Inhalation	No data
	Ground Water	Volatilization	Off site (bathing)	Inhalation	Yes***
	Surface Water	Volatilization	On site & Off site	Inhalation	Insufficient data
GROUND WATER	Soil	Infiltration	On site & Off site (bathing)	Dermal Contact	Yes***
			On site & Off site	Ingestion	Yes***
SURFACE WATER	Ground Water	Recharge or Discharge **	Off site	Dermal Contact*	Insufficient data
			Off site	Ingestion	No- no public intakes
			Off site	Bioaccumulation	No data
	Sewer or storm drain runoff	Volatilization	Off Site	Inhalation	No data
		Runoff	Off Site	Dermal Contact*	No data
SURFACE SOILS	Soil	Direct contact	On site	Dermal Contact*	No- site paved
			On site	Ingestion	No- site paved
SEDIMENTS	Ground Water	Resolution/ Dissolution	Off site	Dermal Contact*	No exposed sediments
			Off site	Ingestion	Not likely
			Off site	Bioaccumulation	No data

* Includes incidental ingestion
** Unknown at this time whether ground water recharges or discharges to surface water
*** Hypothetical well located near MW-7, MW-8,and MW-30. Site and residential areas supplied municipal water.

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resulted in the selection of pathways for further consideration. Some pathways were eliminated from further consideration in this preliminary EA because data were not available or the exposure scenarios were unlikely. The PADER has conducted air dispersion models which will be obtained and reviewed during the remedial investigation. At this time, the pathways selected for consideration are as follows:

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- Inhalation of compounds transported in shallow/deep ground water to a hypothetical well and used for showering;

- Dermal contact of compounds transported in shallow/deep ground water to a hypothetical well and used for showering; and

- Ingestion of compounds transported in shallow/deep ground water to a hypothetical well.

Pathways that require further evaluation owing to insufficient or unavailable data follow:

- inhalation of compounds

  - transported in shallow/deep ground water to the treatment facilities and are emitted from the air stripping towers and dispersed to the nearest receptor,

  - volatilized from off-site surface soils and dispersed to the nearest receptor, and

- emitted as fugitive dust particles from off-site surface soils and dispersed to the nearest receptor;

- dermal contact and incidental ingestion of compounds detected in

  - off-site surface soils,

  - sediments, and

  - surface water;

- ingestion of compounds detected in surface soils off-site (limited to pica children 2-6); and

- bioaccumulation of compounds detected in surface water and sediment.

Eliminated pathways include the following:

- inhalation, dermal contact, and incidental ingestion of on-site surface soils because of the concrete and asphalt pavings at the site, - [illegible]

- ingestion of compounds detected in the sediments of Lycoming Creek and Susquehanna River since sediments are not exposed (perennial water body), and

- ingestion of compounds detected in Lycoming Creek and Susquehanna River because there are no public water intakes in vicinity of the site.

The only exposure pathway which can adequately be addressed at the present time is exposure via ground water use by adults only. This exposure pathway is completely hypothetical, but allows for quantification of the risk associated with compounds being transported in the ground water which are leaving the property boundary. Exposure pathways associated with ground water use have been subdivided into on-site and off-site areas. All the assumptions used in the evaluation of the potential risks to adults at this site are outlined in Table 3-5.

The available data and the potential ground water exposure pathways for the indicator compounds/constituents are used to determine preliminary risks to the adults only. For on-site ground water risks, average and maximum concentrations of compounds detected in all of the on-site monitoring wells were used. Average and maximum concentrations of the indicator compounds/constituents detected in the ground water located off site were used in evaluating the risk via ground water in the off-site area. The on-site and off-site subchronic and chronic intakes (doses) for the ground water pathway and indicator compounds/constituents are shown in Tables 3-6 and 3-7, respectively. The noncarcinogenic effects of the indicators are calculated by dividing the subchronic daily intake (SDI) from Tables 3-6 and 3-7 by the acceptable subchronic intake (AIS). The SDI/AIS and CDI/AIC (Chronic Daily Intake/Acceptable Chronic Intake) values are summed for the noncarcinogenic compounds. The subchronic and chronic values for the on-site and off-site exposure pathways have been calculated and are presented in Tables 3-8 and 3-9, respectively.

Carcinogenic risks have been derived from the product of the CDI and the carcinogenic potency factor (CPF) for each carcinogen (US EPA, 1986). The total of these values yields route-specific

TABLE 3-5
Standard Parameters for Calculation of Doses and Intakes for Adults

		Symbol	Adult
PHYSICAL CHARACTERISTICS			
Average Body Weight	(a)	BW	70 kg
Average Skin Surface Area	(a)	SA	18,150 sq. cm.
ACTIVITY CHARACTERISTICS			
Amount of Water Ingested Daily	(a)	ING	2 liters
Amount of Air Breathed Daily	(a)	AB	20 cu. m.
Length of Time Spent Bathing	(b)	BT	20 min
Degree of Absorption of Inhaled Air	(b)	AIA	0.5
Inhalation Rate While Bathing	(b)	IBR	0.83 cu. m./hr
Length of Additional Exposure After Bathing	(b)	ADD	10 min
Percentage of Skin Surface Area Immersed While Bathing	(b)	%SAB	80%
Volume of Showerstall	(b)	VS	3 cu. m.
Volume of Bathroom	(b)	VB	10 cu. m.
Volume of Water Used While Showering	(b)	VW	200 liters
MATERIAL CHARACTERISTICS			
Mass Flux Rate (water-based)	(a)	MF	0.5 mg/sq. cm./hr

a - Superfund Exposure Assessment Manual, 1986
b - K.G. Symms, "An Approximation of the Inhalation Exposure to Volatile Synthetic Organic Chemicals from Showering with Contaminated Household Water," Paper presented at the Symposium of American College of Toxicologists, Nov. 15, 1986.

Sample: Inhalation During Bathing
Subchronic

CONC,mg/L * {((VW * IBR * BT)/(2 * VS)) + ((IBR * ADD * VW)/VB))} * (1/BW) * MF

CONC, mg/L * {((200L * 0.83 cum/hr * 0.33 hr)/(2 * 3 cum/hr)) + ((0.83 cum/hr * 0.166 hr * 200L)/10 cum))} * 1/70 kg * 0.5 mg/sq cm/hr

Table 3-6
On-Site Subchronic and Chronic Daily Intakes under Ambient Conditions

EXPOSURE MEDIA	ROUTE OF EXPOSURE	CHEMICAL	SHORT TERM * CONCENTRATION (PPM)	LONG TERM ** CONCENTRATION (PPM)	SUBCHRONIC INTAKE (mg/kg/day)	CHRONIC INTAKE (mg/kg/day)
GROUND WATER	INHALATION	Trichloroethene	2.08E+01	2.24E+00	5.83E-01	1.90E-01
		trans-1,2-Dichloroethene	3.80E+01	3.85E+00	1.07E+00	3.27E-01
		Chromium VI	1.20E+01	2.11E+00	3.37E-01	1.79E-01
	DERMAL CONTACT	Trichloroethene	2.08E+01	2.24E+00	7.55E-04	8.13E-05
		trans-1,2-Dichloroethene	3.80E+01	3.85E+00	1.38E-03	1.40E-04
		Chromium VI	1.20E+01	2.11E+00	4.36E-04	7.66E-05
	INGESTION	Trichloroethene	2.08E+01	2.24E+00	5.95E-01	6.41E-02
		trans-1,2-Dichloroethene	3.80E+01	3.85E+00	1.09E+00	1.10E-01
		Chromium VI	1.20E+01	2.11E+00	3.43E-01	6.03E-02
SUBCHRONIC & CHRONIC INTAKE TOTALS (MG/KG/DAY)						
			SUBCHRONIC	CHRONIC		
	INHALATION	Trichloroethene	5.83E-01	1.90E-01		
		trans-1,2-Dichloroethene	1.07E+00	3.27E-01		
		Chromium VI	3.37E-01	1.79E-01		
	DERMAL CONTACT	Trichloroethene	7.55E-04	8.13E-05		
		trans-1,2-Dichloroethene	1.38E-03	1.40E-04		
		Chromium VI	4.36E-04	7.66E-05		
	INGESTION	Trichloroethene	5.95E-01	6.41E-02		
		trans-1,2-Dichloroethene	1.09E+00	1.10E-01		
		Chromium VI	3.43E-01	6.03E-02		

* Short-Term concentration is the maximum concentration of the compound from Worksheet 1.
** Long-Term concentration is the arithmetic mean (including blanks as 1/2 the detection limit) concentration of the compound from Worksheet 1.

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Table 3-7
Off-Site Subchronic and Chronic Daily Intakes under Ambient Conditions

EXPOSURE MEDIA	ROUTE OF EXPOSURE	CHEMICAL	SHORT TERM * CONCENTRATION (PPM)	LONG TERM ** CONCENTRATION (PPM)	SUBCHRONIC INTAKE (mg/kg/day)	CHRONIC INTAKE (mg/kg/day)
GROUND WATER	INHALATION	Trichloroethene	2.04E+00	7.02E-01	5.72E-02	5.97E-02
		trans-1,2-Dichloroethene	1.06E+00	2.29E-01	2.97E-02	1.95E-02
		Chromium VI	Not evaluated	Not evaluated	Not evaluated	Not evaluated
	DERMAL CONTACT	Trichloroethene	2.04E+00	7.02E-01	7.41E-05	2.55E-05
		trans-1,2-Dichloroethene	1.06E+00	2.29E-01	3.85E-05	8.31E-06
		Chromium VI	Not evaluated	Not evaluated	Not evaluated	Not evaluated
	INGESTION	Trichloroethene	2.04E+00	7.02E-01	5.83E-02	2.01E-02
		trans-1,2-Dichloroethene	1.06E+00	2.29E-01	3.03E-02	6.55E-03
		Chromium VI	Not evaluated	Not evaluated	Not evaluated	Not evaluated
SUBCHRONIC & CHRONIC INTAKE TOTALS (MG/KG/DAY):						
			SUBCHRONIC	CHRONIC		
	INHALATION	Trichloroethene	5.72E-02	5.97E-02		
		trans-1,2-Dichloroethene	2.97E-02	1.95E-02		
		Chromium VI	Not evaluated	Not evaluated		
	DERMAL CONTACT	Trichloroethene	7.41E-05	2.55E-05		
		trans-1,2-Dichloroethene	3.85E-05	8.31E-06		
		Chromium VI	Not evaluated	Not evaluated		
	INGESTION	Trichloroethene	5.83E-02	2.01E-02		
		trans-1,2-Dichloroethene	3.03E-02	6.55E-03		
		Chromium VI	Not evaluated	Not evaluated		

* Short-Term concentration is the maximum concentration of the compound from Worksheet 1.
** Long-Term concentration is the arithmetic mean (including blanks as 1/2 the detection limit) concentration of the compound from Worksheet 1.

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Table 3-8
Assessment of On-Site Noncarcinogenic Effects

ROUTE OF EXPOSURE	CHEMICAL	SDI (mg/kg/day)	AIS (mg/kg/day)	SDI/AIS	CDI (mg/kg/day)	RfD (mg/kg/day)	Lifetime-weighted index
INHALATION	trans-1,2-Dichloroethene	1.07E+00	2.00E-01	5.35E+00	3.27E-01	2.00E-02	1.39E+01
	Chromium VI	0.00E+00	2.50E-02	0.00E+00	0.00E+00	5.00E-03	0.00E+00
DERMAL CONTACT	trans-1,2-Dichloroethene	1.38E-03	2.00E-01	6.90E-03	1.40E-04	2.00E-02	5.97E-03
	Chromium VI	4.36E-04	2.50E-02	1.74E-02	7.66E-05	5.00E-03	1.31E-02
INGESTION	trans-1,2-Dichloroethene	1.09E+00	2.00E-01	5.45E+00	1.10E-01	2.00E 02	4.69E+00
	Chromium VI	3.43E-01	2.50E-02	1.37E+01	6.03E-02	5.00E-03	1.03E+01

LIFETIME-WEIGHTED HAZARD INDEX:

trans-1,2-Dichloroethene: 1.86E+01

Chromium: 1.03E+01

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Table 3-9
Assessment of Off-Site Noncarcinogenic Effects

ROUTE OF EXPOSURE	CHEMICAL	SDI (mg/kg/day)	AIS (mg/kg/day)	SDI/AIS	CDI (mg/kg/day)	RfD (mg/kg/day)	Lifetime-weighted index
INHALATION	trans-1,2-Dichloroethene	2.97E-02	2.00E-01	1.49E-01	1.95E-02	2.00E-02	8.32E-01
	Chromium VI	Not evaluated	2.50E-02	Not evaluated	Not evaluated	5.00E-03	Not evaluated
DERMAL CONTACT	trans-1,2-Dichloroethene	3.85E-05	2.00E-01	1.93E-04	8.31E-06	2.00E-02	3.54E-04
	Chromium VI	Not evaluated	2.50E-02	Not evaluated	Not evaluated	5.00E-03	Not evaluated
INGESTION	trans-1,2-Dichloroethene	3.03E-02	2.00E-01	1.52E-01	6.55E-03	2.00E-02	2.79E-01
	Chromium VI	Not evaluated	2.50E-02	Not evaluated	Not evaluated	5.00E-03	Not evaluated

LIFETIME-WEIGHTED HAZARD INDEX:
trans-1,2-Dichloroethene: 1.11E+00
Chromium: Not evaluated

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risks, and the summation of all route-specific risks give the total site risk. These values have been calculated and are presented in Table 3-10 for on-site risks and in Table 3-11 for off-site risks.

The lifetime-weighted hazard indices for the on-site exposure scenario are greater than unity (1), which is not acceptable under US EPA guidelines. A preliminary estimate of the lifetime-weighted carcinogenic risk for the on-site area is 3×10^{-3} as presented in Table 3-10. This value is above US EPA's recommended guidelines of 1×10^{-4} to 1×10^{-7}. For the off-site area, the lifetime-weighted hazard indices exceed unity (1) for the chronic exposure pathway. The lifetime-weighted off-site risk from potential carcinogens via ground water exposure is 9×10^{-4}, which is above US EPA's guidelines of 1×10^{-4} to 1×10^{-7}. This value is higher than US EPA's point of departure cancer risk level of 1×10^{-6}.

These indices and risks are based on calculations using the available data base, conservative assumptions of exposed populations, climatological information, and potential exposure pathways. Further investigation (i.e., addressing the data gaps outlined in Section 4) will provide a more thorough determination of the potential risks to an exposed population from compounds and constituents at the Textron Lycoming site.

3.5 Compare with Applicable or Relevant and Appropriate Requirements

Table 3-12 presents applicable or relevant and appropriate requirements (ARARs) for the three indicator compounds and additional compounds detected during past investigations. At present, the US EPA recognizes drinking water maximum contaminant

Table 3-10
Calculation of Total On-Site Risk From Potential Carcinogens

ROUTE OF EXPOSURE	EXPOSURE MEDIA	CHEMICAL	CDI (mg/kg/day)	CARCINOGENIC POTENCY FACTOR 1/ (mg/kg/day)	LIFETIME-WEIGHTED RISK
INHALATION	GROUND WATER	Trichloroethene	1.90E-01	1.30E-02	2E-03
		Chromium VI *	0.00E+00	4.10E+01	0E+00
		TOTAL RISK FROM INHALATION EXPOSURE =			**2E-03**
DERMAL CONTACT	GROUND WATER	Trichloroethene	8.13E-05	1.10E-02	8E-07
		Chromium VI *	0.00E+00	4.10E+01	0E+00
		TOTAL RISK FROM DERMAL EXPOSURE=			**8E-07**
INGESTION	GROUND WATER	Trichloroethene	6.41E-02	1.10E-02	6E-04
		Chromium VI *	0.00E+00	4.10E+01	0E+00
		TOTAL RISK FROM INGESTION EXPOSURE=			**6E-04**
				LIFETIME-WEIGHTED RISK=	3E-03

* Chromium is a carcinogen only when inhaled. Chromium is a nonvolatile inorganic compound that does not volatilize during bathing.

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Table 3-11
Calculation of Total Off-Site Risk From Potential Carcinogens

ROUTE OF EXPOSURE	EXPOSURE MEDIA	CHEMICAL	CDI (mg/kg/day)	CARCINOGENIC POTENCY FACTOR 1/(mg/kg/day)	LIFETIME-WEIGHTED RISK
INHALATION	GROUND WATER	Trichloroethene	5.97E-02	1.30E-02	7E-04
		Chromium VI *	Not evaluated	4.10E+01	Not evaluated
			TOTAL RISK FROM INHALATION EXPOSURE =		**7E-04**
DERMAL CONTACT	GROUND WATER	Trichloroethene	2.55E-05	1.10E-02	2E-07
		Chromium VI *	Not evaluated	4.10E+01	Not evaluated
			TOTAL RISK FROM DERMAL EXPOSURE=		**2E-07**
INGESTION	GROUND WATER	Trichloroethene	2.01E-02	1.10E-02	2E-04
		Chromium VI *	Not evaluated	4.10E+01	Not evaluated
			TOTAL RISK FROM INGESTION EXPOSURE=		**2E-04**
				LIFETIME-WEIGHTED RISK=	9E-04

* Chromium is a carcinogen only when inhaled. Chromium is a nonvolatile inorganic compound that does not volatilize during bathing.

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Table 3-12
Applicable or Relevant and Appropriate Requirements and Other Criteria

COMPOUND	Maximum On-Site Concentrations ppm	Average On-Site Concentrations ppm	Maximum Off-Site Concentrations ppm	Average Off-Site Concentrations ppm	EPA Drinking Water MCL, (MCLG) ppm
trans-1,2-Dichloroethene	38	3.85	1.06	0.229	(0.1)
Trichloroethene	20.8	2.24	2.04	0.702	0.005
Chromium VI	0.012	0.002	NA	NA	(0.1)
Benzene	<.01	0.005	<.01	0.004	0.005
2-Chloroethylvinyl ether	<.01	0.005	<.01	0.004	No information
Chloroform	<.01	0.005	<.01	0.004	0.1
1,1-Dichloroethane	0.29	0.107	<.01	0.004	No information
1,1-Dichloroethene	0.37	0.142	<.01	0.004	(0.007)
Ethylbenzene	<.01	0.005	<.01	0.004	(0.7)
Toluene	<.01	0.005	<.01	0.004	(2)
1,1,1-Trichloroethane	7.2	2.44	<.01	0.004	0.2
Vinyl Chloride	1.1	0.37	<.01	0.004	0.002

MCL= Maximum Contaminant Level
(MCLG)= Proposed Maximum Contaminant Level Goal

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levels (MCLs), national ambient air quality standards (NAAQS), and federally approved state water quality standards developed under the Clean Water Act as ARARs. Since the only media considered here is ground water and the State of Pennsylvania has not established ground water standards, the ARARs presented are limited to US EPA MCLs (and MCLGs, where appropriate). This information has been supplemented with US EPA drinking water health advisories for a 70 kg adult. Both maximum and average ground water concentrations for these compounds detected on and off site are compared with the US EPA MCL or MCLG.

The average and maximum concentrations of trichloroethene, trans-1,2-dichloroethene, chromium, 1,1-dichloroethene, 1,1,1-trichloroethane, and vinyl chloride in on-site ground water exceed their respective MCLs. Concentrations of 1,1-dichloroethane and 2-chloroethylvinyl ether could not be compared with ARARs because MCLs have not been established for these compounds.

Few data are available for off-site ground water quality and chromium analysis were not performed on these ground water samples. Ground water concentrations in off-site wells were considerably lower than those of the on-site wells for all compounds. Concentrations of benzene, 2-chloroethylvinyl ether, chloroform, 1,1-dichloroethene, 1,1-dichloroethane, ethylbenzene, toluene, 1,1,1-trichloroethane, and vinyl chloride were below analytical detection limits (<10 ug/L). Detectable levels were noted for only two compounds: trans-1,2-dichloroethene and trichloroethene. Maximum and average concentrations for these compounds exceed their assigned MCL or MCLG.

ORIGINAL (Red)

SECTION 4

CONCLUSIONS AND ADDITIONAL DATA REQUIREMENTS

4.1 Conclusions

The Preliminary EA for the Textron Lycoming site examined existing data, developed conceptual model(s) from these data, identified compounds of concern, evaluated potential exposure pathways, compared actual concentrations of a compound to ARARs, and approximated the potential risks to adults. The conclusions of this preliminary assessment are as follows:

- The approximate lifetime-weighted carcinogenic risk to adults for exposure to the indicator compounds in on-site ground water is 3×10^{-3}, which is above the EPA's recommended guidelines of 1×10^{-4} to 1×10^{-7} (U.S. EPA 1986). The lifetime-weighted carcinogenic risk to adults exposed to off-site ground water is lower (9×10^{-4}), but is also above the recommended range.

- The lifetime-weighted hazard indices for adults via on-site uses of ground water are higher than US EPA's recommended acceptable levels. The likelihood of someone receiving such an intake is highly improbable given the fact that the nearest residents receive municipal water. A population is not currently exposed to the ground water in the vicinity of the site and although these calculated

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intakes are too high, in reality, exposure to these intakes is unlikely to ever occur.

- Risks associated with certain exposure pathways could not be addressed at this time. The pathways which require further evaluation because of insufficient data are inhalation of volatile emissions and fugitive dust emissions of compounds detected in off-site soils; bioaccumulation of contaminants detected in surface water and sediments; ingestion of off-site soils by children 2-6 years of age; dermal contact with surface water, soils and sediments; and inhalation of compounds transported by ground water during showering and volatilized during air stripping.

- Risks for other pathways were not addressed due to site-specific conditions. These pathways are inhalation of, dermal contact with, and ingestion of compounds detected in on-site soils (no exposed soils).

The potential risks to adults posed by the existing concentrations of the indicator compounds in ground water are, in general, unacceptable regarding both on-site and off-site ground water resources. These potential risks are in no way a complete estimate of potential risks, even to adults, since the available data do not address many of the potential exposure pathways. Also, risks to the environment have not been considered because of the gaps in the existing data. Specific and quantitative information is required before a complete and formal EA can be prepared.

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4.2 Data Requirements

The following types of data should be collected during the RI at the Textron Lycoming Site to quantitatively address the risks posed by site-related compounds to a potentially exposed population or environment:

- further information on ground water flow and direction with special emphasis on recharge to downgradient surface waters and the extent of contamination and migration of same in the Tully Member and deeper bedrock;

- further information regarding the presence and concentrations of other potential contaminants (TCL constituents);

- further surface and subsurface soil analyses in areas of suspected chromium contamination (western portions of site);

- surface water assessments with special emphasis on upstream and downstream areas of Lycoming Creek and selected areas of the Susquehanna River;

- analyses of sediments associated with on-site and off-site surface waters and the runoff pathway, (e.g. storm water drains, if applicable);

- aquatic organism analyses (e.g., macroinvertebrae studies) to assess potential risks associated with exposures to bioaccumulated contaminants and risks to the environment;

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- speciation of chromium because the hexavalent form is carcinogenic and the trivalent form is noncarcinogenic;

- air sampling at various on-site and off-site locations for volatile emissions from soils, air-stripping operations, and fugitive dusts emissions;

- assessment of soil characteristics, wind speed, and wind direction to permit appropriate emission calculations and dispersion modeling;

- air sampling prior to entering and exiting the facility boundaries to determine potential upgradient sources of volatile emissions;

- ecological assessments of potentially affected areas including habitat characterization, wetland classification, and identification of endangered species; and

- regional climatology, demography, and ecology.

When these data requirements have been met, the formal EA will be able to more adequately and quantitatively address the potential risks to human and non-human receptors posed by compounds and constituents at the Textron Lycoming Site. The significant exposure pathways will be evaluated in detail, and analysis of the unknown pathways will be analyzed in the formal EA.

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SECTION 5

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Appendix C

Preliminary Feasibility Study

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PRELIMINARY FEASIBILITY STUDY

TEXTRON LYCOMING
WILLIAMSPORT PLANT
WILLIAMSPORT, PENNSYLVANIA

11 April 1989

Prepared For:

Textron Lycoming
Williamsport Plant
Williamsport, Pennsylvania

Prepared By:

Environmental Resources Management, Inc.
855 Springdale Drive
Exton, Pennsylvania 19341

File: 723-01-03-01

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PURPOSE

The purpose of a Preliminary Feasibility Study (FS) is to focus the Remedial Investigation (RI) by examining past investigations and remedial actions, and defining data requirements that, once fulfilled, will allow the preparation of a quantitative, formal Feasibility Study. The Preliminary FS is not designed to fit a federal or state format, as that is a requirement of a full FS.

Data from past investigations and remedial actions for the ground water contamination in the Textron Lycoming area, had been developed by Chester Engineers, Inc. from 1984 through 1988. Since the generation of data during this period was not specified for use in an FS, certain data should be developed now in order to properly develop a formal FS.

The Preliminary FS provides a list of data requirements to conduct the formal FS. The data requirements include collecting information to monitor remediation, and addressing on site and off site areas which may have an impact on remediation action. The remedial efforts conducted to date are discussed, along with recommendations in the Preliminary FS for future actions.

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SUMMARY

This Preliminary Feasibility Study (FS) has been prepared by Environmental Resources Management, Inc. (ERM) for Textron Lycoming, to address the ground water contamination and remedial efforts in the area of the Williamsport, Pa. facility. The following summarizes five important points resulting from the Preliminary FS.

Ground water contamination of trichloroethene (TCE) and trans- and cis-1,2-dichloroethene (DCE) has been documented. However, the extent of the contamination is not fully defined with respect to aerial and spatial locations. These definitions play a role in remediation of the contamination.

There are limited soil analyses available. Soil contamination is a possibility, and may be impacting ground water quality and remediation.

Certain areas both on-site and off-site are discussed as possibly having an impact on the ground water/soil contamination, and in turn, possibly having an impact on remediation. The areas of concern that should be investigated are the following:

- Former location of redwood tanks
- Former location of lagoon
- Hazardous Materials Storage Areas

- Areas of Degreasing Practices
- Underground Storage Tanks
- Sumps, Pipelines, Trenches
- Lycoming Creek Sediment

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Beginning in 1985, Textron Lycoming installed three on-site and one off-site air stripper. The WMWA installed four air strippers at the emergency back-up well field. Upon reviewing the operating data, there may be a fouling problem at one of the on-site air stripper units.

Results of past well sampling does not provide a clear picture of the effects of the remediation efforts. The air stripper operations at the Williamsport Municipal Water Authority (WMWA) well field can successfully provide to customers water that meets drinking water standards. However, the pumping at the WMWA well field may be prolonging remediation by drawing the contamination off site, diluting the contaminant concentration. At this time, the Preliminary FS recommends more effort to remediate ground water, and possible contamination sources, at the Textron property.

A variety of remedial technologies, that are applicable to the Textron Lycoming situation, are presented in detail in the Preliminary FS. The technologies address correcting ground water contamination, and possible contamination of soils and sediments. Selection of one or more practical technologies depends on evaluating data to be obtained. It appears that more air stripping could be conducted on site, taking into account air quality impacts and aquifer impacts. If soil contamination is determined, treating the soil in place may provide proper remediation with less liability than off-site disposal.

Estimated unit costs for the technologies are provided in the Preliminary FS. Total costs could not be estimated since the quantities of ground water, and possibly soil, to be remediated cannot be estimated at this time.

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SECTION 1

INTRODUCTION

1.1 Site Background

The Textron Lycoming site occupies approximately 28 acres on the south side of High Street on Oliver and approximately 4,000 ft north of the Williamsport Municipal Water Authority (WMWA) Emergency Backup Well Field in the western central portion of Williamsport, Pennsylvania (Figure 1-1). A more detailed view of the property and surrounding area is shown in Figure 1-2. The site is bounded to the north by High Street, to the east by Park Avenue, to the west by Oliver Street, and to the south by Memorial Avenue. Other nearby significant features include Lycoming Creek to the west and the Susquehanna River to the south.

The plant was owned and operated previously by AVCO Lycoming and has been operating for over 50 years. Historically, plant operations have centered on the manufacture of aircraft engines. Other processes have included the production of automobile engines, sewing machines, sandpaper and silk. Currently, industrial activities include electroplating, parts manufacturing, engine cleaning, remanufacturing, and assembly of aircraft engines (The Chester Engineers, 1988).

Plant wastes include rinsewater, used solvents, waste oil and grease. Electroplating rinse waters are treated on site at a

Figure 1-1
Site Map

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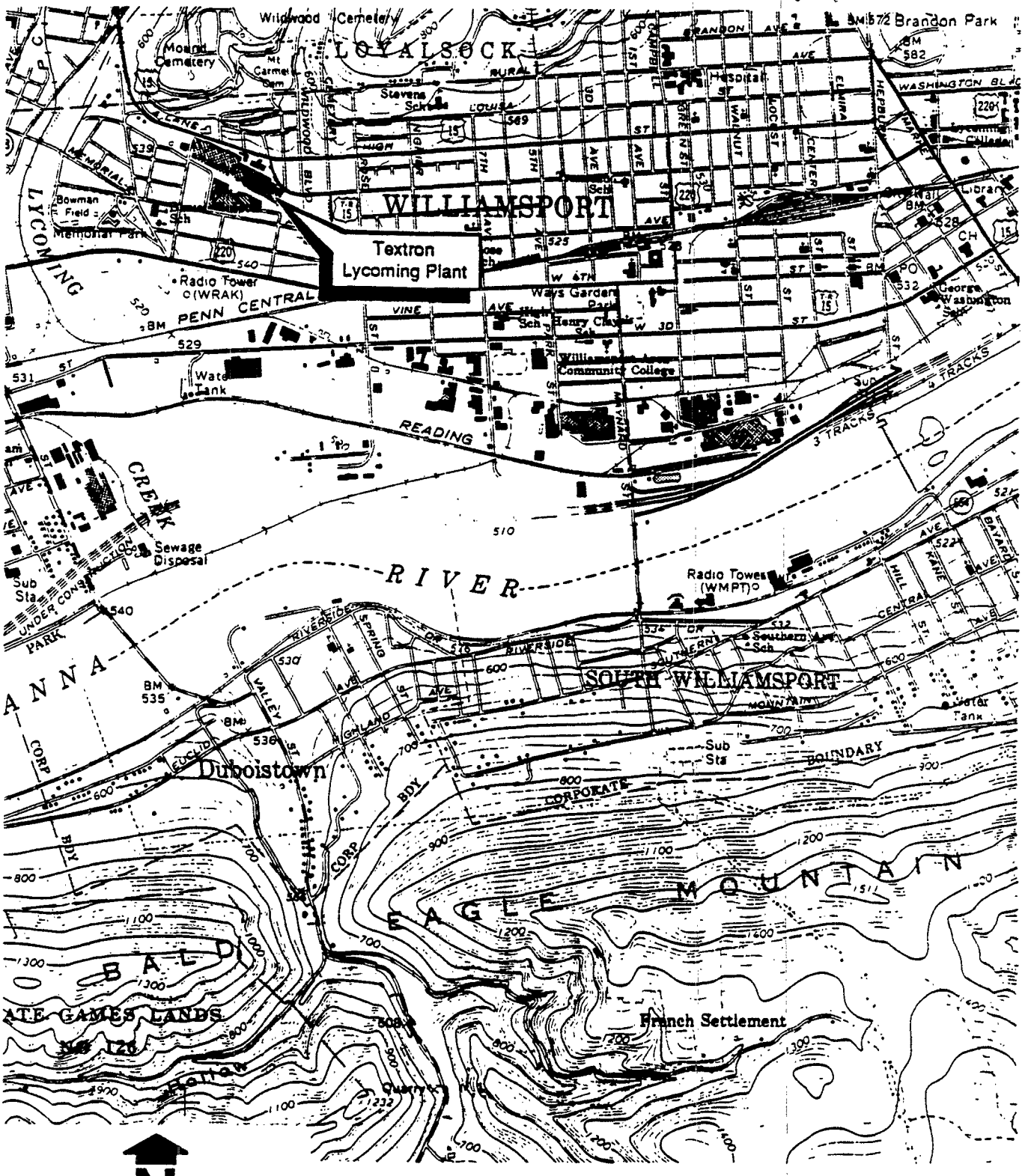

Source: USGS 7.5 Min. Topographic Quadrangle; Williamsport, PA

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Figure 1-2
Site Location Map

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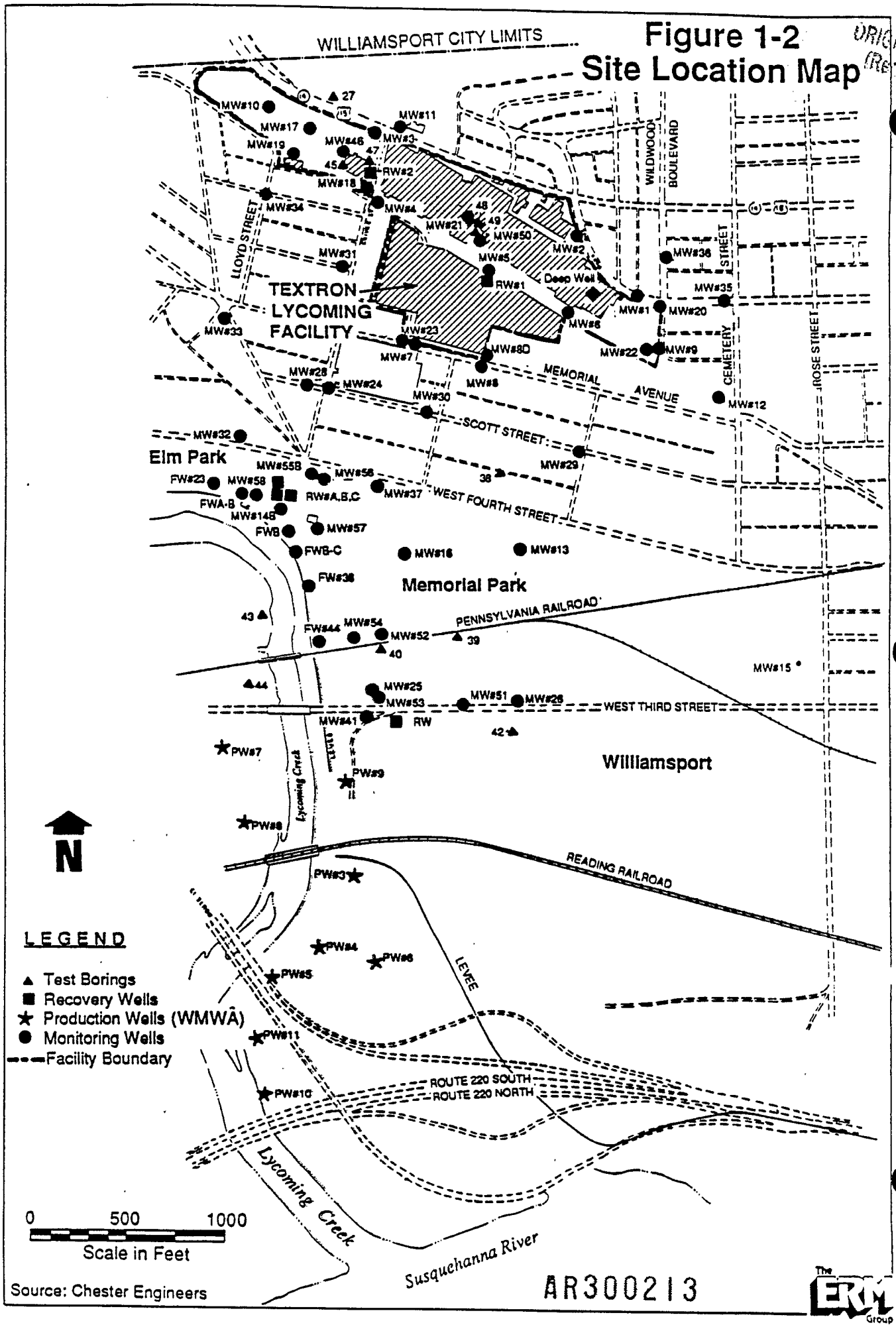

Source: Chester Engineers

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National Pollutant Discharge Elimination System #PA0007455 (NPDES) permitted treatment facility constructed in the 1950s. Sludges from the wastewater treatment plant, used solvents, and other wastes are transported off site for disposal or reclamation in accordance with state and federal regulations.

The Williamsport Municipal Water Authority (WMWA) in 1984 noted the presence of certain volatile organic compounds, trichloroethene (TCE) and trans-1,2-dichloroethene (DCE), in the ground water at their emergency backup supply well field located south of the Textron Lycoming plant. Subsequent analyses performed by the WMWA confirmed that TCE and DCE were the contaminants of greatest concern. Additional testing by the Pennsylvania Department of Environmental Resources (PADER) in late 1984 and January 1985 led the agency to consider the Textron Lycoming plant a potential source of these ground water contaminants (The Chester Engineers, 1988). Textron Lycoming then authorized The Chester Engineers, Inc., to begin a ground water remedial investigation of the plant area. These efforts revealed that "constituents in the shallow ground water aquifer on-site were migrating off the plant property in a southerly direction" (The Chester Engineers, 1988). The Textron Lycoming site has no record of using DCE, and its presence in the ground water has been considered the result of the biological degradation of TCE.

In November 1985, Textron Lycoming entered into a Consent Order and Agreement (COA) with the PADER to develop and implement the current remedial action plan (PADER, 1985). These activities are detailed fully in the following subsection 1.2. Remedial activities were also part of the COA. In addition, the WMWA

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installed a series of air stripping towers on their wells to ensure a back-up water supply that would meet drinking water standards in the event the WMWA well field was brought into production.

The Chester Engineers Summary Report (March 1988) identified two on-site TCE/DCE contaminated ground water plumes: an eastern and a western. The eastern plume has apparently migrated off site toward the south and has affected the shallow aquifer in the glacially related valley fill deposits and the upper portions of the bedrock (Tully Member). The western plume also has migrated off site in the valley fill aquifer, but is apparently less extensive than the eastern plume. This plume contains an additional contaminant, chromium. It appears that this plume is less extensive at least partially owing to alteration of chromium in surface soils. The Chester Engineers' report (1988), therefore, did not consider chromium to be a major contaminant of concern at the site, nor is there evidence to indicate that there is a threat to the WMWA well field from the localized chromium problem.

TCE/DCE contamination of ground water in an off-site area south of Fourth Street, behind the firehouse, also has been identified. The migration pathway that resulted in this contamination is not clear. The Chester Engineers (1988) has considered pathways such as the Oliver Street storm sewer and/or fracture-controlled migration of ground water along the Tully Member strike. It has been concluded that contaminated ground water discharge from the bedrock aquifer to the overburden in the Tully Member mixes with the shallow aquifer plume before discharging at the west end of the site. The Chester Engineers (1988) also concluded that significant recharge of contaminated ground water to Lycoming

Creek is not occurring based on the high TCE/DCE levels noted in the nearby flood relief wells (east of creek) as opposed to trace TCE/DCE levels in and to the west of the creek. Differential hydraulic pressures, the presence of a man-made levee, and the prevailing southerly ground water gradient were offered as factors supporting the absence of detectable ground water recharge to Lycoming Creek.

In May 1988, Environmental Resources Management Inc. (ERM), was retained by Textron Lycoming for the development and implementation of a full Remedial Investigation/Endangerment Assessment/Feasibility Study (RI/EA/FS) that will be required under the current Administrative Consent Order (ACO) with EPA, Region III. This Preliminary FS is the first step toward implementation of the RI/EA/FS.

1.2 Past Site Investigations

Considerable site investigation efforts have been conducted at the Textron Lycoming site and in the adjoining areas. These activities are presented chronologically as follows:

1. 1984 - WMWA discovers the presence of volatile organic compounds (VOCs) in the ground water at their emergency well field used as backup water supply for Williamsport. WMWA advises PADER of the situation.

2. November 1984 - Textron Lycoming is made aware of the situation and advises its consultant, The Chester Engineers, Inc., to initiate an investigation upon completion of PADER's study.

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3. December 1984 to January 1985 - PADER samples various ground water wells within and upgradient from the WMWA emergency well field. Analytical results detected the presence of ground water contaminants similar to those in an abandoned production well on site.

4. 4-20 February 1985 - The Chester Engineers initiates a remedial investigation by drilling 10 on-site monitoring wells (i.e., 9 overburden/shallow and one bedrock--MW-1, 2, 3, 4, 5, 6, 7, 8, 8D, and 9) - report submitted to PADER on 20 March 1985.

5. 22 April 1985 to 21 May 1985 - Seventeen on-site and off-site monitoring wells were drilled (i.e., 12 overburden/shallow, 1 overburden/bedrock, and 4 bedrock--MW-10, 11, 12, 13, 14B, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, and 26) - report submitted to PADER on 8 June 1985.

6. 29 June 1985 to 10 August 1985 - Thirteen overburden/shallow on-site and off-site monitoring wells (MW-28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 41, 46, and 50) were drilled - report submitted to PADER on 30 August 1985.

7. 25 November 1985 - Textron Lycoming and PADER execute a Consent Order and Agreement (COA).

8. December 1985 - Further investigation was deemed necessary to evaluate remedial action alternatives in the area between Fourth Street and the WMWA well field.

9. January 1986 - Four off-site monitoring wells (i.e., 3 overburden and 1 bedrock--MW5051, 52, 53, and 54) were drilled - report submitted to PADER on 8 April 1986.

10. May-June 1986 - Four off-site bedrock monitoring wells (MW-55B, 56, 57, and 58) were drilled - report submitted to PADER in July 1986.

11. 22 January 1987 - Federal Register (52 FR 2392) - U. S. Environmental Protection Agency (US EPA) lists Textron Lycoming as the third entry in Group 7 on the sixth update of the National Priorities List (NPL).

12. 23 March 1987 - Textron Lycoming formally submits a response document to US EPA requesting that the Hazard Ranking System (HRS) scoring be revised.

13. December 1987 - No re-ranking of the site has been proposed by US EPA. Textron Lycoming is advised that it will be required to conduct an RI/EA/FS.

14. May 1988 - ERM selected as RI/EA/FS consultant pending execution of Administrative Consent Order (ACO) with US EPA.

15. ACO between US EPA and Textron Lycoming for the Textron Lycoming Facility in Williamsport, PA, was signed on 27 June 1988.

In summary, 47 ground water monitoring wells have been installed on and around the Textron property. Forty of these are overburden monitoring wells, and seven are bedrock monitoring wells. The Chester Engineers analyses focused primarily on ground water, with 13 soil samples collected and analyzed.

1.3 Remedial Actions

Remedial actions have been underway at Textron Lycoming since Spring 1985. To date, these activities have been performed by The Chester Engineers and have focused on ground water recovery and treatment. The chronology listed below outlines the key steps in the Remedial Action Program.

1. 22 April 1985 to 21 May 1985 - Drilled on-site Recovery Well No. 1 (RW1) near the center of the plant property and installed treatment facility consisting of an air stripper. RW1 is an overburden/bedrock interface well approximately 54 feet deep (on-line in August 1985).

2. 29 June 1985 to 10 August 1985 - Drilled on-site Recovery Well No. 2 (RW2) in the area of the western plume and installed an air stripper and secondary chromium treatment system for treatment of recovered ground water. RW2 is an overburden/bedrock interface well approximately 48 feet deep (on-line in February 1987).

3. A third recovery well/treatment system was installed at the existing on-site Plant Production Well (approximately 300 ft. deep) in the area of the eastern plume (on-line in January 1986).

4. 14 March 1986 - Submitted report on ground water modeling of remedial alternatives to PADER.

5. 15 April 1986 - Submitted remedial action recommendations to PADER.

6. 25 September 1986 to 15 October 1986 - Installed off-site Recovery Wells A, B, and C located south of Fourth Street. These wells are bedrock wells about 43 feet deep (on-line in April 1987).

7. 6 January 1987 to 23 January 1987 - Installed Water Authority Recovery Well located south of Third Street (on-line in May 1987).

8. 15 April 1987 - Submitted First Quarter Progress Report to PADER including sampling results (The Chester Engineers, 1987a).

9. 15 July 1987 - Submitted Second Quarter Progress Report to PADER including sampling results (The Chester Engineers, 1987b).

10. 15 October 1987 - Submitted Third Quarter Progress Report to PADER including sampling results (The Chester Engineers, 1987c).

11. 15 January 1988 - Submitted Fourth Quarter Progress Report to PADER including sampling results (The Chester Engineers, 1988a).

The purpose of the recovery wells and treatment systems was to prevent further off-site migration of contaminants and to prevent migration of contaminants currently off site from further affecting the WMWA emergency well field. The Chester Engineers (1988) indicate that the air stripping operations have resulted in a 95-97% removal efficiency of VOCs in ground water.

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Ground water pumped from these recovery wells has been undergoing air stripping for 12 to 33 months, depending on the particular treatment system. Once treated, the ground water from all recovery wells, except RW2, has been discharged to Lycoming Creek or Cemetery Run and, subsequently, to the Susquehanna River. Ground water from RW2 has been undergoing air stripping and secondary treatment for chromium at the Textron Lycoming Industrial Wastewater Treatment Site, located on the west side of the facility. Following chromium removal, ground water from RW2 also is discharged to Lycoming Creek.

1.4 Purpose and Format of the Preliminary FS

The purpose of this Preliminary FS is to focus the Remedial Investigation (RI) by examining past investigations and remedial actions, and defining data requirements that, once fulfilled, will allow the preparation of a quantitative, formal FS. The Preliminary FS does not attempt to fit a state or federal format. However, the evaluation criteria and approach are consistent with SARA, and the information developed here will be integrated into the formal RI/EA/FS. The Preliminary FS is straightforward, and includes the following sections:

Review of Existing Data

In this section, all available data on the Lycoming site are assembled for analysis. Data will be scrutinized for QA/QC, consistency and validity, and completeness. Data meeting the criteria established will be organized for evaluation and identification of potential areas of concern.

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Identification of Areas of Concern

This section focuses on identifying areas of concern which need to be addressed in the formal RI/EA/FS process, estimating the magnitude of affected areas, and identifying data gaps. Areas of concern include those areas where sampling has revealed contamination, and those areas thought to be affected by migration of contaminants but unsubstantiated by quantitative testing.

Evaluation of Remedial Alternatives, Existing & Proposed

In this section, the effects of the current Remedial Action Plan are interpreted in light of 1) available data meeting QA/QC and completeness criteria, and 2) areas of concern. Effectiveness of existing treatment, given quantitive working data should allow conclusions to be drawn as to future remedial steps or need for further sampling and data acquisition.

Additional Data Requirements

This section is of great importance, since efficient use of resources will be needed to provide an adequate data base while avoiding overlapping, repetitive data, or cost overruns. Once available, the requirements of data as discussed in this section, will allow the formal FS to have a complete characterization of (1) physical and chemical properties of the soil and ground water, and (2) extent and magnitude of contamination in the ground water aquifer as well as other areas of concern.

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SECTION 2

SUMMARY OF EXISTING DATA

2.1 Summary of Existing Data

Considerable analytical data for ground water are available for the Textron Lycoming site, the surrounding off-site monitoring wells, WMWA emergency supply wells, and air-stripper influents (and effluents) of on-site and off-site recovery wells. Limited data for soil and surface water samples are also available. These data have been reported by a variety of groups including Chester Engineers, the WMWA, PADER, and their support laboratories. These data reports span the period from 1984 to 1987.

Most of the data focus on halogenated volatile organics, such as trichloroethene (TCE), trans- and cis-1,2-dichloroethene (DCE); 1,1,1 trichloroethane, and tetrachloroethene. WMWA indicated a problem of TCE and DCE in the backup water supply, and for this reason, the primary focus of the investigation has been on these two compounds. The Chester Engineers data shows wide variations in the concentrations of TCE and DCE, both on-site and off-site. Concentrations of TCE ranged from <10 ppb to 60,400 ppb in on-site monitoring wells. In the off-site monitoring wells the concentrations ranged from <10 ppb to 9560 ppb (Appendix A, Table A-1). DCE concentrations were found to range between <10 ppb and 48,000 ppb in on-site monitoring wells, and between <10 ppb and 1640 ppb in the off-site monitoring wells.

TCE concentrations near the WMWA well fields ranged between 606 ppb and 2,200 ppb in April 1988. However, concentrations on site appear to drop in some wells and increase in others. An increase in the DCE concentrations along with a decrease in the TCE concentrations is found in some cases on site, and can indicate TCE transformation into DCE.

Data are also available for Methods 601 and 602 compounds (i.e., VOCs), certain major anions, and inorganics.

All available data were reviewed by ERM to determine the nature and extent of contamination in and around the Textron Lycoming facility and to assist with the identification of data gaps. The data made available to ERM consisted exclusively of raw data. Quality Assurance/Quality Control (QA/QC) packages were not available from the various analytical laboratories.

Several qualifiers were used in the selection of the most reliable ground water data base upon which to base the Preliminary FS. ERM's QA/QC selection criteria follows:

1) Data should utilize QA/QC data packages, if possible;

2) Data should be as recent as possible to best reflect current site conditions;

3) Data should come from a single source (i.e., laboratory and consultant) to ensure the best possible continuity of analytical procedures, instrumentation, and laboratory QA/QC protocol;

4) Data should be available from as many on-site and off-site wells as possible;

5) Data should represent sampling events over a period of time sufficient to account for seasonal variations; and

6) Data should represent replicate sampling of as many wells as possible.

Of the considerable data available, four quarterly monitoring reports submitted to Textron Lycoming by The Chester Engineers (1987a-c, 1988a) were considered to most closely approach the aforementioned criteria. In addition, a limited soil data base was available from the same laboratory (The Chester Engineers, 1986). Laboratory QA/QC data packages have been requested for each of the selected data sets. Detailed QA/QC review by ERM will commence upon receipt of this information. (Since organizing the existing data for developing the Preliminary FS, the 1988 second quarter ground water sampling was conducted by ERM. The ground water samples were analyzed for the Target Compound List (TCL) of volatile organic compounds. EPA Contract Laboratory Program (CLP) data packages were requested from the data, and a QA/QC review was performed by ERM chemists.)

The monitoring well data was extracted from the reports submitted by Chester Engineers, and a summary of the concentrations and date of sampling is shown in Appendix A, Table A-1. Chester Engineers installed 47 MWs of which 9 MWs are in the fractured bedrock, and one is in bedrock/overburden interface. However, a majority of the MWs are in the shallow aquifer or overburden.

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Metals

Chester Engineers also conducted an investigation to determine the extent of metals concentration in the ground water on-site and off-site. This data is summarized in Appendix A, Table A-2. A plume has been identified in the shallow aquifer on the northwest portion of the Textron Lycoming property as having some metals contamination (primarily chromium), but is believed to be isolated and not migrating off site in the southerly direction towards the WMWA well fields. Chromium (total) concentration was found at a maximum of 15 mg/l for the sample analyzed from MW-18, followed by 8.1 mg/l for the sample taken from MW-3. Both samples were collected in 1985. The other samples show very slight elevations in chromium concentrations compared with the permitted maximum concentration level (MCL) of 0.05 mg/l. Subsequent sampling in 1987 at MW-18 recorded a high level of chromium, and suggests that MW-3 and MW-18 may be situated in a hot spot for chromium. Since this is an area where chromium sludge was being stored in lagoons and also in tanks that could possibly have leaked, the existence of the chromium hot spot is probably related. Low concentrations of chromium in the peripheral and distant shallow aquifer monitoring wells indicates that the chromium contamination may not be a problem for the shallow aquifer and may simply be a localized situation to be corrected.

Volatile Organic Compounds

Chester Engineers sampled all wells, as shown in Table A-1, for volatile organics to determine the extent of ground water contamination. Based on their investigation, they defined three

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plumes. The previously mentioned plume, identified in the shallow aquifer on the northwest portion of the property, has been found to contain TCE and DCE. A second plume was defined in the center of the property and is believed to contribute to the contamination of TCE and DCE discovered near the WMWA well fields.

The third plume is identified by high concentrations of VOCs in the fractured bedrock in the area near MW-14B, and is considered to migrate towards the WMWA well field. The origin of this contamination and media of transport has not been definitively identified. However, Chester Engineers has put forth two theories to explain this third plume. One theory is that this plume was created by the storm runoff from the site carried through storm drainage pipes away from the site. The second theory is that the fractured bedrock in the Tully formation is draining the contaminant plume from the site up to the edge of the Lycoming Creek (Levee) in a southwesterly direction, and then the flow changes direction towards the south and drains into the shallow aquifer as the bedrock dips rapidly towards the WMWA field.

In conducting the investigation of the overall ground water situation at the site, a limited soil contamination study was conducted. The results are presented in Appendix A, Table A-3. The soil contamination study focused on organic contaminants; soils were not analyzed for metals contamination. Alternatives had not been evaluated for cleanup and decontamination of the soil, although it was determined that the area between MW-21 and MW-50 does contain contaminated soil.

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(Red)

Remediation

Based on the monitoring well data, Chester Engineers set up a recovery well network for ground water remediation aimed to arrest the progress of the plume towards the well fields used for emergency public water supply. This system of recovery wells has been operational for over a year and Chester Engineers reported that the network is helping in lowering the contaminant levels within the zone of influence of the pumping recovery wells. Values of TCE and DCE removed from the ground water, as reported by Chester Engineers, are shown in Appendix A, Table A-4.

ORIGINAL
(Red)

SECTION 3

AREAS OF CONCERN

3.1 Introduction

All available data relating to possible contamination as a result of plant activities, were reviewed for the following purposes:

- to identify areas of concern that should be addressed in the Preliminary Feasibility Study and the Remedial Investigation/Feasibility Study process;
- to estimate quantities of affected materials; and
- to aid in the identification of data gaps.

The areas of concern will be identified and separated into the two general categories listed below:

- areas that have been sampled and exhibit levels of contamination, and are therefore classified as confirmed areas of concern; and
- areas that have not yet been addressed, but because of previous site actions could be contaminated, are classified as potential areas of concern.

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3.2 Identified Areas of Concern

The ground water and soils are the areas of concern identified by the existing data as potentially requiring remediation. The primary area of concern was the overall ground water contamination from the site and its potential of affecting the WMWA well field.

The following section gives the summary of the available data and the media affected.

3.2.1 Ground Water

The ground water contamination was first reported by WMWA from its well fields south of the Textron-Lycoming site. An extensive investigation on site and off site has confirmed ground water contamination with VOCs below the site migrating towards the south, and a slightly elevated concentration of chromium at two monitoring wells (MW-3 and MW-18) on the northwest corner of the property was also detected. A wide variation in the concentrations of TCE and trans-1,2-DCE has been observed with respect to time and spatial sampling. Concentrations of TCE ranged from <10 ppb to 60,400 ppb in on-site monitoring wells, and <10 ppb to 9560 ppb in off-site monitoring wells. Concentrations of DCE ranged from <10 ppb to 48,000 ppb in on-site monitoring wells, and <10 ppb to 1640 ppb in off-site monitoring wells. Although a few monitoring wells indicate a possible decrease in VOC concentrations, the extent of past cleanup of ground water is difficult to assess and is a major area of concern. High concentrations of VOCs have been determined near the WMWA well field. No contamination by VOCs is observed in the bedrock formation within about 60 feet of overburden near the WMWA well field.

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3.2.2 Soils

A limited investigation of soil contamination showed the presence of VOCs in soil samples taken from the Textron-Lycoming site. Most of the area on site is covered by buildings or is paved and in the past, these conditions were considered to be an obstacle in conducting a full investigation and development of alternatives for remediation of the soil. Chester Engineers found marginal levels of VOCs near the center of the property.

3.3 Potential Areas of Concern

There are numerous areas on site and off site that are potential areas of concern because of past activities. At this time, there is insufficient data about these areas. The following are on-site areas that can be investigated to develop a strategy to contain and remediate the contamination of ground water:

- Redwood tanks
- Lagoon
- Hazardous material storage areas
- Areas of past degreasing practices/oil spraying
- Underground storage tanks
- On-site pipelines
- Sumps, trenches

In order to evaluate the full extent of the plumes off site, Lycoming Creek bottom sediments, and ground water south west of MW-14B and Lycoming Creek require further evaluation to properly develop a remediation program. Each of these areas is briefly discussed below and could be addressed in the Remedial Investigation.

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3.3.1 Redwood Tanks

In the past, electroplating wastewaters and sludge were stored in two above ground Redwood Tanks. Although these tanks are no longer in use, their past usage dictates investigation of soil contamination by metals at the former locations of the tanks. Ground water samples taken from MW-3 and MW-18 have been analyzed and found to be contaminated by chromium, lead and nickel. However, the soils were not sampled to determine if they were contaminated and had the potential to continuously leach metals into the ground water. A background soil sample can be analyzed to aid in determining the extent of soil contamination.

3.3.2 Lagoon

There was a sludge lagoon located in the northwest corner of the site which is paved now. The lagoon was lined and used to hold sludge. After the sludge dried, it was transported off site. The sludge was removed prior to the closing of the lagoon. There are no reports of soil samples having been analyzed for metals in this area. However, there is a possibility that some metals and organics may be present in the soil matrix from the operation and closure of the former lagoon. In order to better assess the present remediation actions and plan future remediation, the history of the lagoon operation and closure along with soil sampling can be conducted.

3.3.3 Hazardous Material Storage Areas

The storage areas where hazardous materials and hazardous wastes were stored, and are being stored should be screened to evaluate

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if any is a possible source of contamination. These soils may be the source of continuous contamination to the ground water aquifer, and if not addressed in the remediation procedures could extend the time for aquifer restoration.

3.3.4 Areas of Degreasing Practices

The past spraying of waste oil and degreasing solutions onto equipment at some areas on site should be examined for possible soil contamination. No data of sampling and analyses of soil have been taken to screen for contamination in these areas.

3.3.5 Underground Storage Tanks

There are numerous underground storage tanks located on the Textron-Lycoming property, which are used for raw material, fuel and waste storage. A risk of contamination of the soils and ground water from leaking tanks or associated underground connections is a possibility which should be investigated.

3.3.6 Sumps, Pipelines, and Trenches

Concrete trenches, sumps and pipelines that were or are being used to transport raw or waste hazardous materials are potential sources of soil contamination. These must be investigated to determine hot spots and prevent further contamination.

3.3.7 Lycoming Creek Sediments

The creek sediments have not been sampled to determine if there has been any contamination by recharge of the creek from the shallow aquifer or surface runoff from the site. The data will assist to establish the extent of contamination.

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3.3.8 Ground Water Southwest of MW-14B and Lycoming Creek

The potential for ground water contamination on the opposite side (southwest of MW-14B) of the Lycoming Creek has not been fully investigated. If the contamination has traveled in a southwest direction along the fractured bedrock (Tully formation), it has the potential of contaminating the public ground water supply source.

3.4 Air Stripper Operations

The remedial measures undertaken to date for ground water cleanup involve air strippers in five locations for both on-site and off-site ground water treatment. All of the air strippers are removing 95 to 97 percent of the volatile organic compounds from the ground water (Chester Engineers, March 1988). At this time, it is difficult to evaluate the effectiveness of overall past remediation effort because of insufficient data collected and lack of a consistent sampling plan. ERM recommends a uniform sampling of all or certain wells routinely to develop a pattern of water quality, and evaluate the impacts of each air stripping operation on the ground water.

During ERM's review of the monitoring data for the air stripper, ERM observed that the air stripper for Recovery Well No. 1 has been out of operation on occasion to replace the filter media because of fouling. The problem appears to be unique to only this stripper. To assess the fouling problem, samples of fouled tower packing can be examined for evidence of microbiological growth or the presence of iron or manganese. Influent to this stripper can also be analyzed for iron and manganese. ERM can then evaluate and recommend a method to improve the performance and operation of the air stripper.

3.4.1 Air Quality

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An additional area of concern is the impact of ground water treatment by the air strippers to the air quality, both on site and off site. Air quality will be addressed for any increase in the ground water remediation that would transfer the contaminants from the aqueous phase to the atmosphere. No data concerning the emissions in the vicinity of the air stripper was available at this time. The PADER has conducted air dispersion models which will be obtained and reviewed during the remedial investigation.

SECTION 4

EVALUATION OF REMEDIAL TECHNOLOGIES

4.1 Comparing Remedial Technologies

The analysis of remedial technologies presented in this section will employ a tabular presentation of options. The evaluation of the technologies will be performed in accordance with the SARA guidelines listed below.

Treatment Effectiveness

The treatment effectiveness is evaluated by a yes-no description of reduction in toxicity, mobility, and volume, along with permanence of the technologies.

Technical Feasibility

The technical feasibility of a technology is evaluated by a rating of high-moderate-low for general reliability and implementability and a yes-no basis of availability.

Protection of Human Health

The protection of human health is evaluated by a rating of improve-no change-diminish for both the short-term and long-term risks.

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Protection of the Environment

The protection of the environment is evaluated by a rating of improve-no change-diminish for both the short-term and long-term risks.

Magnitude of Cost

A probable range of unit costs is given for each remedial technology selected for inclusion in a remedial alternative. A probable range of total costs is unavailable since the quantity of ground water, and possibly soil, to be remediated are unknown at this time. The estimated costs provided in the tables of Section 4 reflect present pricings of the technologies, as discussed in the available literature. These costs will require adjustment after the completion of the Remedial Investigation. Innovative technologies will be evaluated only when they have the potential to reduce cost for the same level of protectiveness, to increase performance/protectiveness for similar cost, or, if necessary, to achieve applicable standards.

4.2 Areas of Concern

4.2.1 Ground Water

Remedial technologies available for resolving ground water contamination include but are not limited to the following:

- no action
- ground water pumping, treatment and discharge

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- Manufacturing areas - A review of aerial photos, plant schematics, and plant operating history for 5 to 10 year intervals can be performed. The information will assist in deciding practical soil sampling locations to investigate source(s) of TCE and degradation by-products contamination, and in evaluating whether there is a past or ongoing source(s) of contamination. Should soil sampling indicate remediation to alleviate the ground water contamination and assist in ground water cleanup, remediation techniques will be analyzed and recommended, as discussed in Section 4.

- Northeast Section of The Tully Formation - Ground water monitoring data for the bedrock and shallow aquifer will assist the Feasibility Study by establishing background levels of ground water flowing into the Tully formation.

- The West Bank of The Lycoming Creek - Ground water monitoring data for the bedrock and shallow aquifer on the creek's west bank will assist the Feasibility Study by investigating the flow of possibly contaminated ground water along the Tully formation.

- Lycoming Creek Bed - Studing approximately four soil samples (one can be taken upstream for a background sample, one can be taken at a point by the Elm Park stripper, one can be taken at a point by the WMWA stripper, and one can be taken below the WMWA strippers), will provide a check on the possible extent of contamination in the creek. Should soil sampling indicate remediation to alleviate surface water contamination, remediation techniques will be analyzed and recommended, as discussed in Section 4.

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- The Area Immediately Northeast of Elm Park - Ground water monitoring data for the bedrock from one, possibly two, locations will assist in evaluating the connection of the Elm Park area of high concentration - "hot spot" - with the plume of contamination migrating from the facility. Ground water monitoring in this area can record the impact of the travelling contaminated plume on the ground water system, and the progress of remediation on the ground water system.

- Air Strippers - As-built drawings and diagrams for each air stripper along with operational data, can be studied to determine the present operating status and in turn, their impact on the ground water remediation. Additional air stripping capacity/equipment will be recommended if analyses indicates that it would be beneficial in the optimization of cleanup.

- Cleanup Levels - The "levels to clean to" for the various impacted areas are to be established so that remediation efforts meet the agreed upon cleanup goal effectively.

- Water leach testing of the soil samples and sediment samples can be conducted, if the samples are found to be contaminated. These test results aid in determining the potential for migration of contaminating pollutants to the ground water.

- Air quality in the vicinity of the plant area can be monitored to determine the background concentrations, which can then be used to evaluate levels of air stripping treatment in the remediation phase.

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- Data concerning the maximum amount of contaminated ground water that can be pumped out of the ground water system on site should be developed. This information is used to evaluate the optimum remediation of contamination at the source.

- Data concerning the recharge rate of ground water on site and the fluctuation in the ground water levels should be determined to help screen treatment technologies. Based on the available information, the extent of ground water withdrawals should be evaluated further to determine the effect on the contaminant plume.

- Evaluation of selected remedial technologies for the formal Feasibility Study may require generation of the following data:

  - Iron, calcium and total dissolved solids may be tested to evaluate air stripping operations.

  - Bearing capacity of the soil may be tested to define surface suitability for capping.

  - Waste analyses of soil/sediment may be conducted for evaluating off-site disposal.

  - Percolation tests may be performed to define hydraulic loading in the case of soil flushing.

  - Leach tests may be performed to determine the potential duration of soil flushing.

- Soil characteristics such as moisture content, total organic content, total chloride content may be analyzed to evaluate soil stabilization.

- Vapor phase adsorption isotherms and BTU value of material may be developed to evaluate off-gas treatment.

The remedial technologies will be screened once the above data become available to evaluate alternatives that address the following:

- Minimum Remediation - the least site remediation which might be approved by the USEPA,

- Moderate Remediation - the degree of remediation more likely to be required by the USEPA,

- Maximum Remediation - the most extensive remediation which might be required by the USEPA.

5.2 Conclusions

ERM believes that to remedy the problem of ground water contamination, it is beneficial to begin at the source. In the case of the Textron Lycoming property, by possibly drawing the plume towards the WMWA well field (due to increased pumping at the recovery well in the well field), the remediation efforts may become more difficult and prolonged. This may be occurring by pulling the more contaminant concentrated plume into a large ground water supply, where the concentrations are diluted. This, in turn, may be extending the length of remediation. If the

ORIGINAL (Red)

source is eliminated and contaminants are recovered where they are present in the plume at high concentrations, the remediation efforts could be reduced and become more effective and optimal. At this time, the evaluation of the Preliminary FS indicates that more efforts to remediate ground water, and possible contamination sources, at the Textron property would benefit an efficient remediation.

As stated previously, should soil sampling indicate remediation to alleviate ground water and/or surface water contamination, remediation techniques will be analyzed and recommended as discussed in Section 4. Any additional air stripping capacity and/or equipment, will be recommended if analyses indicate that it would be beneficial in the optimization of remediation.

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APPENDIX A

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LE A-1

TEXTRON LYCOMING
WILLIAMSPORT FACILITY
Analytical Results for Monitoring Wells at the Textron Lycoming Facility, Williamsport, PA.

HIT COMPOUNDS / WELL NUMBER	DATE	1,2-Dichloro-ethylene(Total) ppb	Trichloro-ethylene ppb	Benzene ppb	Chloroform ppb	1,1-Dichloro-ethane ppb	1,1-Dichloro-ethylene ppb	Ethylbenzene ppb	Toluene ppb	1,1,1-Trichloro-ethane ppb	Vinyl Chloride ppb	Total Chromium ppm
MW-1	2/6/85	120	500	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/5/85	78	1170	<10	<10	<10	<10	<10	<10	21	<10	< 005
MW-2	2/8/85	<10	17	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/6/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	0 008
MW-3	2/11/85	850	1460	<10	<10	<10	10	<10	<10	<10	<10	NA
	3/6/85	<10	3379	<10	<10	<10	17	<10	<10	<10	<10	8 1
	1/23/86	3460	3406	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/5/86	2600	3300	<10	<10	<10	<10	<10	<10	<10	504	NA
	9/3/86	118	380	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	242	556	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	652	919	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/30/87	21	135	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	<5	90	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	13	144	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/29/87	26	150	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	356	608	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	1400	4000	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/26/88	12	75	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/21/88	*160*	*500*	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*	*22*	*NA*
MW-4	2/7/85	35	904	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/6/85	13	<10	<10	<10	<10	<10	<10	<10	<10	<10	0.09
	5/22/85	10	<10	<10	13	<10	<10	<10	<10	<10	<10	0.03
	1/29/86	150	460	<5	<5	60	<5	<5	<5	<5	<5	NA
	3/5/86	21	30	<10	<10	<10	<10	<10	<10	<10	<10	NA
	9/3/86	6	342	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	20	880	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	28	407	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	19	275	NA	NA	NA	NA	NA	NA	NA	NA	0.03
	4/30/87	19	272	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	9	329	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	11	283	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/29/87	19	180	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	16	149	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	7	135	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/26/88	15	125	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/21/88	*13*	*150*	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*	*<10*	*NA*
MW-5	2/7/85	1900	9360	<10	335	<10	<10	<10	<10	<10	<10	NA
	2/19/85	12621	22928	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/6/85	7137	16274	<10	<10	<10	<10	<10	<10	1567	<10	0.02
	8/9/85	28100	39100	<10	273	<10	111	<10	40	<10	746	NA
	12/10/85	8204	6874	<5	<5	<5	<5	<5	<5	268	<5	NA
	1/10/86	3040	2490	<25	<5	50	56	<5	<5	880	192	NA
	3/5/86	9000	2130	<10	<10	76	114	<10	76	868	418	NA
	9/3/86	2040	706	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	3900	715	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	2430	528	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	4000	572	NA	NA	NA	NA	NA	NA	NA	NA	<0.01
	4/30/87	4060	340	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	1960	285	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	3640	97	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/28/87	3800	390	<10	<10	26	50	<10	<10	112	1100	NA
	12/22/87	2600	600	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	2700	201	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/26/88	2300	320	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/21/88	*1400*	*410*	*<5*	*4J*	*42*	*40*	*3BJ*	*15B*	*250*	*130*	*NA*
	6/21/88	*1,2-Dichloroethane=1J, Tetrachloroethylene=8, Chlorobenzene=3BJ, Xylene(Total)=21J*										

NA = No Analysis
"B" - This result is qualitatively questionable because the compound was detected in method and/or travel blanks at similar concentrations.
"J" - This result is an estimated concentration.

All 6/88 samples collected by ERM, samples analyzed by Lancaster Laboratories for TCL volatile list and extra peaks with CLP data packages Other data compiled from Chester Engineering reports

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TABLE A-1 (CONT.)

TEXTRON LYCOMING
WILLIAMSPORT FACILITY
Analytical Results for Monitoring Wells at the Textron Lycoming Facility, Williamsport, PA.

HIT COMPOUNDS		1,2-Dichloro-ethylene(Total)	Trichloro-ethylene	Benzene	Chloroform	1,1-Dichloro-ethane	1,1-Dichloro-ethylene	Ethylbenzene	Toluene	1,1,1-Trichloro-ethane	Vinyl Chloride	Total Chromium
WELL NUMBER	DATE	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppm
MW-6	2/6/85	338	1495	<10	<10	<10	<10	<10	<10	<10	<10	NA
	2/19/85	1061	4948	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/6/85	633	3623	<10	<10	<10	<10	<10	<10	<10	<10	0.01
	1/10/86	625	3540	<100	<100	<100	<100	<100	<100	<100	<100	NA
	3/5/86	484	2900	<10	<10	<10	<10	<10	<10	<10	59	NA
	9/3/86	179	1080	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	253	925	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	400	1640	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	461	1030	NA	NA	NA	NA	NA	NA	NA	NA	<0.01
	4/30/87	470	1430	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	177	661	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	409	1640	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/28/87	330	870	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	486	2190	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	432	2850	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/26/88	385	2000	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/21/88	*270*	*2400*	*<25*	*<25*	*<25*	*5J*	*<25*	*<25*	*<25*	*30J*	*NA*
	6/21/88	*Tetrachloroethylene = 17J, Methylene Chloride = 10BJ, Acetone = 47BJ*										
MW-7	2/19/85	704	1382	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/5/85	<10	596	<10	<10	<10	<10	<10	<10	<10	<10	0.06
	12/10/85	216	1226	<5	<5	<5	<5	<5	<5	<5	<5	NA
	1/16/86	222	900	<10	<10	<10	<10	<10	<10	<10	<1	NA
	3/5/86	66	976	<10	<10	<10	<10	<10	16	<10	<10	NA
	9/3/86	<5	148	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	6	22	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	6	237	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	8.4	446	NA	NA	NA	NA	NA	NA	NA	NA	0.05
	4/30/87	6	307	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	<5	31	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	<5	107	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/29/87	<5	110	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	<5	125	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	<5	128	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	<5	65	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/21/88	*2J*	*110*	*<5*	*3J*	*<5*	*<5*	*<5*	*<5*	*<5*	*<10*	*NA*
MW-8	2/12/85	15400	16600	<500	<500	<500	<500	<500	<500	<500	<500	NA
	2/19/85	1447	1081	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/5/85	8179	5443	<10	<10	<10	<10	<10	<10	<10	<10	0.01
	12/10/85	9517	4210	<5	<5	19	29	<5	<5	59	<5	NA
	1/16/86	10170	8150	<10	<10	36	66	<10	<10	98	<10	NA
	3/5/86	5800	8500	<10	<10	<10	<10	<10	<10	<10	<10	NA
	9/3/86	1470	1470	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	2570	2000	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	3110	3090	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	1080	799	NA	NA	NA	NA	NA	NA	NA	NA	<0.01
	4/30/87	2510	2260	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	961	842	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	3040	2530	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/29/87	3300	1600	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	2620	1460	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	1800	2000	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	1600	1700	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/21/88	*1400*	*1600*	*<5*	*1J*	*12*	*13*	*<5*	*<5*	*18*	*11*	*NA*
	6/21/88	*Tetrachloroethylene = 140*										

NA = No Analysis
"B" - This result is qualitatively questionable because the compound was detected in method and/or travel blanks at similar concentrations.
"J" - This result is an estimated concentration.

All 6/88 samples collected by ERM. samples analyzed by Lancaster Laboratories for TCL volatile list and extra peaks with CLP data packages Other data compiled from Chester Engineering reports

AR300245

The ERM Group

ORIGINAL (Red)

TABLE A-1 (CONT.)

TEXTRON LYCOMING
WILLIAMSPORT FACILITY
Analytical Results for Monitoring Wells at the Textron Lycoming Facility, Williamsport, PA.

HIT COMPOUNDS / WELL NUMBER	DATE	1,2-Dichloro-ethylene(Total) ppb	Trichloro-ethylene ppb	Benzene ppb	Chloroform ppb	1,1-Dichloro-ethane ppb	1,1-Dichloro-ethylene ppb	Ethylbenzene ppb	Toluene ppb	1,1,1-Trichloro-ethane ppb	Vinyl Chloride ppb	Total Chromium ppm
MW-8D	2/15/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	2/20/85	640	807	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/5/85	1219	1220	<10	<10	<10	<10	<10	<10	<10	<10	0.008
	12/10/85	214	2160	<5	59	<5	13	<5	7	<5	<5	NA
	1/16/86	6070	5800	<100	<100	<100	<100	<100	<100	<100	350	NA
	3/5/86	3700	5200	<10	<10	<10	21	<10	<10	<10	212	NA
	9/3/86	5720	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	4710	4680	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	5240	5380	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	4090	3210	NA	NA	NA	NA	NA	NA	NA	NA	<0.01
	4/30/87	4680	4050	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	4610	4160	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	5880	3960	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/29/87	7700	3700	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	5190	3240	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	4000	4600	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	5200	6100	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/88	*5400*	*6000*	*<100*	*<100*	*<100*	*27J*	*<100*	*<100*	*<100*	*150J*	*NA*
	6/22/88	*Methylene Chloride = 55BJ*										
MW-9	2/6/85	38	868	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/5/85	138	1383	<10	<10	<10	<10	<10	<10	<10	<10	0.005
MW-10	4/26/85	<10	30	<10	<10	<10	<10	<10	<10	<10	<10	NA
MW-11	4/26/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
MW-12	4/26/85	46	93	<10	<10	<10	<10	<10	<10	<10	<10	NA
	4/30/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
MW-13	5/3/85	<10	25	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/5/86	<10	62	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/3/87	6	62	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	14	64	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-14B	5/3/85	730	880	<10	<10	<10	<10	<10	<10	<10	<10	0.02
	6/12/85	1365	9560	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/26/85	1167	3845	<10	<10	<10	<10	<10	<10	<10	<10	NA
	8/9/85	1110	3520	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/17/86	1640	3610	<10	<10	<10	<10	<10	<10	<10	<10	NA
	9/3/86	738	272	<5	15	<5	<5	<5	<5	<5	<5	NA
	1/14/87	1060	1790	<5	<5	<5	<5	<5	<5	<5	<5	NA
	4/30/87	369	535	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/3/87	591	1320	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	306	602	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/28/87	300	600	<10	<10	<10	<10	<10	<10	<10	<10	NA
	12/22/87	469	890	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/29/88	498	1260	<5	<5	<5	<5	<5	<5	<5	<5	<5
	2/18/88	313	1000	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	466	1200	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/23/88	*470*	*1200*	*<25*	*<25*	*<25*	*<25*	*<25*	*<25*	*<25*	*<50*	*NA*
	6/23/88	*Methylene Chloride = 13BJ*										
MW-15	5/3/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MW-16	5/3/85	430	570	<10	<10	<10	<10	<10	<10	<10	<10	NA
	8/15/85	290	1370	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/16/86	671	2538	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/3/87	6	22	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/28/87	560	1600	<10	<10	<10	<10	<10	<10	<10	<10	NA
	12/22/87	536	1870	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/29/88	465	1780	<10	<10	<10	<10	<10	<10	<10	<10	NA
	2/18/88	505	2050	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	516	1800	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/23/88	*670*	*2100*	*<5*	*4J*	*3J*	*3J*	*<5*	*<5*	*4J*	*<10*	*NA*
	6/23/88	*Tetrachloroethylene = 3J, Carbon tetrachloride = 3J*										

NA=No Analysis
"B" - This result is qualitatively questionable because the compound was detected in method and/or travel blanks at similar concentrations.
"J" - This result is an estimated concentration. All 6/88 samples collected by ERM, samples analyzed by Lancaster Laboratories for TCL volatile list and extra peaks with CLP data packages Other data compiled from Chester Engineering reports

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ORIGINAL (Red)

TABLE A-1 (CONT.)
TEXTRON LYCOMING
WILLIAMSPORT FACILITY
Analytical Results for Monitoring Wells at the Textron Lycoming Facility, Williamsport, PA.

HIT COMPOUNDS / WELL NUMBER	DATE	1,2-Dichloro-ethylene(Total)	Trichloro-ethylene	Benzene	Chloroform	1,1-Dichloro-ethane	1,1-Dichloro-ethylene	Ethylbenzene	Toluene	1,1,1-Trichloro-ethane	Vinyl Chloride	otal Chromiun
		ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppm
MW-17	5/10/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	0 07
MW-18	5/9/85	486	37200	<10	<10	<10	<10	<10	<10	<10	<10	15
	6/12/85	456	60400	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/29/86	250	29400	<10	<10	<10	<10	<10	<10	<10	77	NA
	3/5/86	340	29000	<10	<10	<10	<10	<10	<10	<10	99	NA
	9/3/86	106	9780	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	153	9380	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	156	8910	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	159	6790	NA	NA	NA	NA	NA	NA	NA	NA	12
	4/30/87	138	8730	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	165	20800	NA	NA	NA	NA	NA	NA	NA	NA	11
	8/14/87	287	16800	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/29/87	150	7400	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	<10	8700	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	73	8000	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/26/88	107	12600	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/21/88	*39*	*3800*	*<25*	*<25*	*<25*	*<25*	*<25*	*<25*	*<25*	*<50*	*NA*
	6/21/88	*Methylene Chloride = 13BJ*										
MW-19	5/10/85	<10	680	<10	<10	<10	<10	11	<10	<10	<10	0.06
MW-20	5/10/85	143	1990	<10	<10	<10	22	<10	<10	<10	<10	0.02
	6/26/85	116	1831	<10	35	<10	<10	<10	<10	<10	64	NA
MW-21	5/10/85	1750	11100	<10	<10	1560	825	70	<10	15300	<10	0.08
	6/26/85	1744	10560	<10	<10	652	526	<10	14	16590	<10	NA
	8/9/85	116	685	<10	<10	25	10	<10	<10	308	<10	NA
	12/11/85	2980	8802	91	<5	439	466	<5	128	10843	<5	NA
	1/23/86	4090	8590	<10	<10	585	623	<10	<10	11260	<10	NA
	1/29/86	280	8290	<10	<10	500	910	<10	<10	4200	<10	NA
	3/5/86	3340	6300	<20	<20	472	397	<20	<20	12000	<20	NA
	9/3/86	1920	1860	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	5480	3030	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	5480	2440	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	9430	1780	NA	NA	NA	NA	NA	NA	NA	NA	<0.01
	4/30/87	9640	1940	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	9300	1780	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	6150	695	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/28/87	14000	960	<10	<10	290	370	<10	<10	7200	<10	NA
	12/22/87	12000	872	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	5900	1100	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/26/88	11000	1400	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/88	*7800*	*1100*	*<50*	*<50*	*210*	*180*	*18BJ*	*15BJ*	*6000*	*320*	*NA*
	6/22/88	*Methylene Chloride = 30BJ*										
MW-22	5/16/85	<10	<10	16	<10	<10	<10	<10	<10	<10	<10	0.01
	6/26/85	Only 25 ppb of 1,2- Dichloroethane, all other volatiles are below detection limit, <10 ppb.										NA
MW-23	5/17/85	631	1010	36	<10	<10	<10	<10	<10	26	<10	<0.01
	6/26/85	60	55	<10	<10	<10	<10	<10	<10	<10	<10	NA
	12/11/85	1705	2320	<5	14	13	10	<5	<5	40	<5	NA
	1/16/86	2785	2117	<10	<10	20	16	<10	<10	62	<10	NA
	3/5/86	1160	1730	<10	<10	<10	<10	<10	<10	31	<10	NA
	9/3/86	20	912	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	224	291	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	1780	2540	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	330	456	NA	NA	NA	NA	NA	NA	NA	NA	0 05
	4/30/87	971	841	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	2.5	355	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	1660	2040	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/29/87	9 3	170	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	15	380	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	5 5	386	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	61	337	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/21/88	*32*	*300*	*<5*	*3J*	[illegible]	*<5*	*<5*	*<5*	*<5*	*<10*	*NA*

NA=N[illegible]alysis
All 6/88 samples collected by ERM. samples analyzed by [illegible]ier Laboratories for TCL volatile list and extra peaks with CLP data packages Other data compiled from Chest[illegible]gineering reports
"B" - This result is qualitatively questionable because the compound was detected in method and/or travel blanks at similar concentrations.

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The ERM Group

ORIGINAL (Red)

TABLE [illegible]-1 (CONT.)
TEXTRON LYCOMING
WILLIAMSPORT FACILITY
Analytical Results for Monitoring Wells at the Textron Lycoming Facility, Williamsport, PA.

HIT COMPOUNDS		1,2-Dichloro-ethylene(Total)	Trichloro-ethylene	Benzene	Chloroform	1,1-Dichloro-ethane	1,1-Dichloro-ethylene	Ethylbenzene	Toluene	1,1,1-Trichloro-ethane	Vinyl Chloride	Total Chromium
WELL NUMBER	DATE	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppm
MW-24	5/7/85	<10	33	<10	<10	<10	<10	<10	<10	<10	<10	NA
	5/17/85	<10	57	<10	24	<10	<10	<10	<10	<10	<10	0.04
	6/12/85	<10	122	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/26/85	<10	77	<10	<10	<10	<10	<10	<10	<10	<10	NA
	2/18/88	<5	9.7	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-25	5/22/85	213	1580	<10	<10	<10	<10	<10	<10	<10	<10	0.02
	8/15/85	153	1232	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/6/86	229	1180	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/15/87	308	1870	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/16/87	318	1630	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/3/87	312	1990	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	400	2040	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	443	1700	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/26/87	360	1000	<10	<10	<10	<10	<10	<10	<10	<10	NA
	12/22/87	443	1700	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	12	107	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	455	1800	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/88	*620*	*1900*	*<5*	*4J*	*2J*	*2J*	*<5*	*<5*	*2J*	*<10*	*NA*
	6/22/88	*Carbon Tetrachloride = 4J*										
MW-26	5/22/85	<10	53	<10	<10	<10	<10	<10	<10	<10	<10	0.48
	6/19/85	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	<.005
	3/6/86	26	152	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/3/87	15	105	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	7	60	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/29/88	7.1	65	<5	<5	<5	<5	<5	<5	<5	<5	NA
	2/19/88	<5	8.6	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	5	46	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/88	*6*	*53*	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*	*<10*	*NA*
MW-28	8/2/85	<10	18	<10	<10	<10	<10	<10	<10	<10	<10	NA
	8/14/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	2/19/88	<5	5.5	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-29	8/8/85	13	28	48	<10	<10	<10	<10	<10	<10	<10	NA
MW-30	8/8/85	538	1256	<10	<10	<10	<10	<10	<10	27	<10	NA
	8/15/85	366	872	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/29/88	243	661	<5	<5	<5	<5	<5	<5	<5	<5	NA
	2/19/88	225	636	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	331	853	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/88	*390*	*840*	*<25*	*<25*	*<25*	*<25*	*<25*	*<25*	*<25*	*<50*	*NA*
	6/22/88	*Methylene Chloride = 15BJ*										
MW-31	8/7/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	8/13/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/22/88	*10*	*510*	*<5*	*3J*	*<5*	*<5*	*<5*	*<5*	*<5*	*<10*	*NA*
MW-32	8/8/85	16	78	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/3/87	7	82	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-33	8/8/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
MW-34	8/9/85	<10	16	<10	<10	<10	<10	<10	<10	<10	<10	NA
MW-35	8/9/85	<10	35	<10	<10	<10	<10	<10	<10	<10	<10	NA
MW-36	8/9/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
MW-37	8/8/85	<10	17	<10	<10	<10	<10	<10	<10	<10	<10	NA
	8/13/85	<10	27	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/16/86	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/3/87	24	55	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA=No Analysis
"B" - This result is qualitatively questionable because the compound was detected in method and/or travel blanks at similar concentrations.
"J" - This result is an estimated concentration. All 6/88 samples collected by ERM, samples analyzed by Lancaster Laboratories for TCL volatile list and extra peaks with CLP data packages. Other data compiled from Chester Engineering reports.

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TABLE A-1 (CONT.)
TEXTRON LYCOMING
WILLIAMSPORT FACILITY
Analytical Results for Monitoring Wells at the Textron Lycoming Facility, Williamsport, PA.

HIT COMPOUNDS		1,2-Dichloro-ethylene(Total)	Trichloro-ethylene	Benzene	Chloroform	1,1-Dichloro-ethane	1,1-Dichloro-ethylene	Ethylbenzene	Toluene	1,1,1-Trichloro-ethane	Vinyl Chloride	Total Chromium
WELL NUMBER	DATE	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppm
MW-41	8/8/85	<10	40	<10	<10	<10	<10	<10	<10	<10	<10	NA
	8/15/85	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/6/86	283	394	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/3/87	141	243	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	54	111	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-46	8/2/85	<10	15	<10	<10	<10	<10	<10	<10	<10	<10	NA
	3/5/86	<10	30	<10	<10	<10	<10	<10	<10	<10	<10	NA
	9/3/86	<5	24	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	<5	23	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	<5	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	<5	61	NA	NA	NA	NA	NA	NA	NA	NA	<0.01
	4/30/87	<5	81	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	<5	78	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	<5	124	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/29/87	<5	83	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	<5	92	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	<5	104	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/26/88	1600	2500	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/21/88	*<5*	*90*	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*	*<10*	*NA*
	6/21/88	*1,2-Dichloroethane = 2J*										
MW-50	8/2/85	67	26	<10	<10	<10	<10	<10	<10	<10	32	NA
	8/8/85	122	63	<10	<10	<10	<10	<10	<10	<10	169	NA
	12/11/85	2271	502	<5	<5	24	8	10	<5	<5	1675	NA
	3/5/86	3690	4880	<10	<10	24	16	<10	<10	14	2340	NA
	9/3/86	478	141	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/10/86	3140	1070	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/18/86	8240	405	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/5/87	15200	3060	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/30/87	22400	2900	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/2/87	19900	1980	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	6810	340	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/28/87	38000	15000	<10	<10	<10	<10	<10	<10	<10	<10	NA
	12/22/87	38000	8200	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/19/88	22800	2100	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/28/88	48000	2800	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/88	*5900*	*4300*	*<50*	*<50*	*14J*	*12J*	*<50*	*<50*	*<50*	*750*	*NA*
	6/22/88	*Methylene Chloride = 29BJ*										
MW-51	1/29/86	384	1480	<5	<5	<5	<5	<5	<5	<5	<5	NA
	3/6/86	56	370	<10	<10	<10	<10	<10	<10	<10	<10	NA
	6/3/87	202	762	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/28/87	410	810	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/29/87	170	740	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/22/87	100	501	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/29/88	83	410	<5	<5	<5	<5	<5	<5	<5	<5	NA
	2/19/88	<5	12	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	105	606	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-52	1/29/86	657	1600	<5	<5	<5	<5	<5	<5	<5	<5	NA
	3/5/86	310	900	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/15/87	342	1180	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/16/87	251	834	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/23/87	356	1040	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/3/87	433	1730	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/28/87	270	420	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	800	2200	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-53	1/31/86	<5	7	<5	<5	<5	<5	<5	<5	<5	<5	NA
	3/6/86	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/15/87	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/16/87	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/23/87	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/3/87	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA = No Analysis
"B" [illegible]s result is qualitatively questionable because the compound was detected in method and/or [illegible]vel blanks at similar concentrations.
"J" [illegible] result is an estimated concentration. All 6/88 samples collected by ERM, samples analyzed b[illegible]aster Laboratories for TCL volatile list and extra peaks with CLP data packages. Other data compiled from Ch[illegible]ngineering reports.

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ORIGINAL PAGE

TABLE A-1 (CONT.)

TEXTRON LYCOMING
WILLIAMSPORT FACILITY
Analytical Results for Monitoring Wells at the Textron Lycoming Facility, Williamsport, PA.

HIT COMPOUNDS		1,2-Dichloro-ethylene(Total)	Trichloro-ethylene	Benzene	Chloroform	1,1-Dichloro-ethane	1,1-Dichloro-ethylene	Ethylbenzene	Toluene	1,1,1-Trichloro-ethane	Vinyl Chloride	Total Chromium
WELL NUMBER	DATE	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppm
MW-54	1/31/86	136	217	<5	<5	<5	<5	<5	<5	<5	<5	NA
	3/5/86	230	330	<10	<10	<10	<10	<10	<10	<10	<10	NA
	1/15/87	174	173	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/16/87	221	536	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/23/87	606	1930	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/3/87	366	907	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	434	837	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	216	1210	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-55B	9/3/86	103	411	<5	411	<5	<5	<5	<5	<5	<5	NA
	4/30/87	88	320	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/3/87	73	244	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	65	239	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/88	*92*	*380*	*<5*	*9*	*<5*	*<5*	*<5*	*<5*	*<5*	*NA*	*NA*
MW-56	9/3/86	9	51	<5	8	<5	<5	<5	<5	<5	<5	NA
	4/30/87	5	25	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/3/87	<5	17	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/88	21	130	<5	10	<5	<5	<5	<5	<5	<10	NA
MW-57	9/3/86	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	NA
	4/30/87	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/3/87	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-58	9/3/86	38	190	<5	<5	<5	<5	<5	<5	<5	<5	NA
	4/30/87	193	451	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/3/87	88	246	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/14/87	35	137	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/27/88	507	1300	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/88	*200*	*550*	*<25*	*<25*	*<25*	*<25*	*<25*	*<25*	*<25*	*<50*	*NA*
	6/22/88	*Methylene Chloride = 10BJ*										

NA = No Analysis
"B" - This result is qualitatively questionable because the compound was detected in method and/or travel blanks at similar concentrations.
"J" - This result is an estimated concentration. All 6/88 samples collected by ERM; samples analyzed by Lancaster Laboratories for TCL volatile list and extra peaks with CLP data packages. Other data compiled from Chester Engineering reports.

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ORIGINAL (Red)

TABLE A-2
TEXTRON GROUND WATER ANALYSIS SUMMARY TABLE
METALS

Monitoring Well	Sample Date	Aluminum mg/L Al	Cadmium mg/L Cd	Chromium mg/L Cr	Copper mg/L Cu	Iron mg/L Fe	Lead mg/L Pb	Manganese mg/L Mn	Nickel mg/L Ni	Zinc mg/L Zn
MW-1	3/6/85	0.6	0.005	<.005	0.02	1.6	0.01	24	0.02	0.03
MW-2	3/6/85	2.3	<.005	0.008	0.02	5.1	0.03	1.4	0.02	0.14
MW-3	3/6/85	24	4.1	8.1	14	40	0.11	19	0.39	0.88
MW-4	3/6/85	20	0.01	0.09	0.14	14	0.11	6.3	0.01	0.08
	5/22/85	-	<.005	0.03	0.02	-	0.03	-	0.01	0.06
	3/5/87			0.03						
MW-5	3/6/85	1.8	0.005	0.02	0.04	4.3	0.02	7.2	<.01	0.03
	3/5/87			<0.01						
MW-6	3/6/85	2.6	<.005	0.01	0.04	4.8	0.04	4.3	0.01	0.05
	3/5/87			<0.01						
MW-7	3/6/85	7.5	<.005	0.06	0.04	15	0.05	3.6	0.01	0.06
	3/5/87			0.05						
MW-8D	3/6/85	0.8	<.005	0.008	0.02	1.6	<.01	0.07	<.01	0.02
	3/5/87			<.0.01						
MW-8	3/6/85	4.3	<.005	0.01	0.03	9.8	0.03	2	<.01	0.05
	3/5/87			<0.01						
MW-9	3/6/85	1.6	0.005	0.005	0.02	4.4	0.02	5.4	0.02	0.02
MW-14B	5/3/85	-	<0.01	0.02	0.07	-	0.07	-	0.02	0.18
MW-17	5/10/85	-	0.006	0.07	0.11	-	0.11	-	0.18	0.45
MW-18	5/9/85	-	<.005	15	0.12	-	0.04	-	0.13	0.34
	3/5/87			12						
MW-19	5/10/85	-	0.005	0.06	0.1	-	0.11	-	0.08	0.46
MW-20	5/10/85	-	<.005	0.02	0.05	-	0.05	-	0.01	0.19
MW-21	5/10/85	-	0.02	0.08	0.26	-	0.14	-	0.31	0.56
	3/5/87			<0.01						
MW-22	5/16/85	-	<.005	0.01	0.01	-	<.01	-	0.01	0.06
MW-23	5/17/85	-	<.005	<.01	<.01	-	<.01	-	<.01	0.03
	3/5/87			<0.05						
MW-24	5/17/85	-	0.005	0.04	0.1	-	0.11	-	0.13	0.42
MW-25	5/22/85	-	<0.005	0.02	0.03	-	0.06	-	0.04	0.10
MW-26	5/22/85	-	0.02	0.48	0.37	-	0.24	-	0.81	0.47
	6/19/85	-	<.005	<.005	0.008	-	<.01	-	0.006	0.05
MW-46	3/5/87			<0.01						

Source: Compiled from Chester Engineers, Inc. reports.

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TABLE A - 3
TEXTRON LYCOMING, WILLIAMSPORT FACILITY
SOIL ANALYSIS DATA

HIT COMPOUNDS	MW - 5 10 - 11 FT 2/7/85	MW - 5 25 -26 FT 2/7/85	MW - 8 20 - 21 FT 2/12/85	MW - 8 30 - 31 FT 2/12/85	B - 45 18.5 -19.5 FT 7/30/85	MW - 46 18.0 - 19.6 FT 7/30/85	B-48 0.7 - 2.2 FT 7/30/85	B-48 8.5 - 10 FT 7/30/85
BENZENE ppb	<10	<10	<10	<10	<10	<10	35	<10
CHLOROFORM ppb	<10	<10	<10	<10	<10	<10	28	<10
1,2-DICHLOROETHANE ppb	<10	<10	<10	<10	<10	<10	<10	<10
ETHYLBENZENE ppb	19	<10	<10	<10	<10	<10	<10	112
METHYLENE CHLORIDE ppb	<10	<10	<10	<10	<10	<10	101	<10
TOLUENE ppb	23	<10	<10	<10	<10	<10	61	<10
1,2-TRANS-DICHLOROETHYLENE ppb	<10	<10	<10	<10	<10	<10	<10	<10
TRICHLOROETHYLENE ppb	<10	<10	<10	<10	<10	<10	35	<10
VINYL CHLORIDE ppb	<10	<10	<10	<10	<10	<10	<10	<10

Source: Chester Engineers Report on soil investigation, May 23 1986.

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ORIGINAL (Red)

TABLE A - 3 (continued)
TEXTRON LYCOMING, WILLIAMSPORT FACILITY
SOIL ANALYSIS DATA

HIT COMPOUNDS	B-49 0.7 - 2.2 FT 7/30/85	B-49 8.5 -10.0 FT 7/30/85	MW - 50 3.5 - 5.0 FT 7/30/85	MW - 50 13.5 -15.0 FT 7/30/85	B-47 23.5 - 25.0 FT 7/30/85	B-39 19.0 - 20.5 FT 8/19/85	B-39 Composite 8/19/85
BENZENE ppb	<10	<10	<10	<10	<10	<10	<10
CHLOROFORM ppb	<10	<10	3.0	26	<10	<10	<10
1,2-DICHLOROETHANE ppb	227	<10	<10	<10	<10	<10	<10
ETHYLBENZENE ppb	<10	<10	<10	<10	<10	<10	<10
METHYLENE CHLORIDE ppb	<10	<10	23	22	<10	13	<10
TOLUENE ppb	<10	<10	<10	<10	<10	<10	<10
1,2-TRANS-DICHLOROETHYLENE ppb	<10	<10	<10	29	<10	<10	<10
TRICHLOROETHYLENE ppb	<10	<10	<10	13	<10	<10	<10
VINYL CHLORIDE ppb	<10	<10	<10	25	<10	<10	<10

Source: Chester Engineers Report on soil investigation, May 23 1986.

ORIGINAL (Red)

TABLE A - 3 (continued)
TEXTRON LYCOMING, WILLIAMSPORT FACILITY
SOIL ANALYSIS DATA

HIT COMPOUNDS	B-40 13.5 - 15.0 FT 8/19/85	B-40 Composite 8/19/85	B-41 13.5 - 15.0 FT 8/19/85	B-41 Composite 8/19/85	B-42 14.0 - 15.5 FT 8/19/85	B-42 Composite 8/19/85	B-43 8.5 - 10 FT 8/19/85	B-43 Composite 8/19/85	B-44 Composite 8/19/85
BENZENE ppb	<10	<10	<10	<10	<10	<10	<10	<10	<10
CHLOROFORM ppb	<10	<10	<10	<10	<10	<10	<10	<10	<10
1,2-DICHLOROETHANE ppb	<10	<10	<10	<10	<10	<10	<10	<10	<10
ETHYLBENZENE ppb	<10	<10	<10	<10	<10	<10	<10	<10	<10
METHYLENE CHLORIDE ppb	6	<10	<10	<10	<10	<10	<10	<10	33
TOLUENE ppb	<10	<10	<10	<10	<10	<10	<10	<10	<10
1,2-TRANS-DICHLOROETHYLENE ppb	<10	<10	<10	<10	<10	<10	<10	<10	<10
TRICHLOROETHYLENE ppb	17	<10	<10	<10	<10	<10	<10	<10	<10
VINYL CHLORIDE ppb	<10	<10	<10	<10	<10	<10	<10	<10	<10

Source: Chester Engineers Report on soil investigation, May 23 1986.

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ORIGINAL (Red)

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TABLE A-4
TEXTRON LYCOMING
GROUND WATER RECOVERY SYSTEM

Recovery Well	Normal Flow Rate (gpd)	Treatment	Date of Start-up	Discharge Point	TCE-DCE Total lbs. Removed*	TCE-DCE lbs. Removed per million gallons	TCE-DCE Average lbs. Removed Daily
Plant Site							
1	7,000	Air Stripping	Aug-85	Cemetery Run-Susquehanna River	610	235	1.1
2	15,000	Air Stripping Chromium Removal	Mar-87**	Lycoming Creek	77	39	0.2
Deep Well	30,000	Air Stripping	Jan-86	Cemetery Run-Susquehanna River	536	50	1
Off-Site							
Elm Park	50,000	Air Stripping	Apr-87	Lycoming Creek	94	13	0.3
WMWA	1,000,000	Air Stripping	May-87	Lycoming Creek	845	4	3
TOTAL	1,102,000				2,162		5.6

Source: Chester Engineers Report, March 1988
* Estimated from values extrapolated through February 1988
**Chromium, Total removed 49 lbs.

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ORIGINAL (Red)

APPENDIX B

Table 4-1-1
Evaluation of the no action alternative as a remedial action for the ground water

The no action alternative should be investigated to generate base-line values for comparison with the proposed remediation effort. The no action alternative could be implemented if it was shown that the area met the applicable standards, did not affect human health, and therefore required no remediation.

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	No	No change in contaminated material
	Reduction in mobility	No	No change in contaminated material
	Reduction in volume	No	No change in contaminated material
	Permanent solution	NA	
Technical Feasibility	Reliability	NA	
	Readily available	NA	
	Implementability	NA	
Protection of Human Health	Short term	No change	No disturbance of the current ground water flow
	Long term	Unknown	No remediation of the source material
Protection of the Environment	Short term	No change	The potential environmental effects are unknown
	Long term	Unknown	The potential environmental effects are unknown
Magnitude of Cost		Not Applicable	

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Table 4-1-2
Evaluation of ground water pumping and treatment as a remedial action for the ground water

This alternative will employ a number of wells to pump the contaminated ground water and prevent further plume migration. Treatment will remove both the organics and metals in the ground water before the water is discharged to the river.

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	Yes	However, contaminants will be transferred to another medium
	Reduction in mobility	Yes	Pumping prevents the migration of the contaminated plume
	Reduction in volume	Yes	Contaminants transferred to small volume of treated sludge
	Permanent solution	Yes	Once contaminants are removed from ground water they will not return
Technical Feasibility	Reliability	High	Ground water pumping and treatment are well established technologies
	Readily available	Yes	There are a number of contractors available to do this type of project
	Implementability	Moderate	Large volumes of ground water will have to be pumped to intercept all the plume
Protection of Human Health	Short term	No change	No increased exposure to contaminants with proper health and safety procedures
	Long term	Improve	Contaminants will be permanently removed from the ground water
Protection of the Environment	Short term	No change	No new exposure to contaminants
	Long term	Improve	Contaminants will be permanently removed from the ground water
Magnitude of Cost		$2.00 -$10.00 per 1000 gallons ground water	The cost reflect the range for different treatment alternatives and pumping of ground water. The cost does not include any treatment for the offgas in combination with aqueous phase treatment

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Table 4-1-3.
Evaluation of ground water pumping and treatment and recharge of aquifer on the upstream side of ground water flow

This alternative will employ a number of wells to pump the contaminated ground water and prevent further plume migration. Treatment will remove both the organics and metals in the ground water before the water is used to recharge the aquifer on the upstream side of ground water flow (above point of withdrawal). This alternative could accelerate the ground water cleanup operation.

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	Yes	However, contaminants will be transferred to another medium
	Reduction in mobility	Yes	Pumping prevents the migration of the contaminated plume
	Reduction in volume	Yes	Contaminants transferred to small volume of treated sludge
	Permanent solution	Yes	Once contaminants are removed from ground water they will not return
Technical Feasibility	Reliability	High	Ground water pumping and treatment are well established technologies
	Readily available	Yes	There are a number of contractors available to do this type of project
	Implementability	Moderate	Large volumes of ground water will have to be pumped to intercept all the plume
Protection of Human Health	Short term	No change	No increased exposure to contaminants with proper health and safety procedures
	Long term	Improve	Contaminants will be permanently removed from the ground water
Protection of the Environment	Short term	No change	No new exposure to contaminants
	Long term	Improve	Contaminants will be permanently removed from the ground water
Magnitude of Cost		$2.00 - $10.00 per 1000 gallon + recharge costs	The cost for recharging the aquifer with the treated ground water is to be added to ground water pumping and treatment costs

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ORIGINAL (Red)

Table 4-1-4
Evaluation of ground water pumping, treatment and utilization of the treated water in the plant area

This alternative will employ a number of wells to pump the contaminated ground water and prevent further plume migration. Treatment will remove both the organics and metals in the ground water before the water is used in the facility. By using the treated water in the plant, substantial cost savings are expected.

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	Yes	However, contaminants will be transferred to another medium
	Reduction in mobility	Yes	Pumping prevents the migration of the contaminated plume
	Reduction in volume	Yes	Contaminants transferred to small volume of treated sludge
	Permanent solution	Yes	Once contaminants are removed from ground water they will not return
Technical Feasibility	Reliability	High	Ground water pumping and treatment are well established technologies
	Readily available	Yes	There are a number of contractors available to do this type of project
	Implementability	Moderate	Large volumes of ground water will have to be pumped to intercept all the plume
Protection of Human Health	Short term	No change	No increased exposure to contaminants with proper health and safety procedures
	Long term	Improve	Contaminants will be permanently removed from the ground water
Protection of the Environment	Short term	No change	No new exposure to contaminants
	Long term	Improve	Contaminants will be permanently removed from the ground water
Magnitude of Cost		$2.00 - $10.00 per 1000 gallon + distribution costs	Cost for piping the treated ground water for plant use is to be added to the pumping and treatment costs

AR300260

The ERM Group

ORIGINAL (Red)

Table 4-2-1
Evaluation of the no action alternative as a remedial action for the former lagoon area

The no action alternative should be investigated to generate base-line values for comparison with the proposed remediation effort. The no action alternative could be implemented if it was shown that the area met the applicable standards, did not affect human health, and therefore required no remediation.

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	No	No change in contaminated material
	Reduction in mobility	No	No change in contaminated material
	Reduction in volume	No	No change in contaminated material
	Permanent solution	NA	
Technical Feasibility	Reliability	NA	
	Readily available	NA	
	Implementability	NA	
Protection of Human Health	Short term	No change	No disturbance of the former lagoon materials
	Long term	Unknown	No remediation of the source material
Protection of the Environment	Short term	No change	The potential environmental effects are unknown
	Long term	Unknown	The potential environmental effects are unknown
Magnitude of Cost		Not Applicable	

AR300261

The ERM Group

ORIGINAL (Red)

Table 4-2-2
Evaluation of a cap as a remedial action for the former lagoon area

An engineered cap over the former lagoon area would reduce the potential for further infiltration into the waste material. A cap would consist of an area gently sloped to promote runoff, constructed with a vegetated cover or paved material, over an impermeable layer of clay and/or a geomembrane.

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	No	No change in contaminated material
	Reduction in mobility	Yes	Reduction of infiltration restricts further movement of contaminants by limiting carrier medium
	Reduction in volume	No	No change in the contaminated material
	Permanent solution	No	Design life is typically 50 years
Technical Feasibility	Reliability	High	Proven technology used as an acceptable effort for many projects
	Readily available	Yes	Construction equipment and materials are readily available
	Implementability	High	Simple construction technology
Protection of Human Health	Short term	No change	No disturbance of the waste material
	Long term	Unknown	The potential human health effects are unknown
Protection of the Environment	Short term	No change	No disturbance of the waste material
	Long term	Unknown	The potential environmental effects are unknown
Magnitude of Cost		$3.00 - $7.00 per sq. ft. of cap to be provided	

AR300262

ORIGINAL (Red)

The ERM Group

Table 4-2-3
Evaluation of excavation and removal to off-site landfill as a remedial action for the former lagoon area

This option would require the excavation and loading of waste material into 20-yard over-the-road trucks with final deposition of the material in an approved storage facility.

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	Yes	Contaminants are removed from the site
	Reduction in mobility	Yes	Separation of the contaminated material from the environment by a physical boundary
	Reduction in volume	No	Waste material is removed from the site
	Permanent solution	Yes	Once contaminants are separated from the site they will not return
Technical Feasibility	Reliability	High	Numerous operational and under construction landfills designed for receipt of hazardous material
	Readily available	Yes	A number of landfills are permitted to receive hazardous materials
	Implementability	Low	Requires truckloads of material to be removed from the site; SARA discourages land disposal
Protection of Human Health	Short term	Diminish	Excavation and handling of waste material; possible exposure of the public to volatile emissions, fugitive dust. Possible increase in heavy truck traffic.
	Long term	Improve	Removal of waste material from the site
Protection of the Environment	Short term	Diminish	Excavation and handling of waste material allows emissions to the air
	Long term	Improve	Removal of waste material from the site
Magnitude of Cost		$200 - $300 per cu. yd of soil removed	

AR300263

ORIGINAL (Red)

The ERM Group

Table 4-2-4
Evaluation of soil flushing as a remedial action for the lagoon soils

This alternative would remove contaminants from the lagoon soils by in-situ flushing with dilute acid or chelating agents, requiring ground water collection and treatment

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	Yes	However, contaminants are transferred to another medium
	Reduction in mobility	Yes	Contaminants are physically separated from the environment
	Reduction in volume	Unknown	Contaminants transferred to an unknown volume of treated wash water sludges
	Permanent solution	Yes	Contaminants will not return to the soils once they are removed
Technical Feasibility	Reliability	Unknown	Field testing of soil flushing has not been extensively performed
	Readily available	Unknown	Availability of a mobile soil flushing unit is unknown
	Implementability	Low	Feasibility of locating a contractor to do this type of job is low
Protection of Human Health	Short term	No change	Soils would not be disturbed by flushing
	Long term	Improve	Separation of contaminants from the environment
Protection of the Environment	Short term	No change	No disturbance of source during flushing
	Long term	Improve	Separation of contaminants from the environment
Magnitude of Cost		$150 - $200 per cu. yd. of soil to be flushed	

AR300264

ORIGINAL (Red)

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Table 4-3-1
Evaluation of the no action alternative as a remedial action for the soils

The no action alternative should be investigated to generate base-line values for comparison with the proposed remediation effort. The no action alternative could be implemented if it was shown that the area met the applicable standards, did not affect human health, and therefore required no remediation.

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	No	No change in contaminated material
	Reduction in mobility	No	No change in contaminated material
	Reduction in volume	No	No change in contaminated material
	Permanent solution	NA	
Technical Feasibility	Reliability	NA	
	Readily available	NA	
	Implementability	NA	
Protection of Human Health	Short term	No change	No disturbance of the soils
	Long term	Unknown	No remediation of the source material
Protection of the Environment	Short term	Unknown	The potential environmental effects are unknown
	Long term	Unknown	The potential environmental effects are unknown
Magnitude of Cost		Not Applicable	

AR300265

ORIGINAL (Red)

The ERM Group

Table 4-3-2
Evaluation of excavation of "Hot" Spots and removal to off-site landfill as a remedial action for the soils

This option would require the excavation and loading of waste material into 20-yard over-the-road trucks with final deposition of the material in an approved storage facility.

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	Yes	Contaminants are removed from the site
	Reduction in mobility	Yes	Separation of the contaminated material from the environment by a physical boundary
	Reduction in volume	No	Waste material is removed from the site
	Permanent solution	Yes	Once contaminants are separated from the site they will not return
Technical Feasibility	Reliability	High	Numerous operational and under construction landfills designed for receipt of hazardous material
	Readily available	Yes	A number of landfills are permitted to receive hazardous materials
	Implementability	Low	Requires truckloads of material to be removed from the site; SARA discourages land disposal
Protection of Human Health	Short term	Diminish	Excavation and handling of waste material; possible exposure of the public to volatile emissions, fugitive dust. An increase in heavy truck traffic.
	Long term	Improve	Removal of waste material from the site
Protection of the Environment	Short term	Diminish	Excavation and handling of waste material allows emissions to the air
	Long term	Improve	Removal of waste material from the site
Magnitude of Cost		$200 -$300/cu.yd. of soil removed	

AR300266

ORIGINAL (Red)

The ERM Group

Table 4-3-3
Evaluation of enhanced volatilization as a remedial action for the on-site soils

This remedial action requires contact of soil with clean air, by either rototilling, mechanical aeration, in situ air stripping, or low-temperature thermal stripping.

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	Yes	However, contaminants are transferred to another medium
	Reduction in mobility	Yes	Separation of the contaminated material from the environment by a physical boundary
	Reduction in volume	Unknown	Contaminants transferred to an unknown volume of air
	Permanent solution	Yes	Once contaminants are separated from the site they will not return
Technical Feasibility	Reliability	Moderate	It has been documented as a successful method for removing contaminants from the soil, with vapor pressures similar to gasoline.
	Readily available	No	Field testing has been limited
	Implementability	Moderate	Requires substantial land for rototilling, control of dust and vapor emissions. Soil characteristics limit vapor movements.
Protection of Human Health	Short term	Diminish	The mechanical aeration is likely to cause exposure of the public to volatile emissions and fugitive dust.
	Long term	Improve	Removal of contaminant from the site soils
Protection of the Environment	Short term	Diminish	Excavation and handling of waste material allows emissions to the air
	Long term	Improve	Removal of contaminant from the site soils
Magnitude of Cost		$250 to $320/cu.yd of soil removed	

AR300267

ORIGINAL (Red)

The ERM Group

Table 4-3-4
Evaluation of Excavation and On-Site Incineration as a remedial action for soils from "Hot" spots

This remedial action requires excavation of soil from the "Hot" spots and then incinerating it on site in a mobile incinerator which would provide for thermal destruction of organics. The remaining ash could potentially be used to backfill the excavated areas.

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	Yes	Thermal destruction of the organic material
	Reduction in mobility	Yes	Thermal destruction of the organic material
	Reduction in volume	Unknown	Volume of ash with associated operational by-products may cause a change in total volume
	Permanent solution	Yes	Thermal destruction of organic material
Technical Feasibility	Reliability	High	Proven technology exhibits consistently 99.99% destruction with removals to 99.9999% with some units
	Readily available	Yes	Extensive waiting list for the available units may impact schedule
	Implementability	Moderate	An incinerator could not be operated on all areas because of the close proximity of the site to residences
Protection of Human Health	Short term	Diminish	The excavation is likely to cause exposure of the public to volatile emissions and fugitive dust.
	Long term	Improve	Destruction of the waste material eliminates the source for future exposures.
Protection of the Environment	Short term	Diminish	The excavation is likely to cause exposure of the public to volatile emissions and fugitive dust.
	Long term	Improve	Removal of contaminant from the site soils
Magnitude of Cost		$200 to $650/cu.yd of soil incinerated	

AR300268

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ORIGINAL (Red)

Table 4-3-5
Evaluation of Soil Venting and Offgas Treatment as a remedial action for site soils

This remedial action is an in situ treatment that draws air through the unsaturated zone of the soil matrix and strip the volatile fraction of the waste material. The gases that are removed can be processed by a number of technologies including fume incineration, vapor phase granular activated carbon, and various scrubbing techniques.

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	Yes	Partial removal of the volatile fraction of the waste material
	Reduction in mobility	Yes	Partial removal of the volatile fraction, primarily the most mobile compounds
	Reduction in volume	No	No significant reduction in the volume of the material
	Permanent solution	Yes	Partial removal of volatiles is nonreversible
Technical Feasibility	Reliability	Moderate	Relatively new technology, but has been shown effective in a number of cases.
	Readily available	Yes	System components are simple and available
	Implementability	Moderate	Soil venting systems are conceptually simple; system design usually done by the speciality contractor performing the work.
Protection of Human Health	Short term	Diminish	The soil is not disturbed but since the contaminants are removed and transferred to another medium a potential for exposure exists
	Long term	Improve	Removal of the waste material from soil eliminates the source
Protection of the Environment	Short term	Diminish	The soil is not disturbed but since the contaminants are removed and transferred to another medium a potential for exposure exists
	Long term	Improve	Removal of contaminant from the site soils
Magnitude of Cost		$15 to $20/cu.yd	The prices reflect typical costs computed for soils contaminated with gasoline and does not include the cost for treating the offgas

AR300269

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ORIGINAL (Red)

Table 4-3-6
Evaluation of soil stabilization as a remedial action for the on site soils

Soil stabilization would make the contaminants in the soil less susceptible to leach out by changing the soil characteristics such as permeability or by chemically binding the contaminants within the soil matrix

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	No	Contaminants not altered or removed from site
	Reduction in mobility	Yes	Contaminants prevented from migrating to river
	Reduction in volume	No	No change in source material
	Permanent solution	No	Finite lifespan of the stabilized soil
Technical Feasibility	Reliability	Moderate	Soil stabilization will reduce the migration of contaminants to the ground water but reliability of this technique is site specific
	Readily available	Yes	A number of contractors are available for this type of work
	Implementability	Unknown	The depth of soil, access and the areal extent of contamination will influence the implementability
Protection of Human Health	Short term	Diminish	The soil stabilization process will involve disturbing the contaminated soil which could release the VOC with potential for human exposure
	Long term	Unknown	Long term impact of contaminants' presence in soil unknown
Protection of the Environment	Short term	Diminish	Site activities for soil stabilization disturb area- dust, heavy equipment and release of VOC
	Long term	Unknown	Long term impact of contaminants' presence in soil unknown
Magnitude of Cost		$40 - $85 per cu. yd. of soil	

AR300270

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ORIGINAL (Red)

Table 4-3-7
Evaluation of soil flushing as a remedial action for the on-site soils

This alternative would remove contaminants from the site soils by in-situ flushing with dilute acid or chelating agents, requiring ground water collection and treatment

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	Yes	However, contaminants are transferred to another medium
	Reduction in mobility	Yes	Contaminants are physically separated from the environment
	Reduction in volume	Unknown	Contaminants transferred to an unknown volume of treated wash water sludges
	Permanent solution	Yes	Contaminants will not return to the soils once they are removed
Technical Feasibility	Reliability	Unknown	Field testing of soil flushing has not been extensively performed
	Readily available	Unknown	Availability of a mobile soil flushing unit is unknown
	Implementability	Low	Feasibility of locating a contractor to do this type of job is low
Protection of Human Health	Short term	No change	Soils would not be disturbed by flushing
	Long term	Improve	Separation of contaminants from the environment
Protection of the Environment	Short term	No change	No disturbance of source during flushing
	Long term	Improve	Separation of contaminants from the environment
Magnitude of Cost		$150 - $200 per cu. yd.	

AR300271

ORIGINAL (Red)

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Table 4-3-8
Evaluation of a cap as a remedial action for the contaminated soils

An engineered cap over the "hot spots" in the soils would reduce the potential for further infiltration into the waste material. A cap would consist of an area gently sloped to promote runoff, constructed with a vegetated cover over an impermeable layer of clay and/or a geomembrane.

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	No	No change in contaminated material
	Reduction in mobility	Yes	Reduction of infiltration restricts further movement of contaminants by limiting carrier medium
	Reduction in volume	No	No change in the contaminated material
	Permanent solution	No	Design life is typically 50 years
Technical Feasibility	Reliability	High	Proven technology used as an acceptable effort for many projects
	Readily available	Yes	Construction equipment and materials are readily available
	Implementability	High	Simple construction technology
Protection of Human Health	Short term	No change	No disturbance of the waste material
	Long term	Unknown	The potential human health effects are unknown
Protection of the Environment	Short term	No change	No disturbance of the waste material
	Long term	Unknown	The potential environmental effects are unknown
Magnitude of Cost		$3.00 - $ 7.00 per sq. ft.	

AR300272

ORIGINAL (Red)

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Table 4-4-1
Evaluation of the no action alternative as a remedial action for the sediments

The no action alternative should be investigated to generate base-line values for comparison with the proposed remediation effort. The no action alternative could be implemented if it was shown that the area met the applicable standards, did not affect human health, and therefore required no remediation.

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	No	No change in contaminated material
	Reduction in mobility	No	No change in contaminated material
	Reduction in volume	No	No change in contaminated material
	Permanent solution	NA	
Technical Feasibility	Reliability	NA	
	Readily available	NA	
	Implementability	NA	
Protection of Human Health	Short term	No change	No disturbance of the sediments
	Long term	Unknown	No remediation of the source material
Protection of the Environment	Short term	Unknown	The potential environmental effects are unknown
	Long term	Unknown	The potential environmental effects are unknown
Magnitude of Cost		Not Applicable	

AR300273

ORIGINAL (Red)

The ERM Group

Table 4-4-2
Evaluation of excavation and disposal as a remedial action for the sediments

This alternative would remove the bulk of contaminated sediments for disposal in a permitted off-site hazardous waste landfill.

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	Yes	Contaminants are removed from the creek
	Reduction in mobility	Yes	The source material is separated from the environment
	Reduction in volume	No	Contaminants are transferred to another location
	Permanent solution	Yes	Once contaminated sediments are separated from the site they will not return
Technical Feasibility	Reliability	High	Excavation and disposal is a well established technology
	Readily available	Yes	A number of contractors are available to do this type of work
	Implementability	Moderate	Excavation and removal are readily done but SARA discourages land disposal
Protection of Human Health	Short term	Diminish	Excavation and handling of waste material; exposure of public to dust and fugitive emissions during excavation and removal
	Long term	Improve	Separation of contaminants from environment
Protection of the Environment	Short term	Diminish	Exposure to dust and fugitive emissions during excavation and removal
	Long term	Improve	Separation of contaminants from environment
Magnitude of Cost		Not Available	The cost will depend on the concentration of contaminants and the amount of sediments to be removed

AR300274

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Table 4-4-3
Evaluation of excavation, treatment, and land disposal as a remedial action for the sediments

This alternative would remove the bulk of contaminated sediments from the site for treatment (soil washing) and re-placement as on-site or off-site soils

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	Yes	However, contaminants are transferred to another medium
	Reduction in mobility	Yes	Contaminants are removed from the site
	Reduction in volume	Unknown	Contaminants are transferred to another medium that may be smaller or larger in volume
	Permanent solution	Yes	Contaminants will not return to the sediments once they are removed
Technical Feasibility	Reliability	Moderate	Excavation is a well established technology but soil washing is not extensively field tested
	Readily available	Unknown	A contractor may be available to do this type of work
	Implementability	Moderate	Depends on availability of a mobile soil washing unit
Protection of Human Health	Short term	Diminish	Excavation and handling of waste material; exposure of public to dust and fugitive emissions during excavation and treatment
	Long term	Improve	Separation of contaminants from environment
Protection of the Environment	Short term	Diminish	Exposure to dust and fugitive emissions during excavation and treatment
	Long term	Improve	Separation of contaminants from environment
Magnitude of Cost		Not Available	The cost will depend on the concentration of contaminants and the amount of sediments to be removed

AR300275

ORIGINAL (Red)

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Table 4-4-4
Evaluation of containment as a remedial action for the sediments

Containment of the sediments in the creek would prevent their migration to the river, eliminating them as a source of contamination to the creek water and river sediments and water

Evaluation criteria		Rating	Explanation
Source Treatment	Reduction in toxicity	No	Contaminants not altered or removed from site
	Reduction in mobility	Yes	Contaminants prevented from migrating to river
	Reduction in volume	No	No change in source material
	Permanent solution	No	Finite lifespan of containment system
Technical Feasibility	Reliability	Moderate	Containment barrier will stop sediment migration but sediments may continue to leach to ground water
	Readily available	Yes	A number of contractors are available for this type of work
	Implementability	High	Construction of surface barriers is a well established technology
Protection of Human Health	Short term	No change	No disturbance of waste materials if barrier is constructed down grade from most contaminants
	Long term	Unknown	Long term impact of contaminants' presence in sediments unknown
Protection of the Environment	Short term	Diminish	Construction activities disturb area- dust, heavy equipment
	Long term	Unknown	Long term impact of contaminants' presence in sediments unknown
Magnitude of Cost		Not Available	The cost depends on the extent of containment which is not evaluated due to lack of information on the sediments

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- ground water pumping, treatment and recharge to the aquifer at the upstream side of the facility and ground water flow
- ground water pumping, treatment and use of the water in the plant

Treatment options may include:

- chemical treatment - precipitation, UV/peroxidation
- physical treatment - activated carbon, air stripping, ion exchange
- biological treatment for organic removal

A summary of these technologies is presented in Table 4.1 with detailed summaries presented in Appendix B, Tables 4.1-1 through 4.1-4.

4.2.2 Lagoon

The remedial technologies available for the lagoons include, but are not limited to, the following:

- no action
- capping
- excavation and off-site disposal
- soil flushing and on-site disposal

Table 4-2 presents the summary of the available technologies, with detailed evaluations presented in Appendix B, Tables 4.2-1 through 4.2-4.

TABLE 4-1
Summary of the available technologies
for remediation of the ground water

Evaluation criteria		Ratings of applicable technologies for remediation of the ground water			
		No Action	Ground Water Pumping and Treatment	Ground Water Pumping, Treatment & Recharge Upstream to Aquifer	Ground Water Pumping, Treatment and Use Water in the Plant
Treatment Efficiency	Reduction in toxicity	No	Yes	Yes	Yes
	Reduction in mobility	No	Yes	Yes	Yes
	Reduction in volume	No	Yes	Yes	Yes
	Permanent solution	NA	Yes	Yes	Yes
Technical Feasibility	Reliability	NA	High	High	High
	Readily available	NA	Yes	Yes	Yes
	Implementability	NA	Moderate	Moderate	Moderate
Protection of Human Health	Short term	No change	No change	No change	No change
	Long term	Unknown	Improve	Improve	Improve
Protection of the Environment	Short term	No change	No change	No change	No change
	Long term	Unknown	Improve	Improve	Improve
Magnitude of Cost		Not Applicable	$2.00 - $10.00 per 1000 gallon	$2.00 - $10.00 per 1000 gallon + recharge cost	$2.00 - $10.00 per 1000 gallon + distribution costs

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TABLE 4-2
Summary of the available technologies
for remediation of the former lagoon area

Evaluation criteria		Ratings of applicable technologies for remediation of the lagoon area			
		No Action	Cap Former Lagoon Area	Excavation and Off-Site Disposal	Soil Flushing and On-Site Disposal
Treatment Efficiency	Reduction in toxicity	No	No	Yes	Yes
	Reduction in mobility	No	Yes	Yes	Yes
	Reduction in volume	No	No	No	Unknown
	Permanent solution	NA	No	Yes	Yes
Technical Feasibility	Reliability	NA	High	High	Unknown
	Readily available	NA	Yes	Yes	Unknown
	Implementability	NA	High	Low	Low
Protection of Human Health	Short term	No change	No change	Diminish	No change
	Long term	Unknown	Unknown	Improve	Improve
Protection of the Environment	Short term	No change	No change	Diminish	No change
	Long term	Unknown	Unknown	Improve	Improve
Magnitude of Cost		Not Applicable	$3.00 - $7.00 per sq. ft. of cap	$200 - $300 per cu. yd. of soil removed	$150 - $200 per cu. yd. of soil treated

AR300279

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4.2.3 Soils

The remedial technologies applicable to the on-site soils include but are not limited to the following alternatives:

- no action
- excavation of "hot" areas and off-site disposal
- enchanced volatilization*
- excavation of "hot areas" and on-site incineration*
- soil venting*
- in situ soil stabilization
- soil flushing (combined with ground water recovery)
- capping of "hot" spots

Note: *The alternatives designated by an asterisk are applicable for organic remediation and are not considered suitable for remediation of metal(s) contaminated soil.

Table 4-3 presents a summary of these technologies. A detailed evaluation of these technologies is presented in Appendix B, Tables 4.3-1 through 4.3-8.

4.2.4 Sediments

If required, sediments of the Lycoming Creek may be remediated with one or more of the following technologies:

- no action
- excavation and disposal

Table 4-3
Summary of the evaluation of applicable technologies
for the remediation of the site soils

Evaluation criteria		Ratings of applicable technologies for remediation of the soils							
		No Action	Excavation of "Hot" Spots and Off-Site Disposal	Enhanced Volatilization	Excavation and On-Site Incineration of "Hot" Spots	Soil Venting and Offgas Treatment	Soil Stabilization	Soil Flushing	Capping of "Hot" Spots
Treatment Efficiency	Reduction in toxicity	No	Yes	Yes	Yes	Yes	No	Yes	No
	Reduction in mobility	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Reduction in volume	No	No	Unknown	Unknown	No	No	Unknown	No
	Permanent solution	NA	Yes	Yes	Yes	Yes	No	Yes	No
Technical Feasibility	Reliability	NA	High	Moderate	High	Moderate	Moderate	Unknown	High
	Readily available	NA	Yes	No	Yes	Yes	Yes	Unknown	Yes
	Implementability	NA	Low	Moderate	Moderate	Moderate	Unknown	Low	High
Protection of Human Health	Short term	No change	Diminish	Diminish	Diminish	Diminish	Diminish	No change	No change
	Long term	Unknown	Improve	Improve	Improve	Improve	Unknown	Improve	Unknown
Protection of the Environment	Short term	Unknown	Diminish	Diminish	Diminish	Diminish	Diminish	No change	No change
	Long term	Unknown	Improve	Improve	Improve	Improve	Unknown	Improve	Unknown
Magnitude of Cost		Not Applicable	$200 - $300 per cu. yd. of soil removed	$250 - $320 per cu. yd. of soil treated	$200 - $650 per cu. yd. soil incinerated	$15 - $20 per cu. yd.	$40 - $85 per cu. yd.	$150 - $200 per cu. yd.	$3.00 - $7.00 per sq. ft.

AR300281

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- excavation, treatment (soil washing), and replacement on site
- containment

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Table 4-4 summarizes the above technologies with detailed evaluations presented in Appendix B, Tables 4.4-1 through 4.4-4.

4.3 Summary of Applicable Technologies

The four major areas of concern, ground water, lagoon, soils and sediments, were evaluated to determine the most applicable technology that can be cost effective as well as achieve the goal of either containing the contaminants or removing and treating, to make them harmless. A scenario which is appropriate for each, based on the available data, follows.

Ground Water

The remediation of ground water should concentrate on removing the contaminants from the ground water, as close to the source as possible. By intercepting the ground water flow on the south side of the site, possibly by establishing a well point system in conjunction with adjusting the pumping rates, increased ground water recovery of high contaminant concentration can be achieved. This system would be designed to prevent the aquifer, which is being used by the WMWA, from further contamination. The cost for treating ground water with less contaminants is considerably high compared to treating ground water with high concentration of contaminants.

Table 4-4
Summary of the evaluation of applicable technologies
for the remediation of the sediments

Evaluation criteria		Ratings of applicable technologies for remediation of the sediments			
		No Action	Excavation and Disposal	Excavation, Treatment, and Land Disposal	Containment
Treatment Efficiency	Reduction in toxicity	No	Yes	Yes	No
	Reduction in mobility	No	Yes	Yes	Yes
	Reduction in volume	No	No	Unknown	No
	Permanent solution	NA	Yes	Yes	No
Technical Feasibility	Reliability	NA	High	Moderate	Moderate
	Readily available	NA	Yes	Yes	Yes
	Implementability	NA	Moderate	Moderate	High
Protection of Human Health	Short term	No change	Diminish	Diminish	No change
	Long term	Unknown	Improve	Improve	Unknown
Protection of the Environment	Short term	Unknown	Diminish	Diminish	Diminish
	Long term	Unknown	Improve	Improve	Unknown
Magnitude of Cost		Not Applicable	Not Available	Not Available	Not Available

AR300283

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The applicable treatment technology is air stripping for volatile organics in the ground water. Should the final risk assessment indicate an air quality problem, an offgas treatment system may be required. Offgas treatment, if required, is likely to increase the cost of treatment using air strippers alone by a factor of 2 to 3. Since air strippers for ground water cleanup are already in operation, a uniformity in ground water treatment technology can be maintained. In case of metals, the ground water can be routed through the existing wastewater treatment facility on site, after the volatile organics have been removed by air stripping. The pumping rate for the off-site recovery well in the WMWA well field may need to be reduced in order to prevent the plume with concentrated contaminants being drawn towards the deeper aquifer.

Lagoon

In case contamination is present in the lagoon soils, the applicable technology is likely flushing the lagoon soil with a flushing solution. However, this is only appropriate with a ground water collection system that will prevent the contaminants from leaching into the ground water. The soil flushing may not be extensive if provisions are made to prevent drainage and percolation of water in the lagoon soils.

Soil

In the event of soil contaminated with volatile organics, soil venting can be applied and offgas treated.

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Sediments

Contamination of the sediments has not been reported to date. In case these are found to be contaminated, contamination is more than likely to be minimum, since surface water is reported to be fairly clean. Based on the available information, the no action alternative is considered to be appropriate unless information obtained in the remedial investigation points otherwise.

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SECTION 5

SUMMARY OF ADDITIONAL INFORMATION

5.1 Data Requirements

The Preliminary Feasibility Study provides a forum to identify areas of concern and express data requirements that would aid in the full Feasibility Study process. A summary of the additional information which should be collected in order to fully address the areas of concern is as follows:

- The Ground Water Contaminated Plume in the Northwest Corner of the Property - Ground water monitoring data for the bedrock and shallow aquifer will assist the Feasibility Study by establishing background levels of organic compounds and metals in the northwest area.

- The Wastewater Treatment Area of The Facility - A review of aerial photos, plant schematics, and plant operating history for 5 to 10 year intervals can be performed. The information will assist in deciding practical soil sampling locations to investigate source(s) of metal contamination, and in evaluating whether there is a past or on-going source(s) of contamination. Should soil sampling indicate remediation to alleviate the ground water contamination and assist in ground water cleanup, remediation techniques will be analyzed and recommended, as discussed in Section 4.

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Appendix D

Quality Assurance Project Plan

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Date of QAPP Revision (No.)
1 May 1989 (0)

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QUALITY ASSURANCE PROJECT PLAN (QAPP)
for the
Remedial Investigation/Feasibility Study
at the
Textron Lycoming
Williamsport Plant Site
Williamsport, Pennsylvania

1 May 1989

_____	Richard Wroblewski Richard Wroblewski, P.G. Project Manager
EPA Project Officer	
_____	David E. Gallis, Ph.D. Senior Quality Assurance Chemist
EPA Quality Assurance Officer	

Prepared For:

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Williamsport Plant
Williamsport, Pennsylvania

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SECTION 1

INTRODUCTION

1.1 Background

The Textron Lycoming facility is located in the western portion of Williamsport in Lycoming County, Pennsylvania (Figure 1-1). The facility is located on approximately 28 acres near the edge of a residential neighborhood that also contains some light industry. Major topographical features include a steep ridge north of the plant, Lycoming Creek 2,000 feet west of the plant, and the Susquehanna River 5,000 feet south of the plant.

The first buildings on the property were constructed around the turn of the century. The plant was previously owned and operated by AVCO Lycoming and has been operating for over 50 years. Historically, plant operations have centered on the manufacture of aircraft engines. Other processes have included the production of automobile engines, sewing machines, sandpaper and silk. Portions of the facility were used during World War II by other firms. Currently, industrial activities include electroplating, parts manufacturing, engine cleaning, premanufacturing, and assembly of aircraft engines (The Chester Engineers, 1988).

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Plant wastes include rinsewater, used solvents, waste oil and grease. Electroplating rinse waters are treated on site at a National Pollutant Discharge Elimination System #PA0007455 (NPDES) permitted treatment facility constructed in the 1950s. Sludges from the wastewater treatment plant, used solvents, and other wastes are transported off site for disposal or reclamation in accordance with state and federal regulations.

Ground water contamination related to the manufacturing processes has been identified beneath the plant property. The principal contaminants detected in the ground water at the plant include total chromium and volatile organic compounds, most notably trichloroethylene (TCE) and 1,2-dichloroethylene (DCE). These contaminants have migrated off the property to the south and southwest. Ground water in the valley fill overburden material has been most affected, however, some TCE has been detected in the bedrock underlying the glacial deposits at the plant and, to a limited extent, in the bedrock off the property southwest of the plant.

A comprehensive discussion of the project history can be found in Section 1 of the Work Plan.

Figure 1-1
Site Location Map
Textron Lycoming
Williamsport, Pennsylvania

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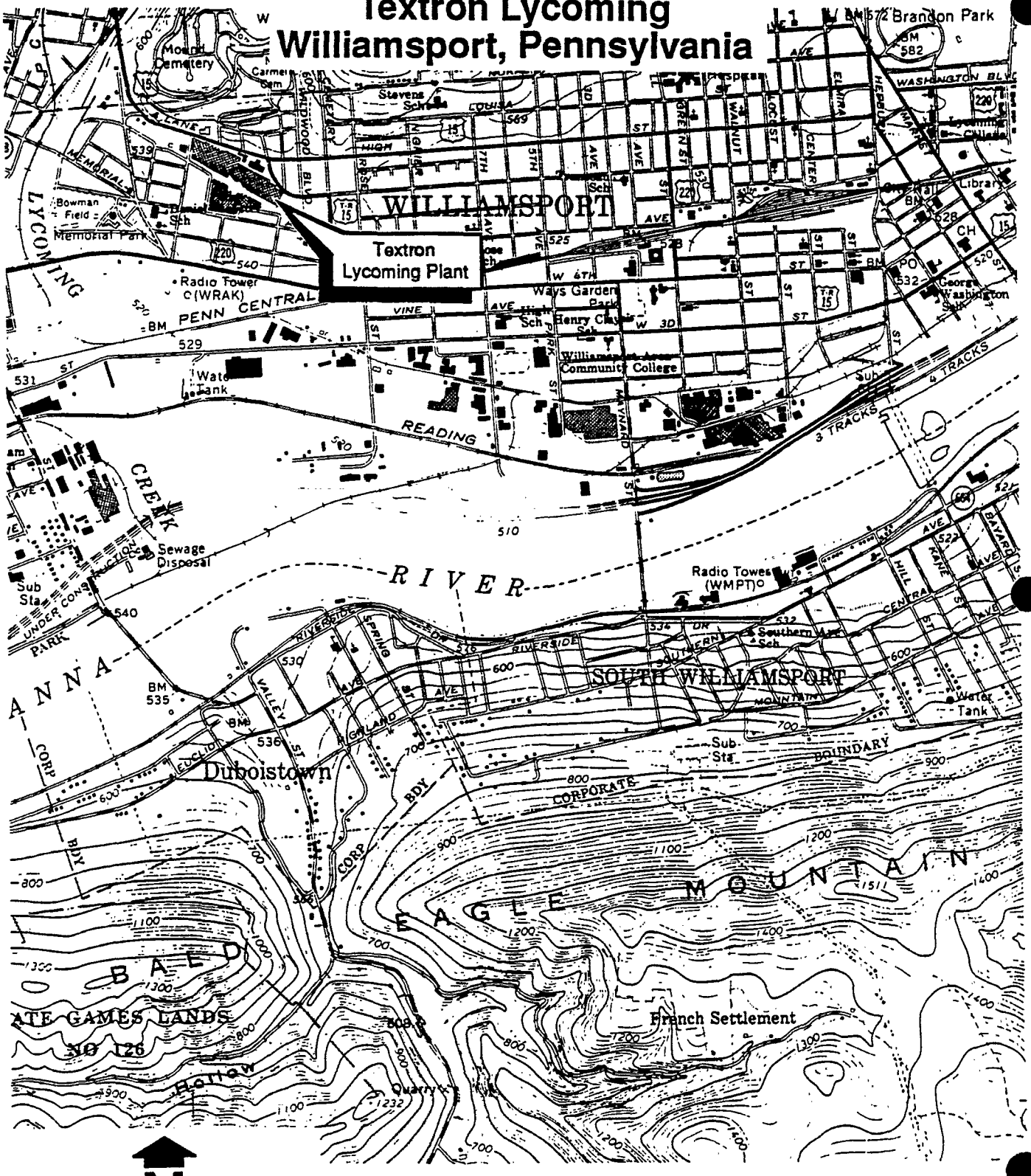

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Source: USGS 7.5 Min. Topographic Quadrangle; Williamsport, PA

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SECTION 2

PROJECT ORGANIZATION AND RESPONSIBILITY

While all personnel involved in an investigation and in the generation of data are implicitly a part of the overall project and quality assurance program, certain individuals have specifically delegated responsibilities. Within Environmental Resources Management (ERM), these are the Project Manager, the Senior Quality Assurance Chemist, the Quality Assurance Chemist, the Laboratory Coordinator, the Field Operations Manager/Project Geologist, and the Project Technicians. Lancaster Laboratories, Inc., of Lancaster, Pennsylvania, will provide all analytical services for this investigation. A project organization chart is presented in Figure 2-1. Specific laboratory personnel with quality assurance/quality control responsibilities include the Laboratory Quality Assurance Officer and Laboratory Sample Custodian.

2.1 Project Manager

Mr. Richard T. Wroblewski is the Project Manager for the Textron Lycoming Remedial Investigation and Feasibility Study. The Project Manager is responsible for oversight and coordinating of the various elements of the Remedial Investigation, Feasibility Study, and Endangerment Assessment.

Figure 2-1
Project Organization Chart

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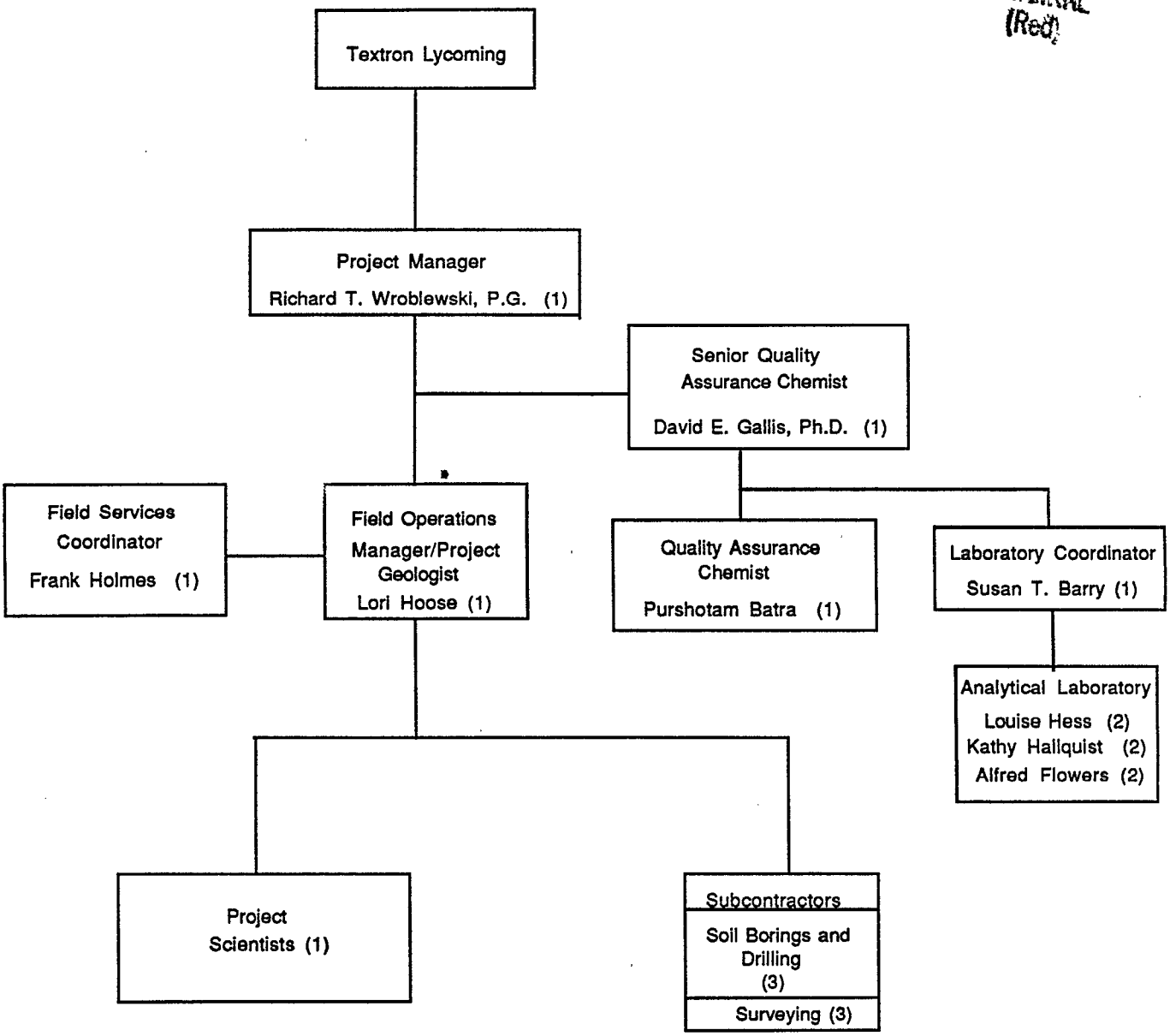

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(3) To Be Determined

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The Project Manager maintains routine contact with the investigation's progress, regularly reviews the project schedule, and reviews all major work elements prior to submittal. Also, as the Project Manager for the Remedial Investigation, he oversees all scheduling and budgeting for the Remedial Investigation and serves as the prime contact with Textron-Lycoming.

2.2 Senior Quality Assurance Chemist

Dr. David E. Gallis will serve as the Senior Quality Assurance Chemist on the Textron Lycoming project and as such is not directly involved in the routine performance of technical aspects of the investigations.

The Senior Quality Assurance Chemist's responsibilities include the development, evaluation, and documentation of the Quality Assurance Project Plan and procedures appropriate to the investigation. Additional responsibilities include reviewing project plans and revising the plans to assure that proper quality assurance is maintained. The Senior Quality Assurance Chemist is also responsible for all data processing activities, data processing quality control, and final analytical data quality review. The Senior Quality Assurance Chemist is also responsible for final review of all Tentatively Identified Compound (TIC) mass spectra.

It is a major responsibility of the Senior Quality Assurance Chemist to insure that all personnel have a good understanding of the project quality assurance plan, an understanding of their respective roles relative to one another, and an appreciation of the importance of the roles to the overall success of the program.

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2.3 Quality Assurance Chemist

Mr. Purshotam Batra will serve as the Project Quality Assurance Chemist. The Quality Assurance Chemist has primary responsibility for analytical data validation and review. In this capacity, the Quality Assurance Chemist will prepare analytical quality assurance reports describing data usability and any analytical quality control problems encountered.

2.4 Laboratory Coordinator

Ms. Susan Barry will serve as ERM's Laboratory Coordinator with the primary responsibilities of coordinating communication between the project team and the subcontracted laboratory. Her duties include scheduling analytical services and informing the laboratory of sample shipment and expected receipt dates; issuing ERM chain-of-custody and traffic report forms; tracking, logging, and filing documentation returned from the laboratory; and routing analytical data to the Senior Quality Assurance Chemist for validation review.

2.5 Field Operations Manager

It is ERM's policy that a Field Operations Manager/Project Geologist be assigned to all projects. Ms. Lori Hoose will serve as the Field Operations Manager/Project Geologist for this investigation. The Field Operations Manager/Project Geologist is responsible for the day-to-day activities of all ERM field personnel. The Field Operation Manager is also responsible for field quality assurance and all other non-analytical data quality review. Further responsibilities include the verification for

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accuracy of field notebooks, driller's logs, chain-of-custody records, sample labels, and all other field-related documentation.

2.6 Field Services Coordinator

Mr. Frank Holmes will serve as ERM's Field Services Coordinator with the primary responsibility of coordinating communication between project management and field sampling activities. His duties also include the performance of internal field audits and preparation of site specific sampling instructions.

2.7 Project Technicians

All sampling tasks required by this investigation will be conducted by experienced environmental technicians. Their responsibilities will include the documentation of the proper sample collection protocols, sample collection and field measurements, equipment decontamination, and chain-of-custody documentation.

2.8 Lancaster Laboratories' Quality Assurance Officer

The volume of analytical work for a project of this size necessitates the subcontract analytical laboratory specify a Quality Assurance Officer whose duties are specific to the project. Ms. Louise Hess will serve as Lancaster Laboratories' Quality Assurance Officer with the responsibility for maintenance of all laboratory quality assurance activities in association with the project.

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2.9 Laboratory Sample Custodian

Ms. Kathy Hallquist and Mr. Alfred Flowers will serve as project Laboratory Sample Custodians for Lancaster Laboratories. The Sample Custodians' responsibilities include insuring proper sample entry and sample handling procedures by laboratory personnel.

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SECTION 3

QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, REPRESENTATIVENESS, COMPARABILITY, AND COMPLETENESS

3.1 Overall Project Objectives

Data Quality Objectives (DQO) are quantitative and qualitative statements specifying the quality of the environmental data required to support the decision-making process. DQO define the total uncertainty in the data that is acceptable for each specific activity during the investigation. This uncertainty includes both sampling error and analytical error. Ideally, the prospect of zero uncertainty is the intent; however, the variables associated with the process (field and laboratory) inherently contribute to the uncertainty of the data. It is the overall objective to keep the total uncertainty within an acceptable risk that will not hinder the intended use of the data. In order to achieve this objective, specific data quality requirements such as detection limits, criteria for accuracy and precision, sample representativeness, data comparability and data completeness will be specified. The overall objectives and requirements will be established such that there is a high degree of confidence in the measurements. The data collected during the course of the investigation will be used to answer the following questions:

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1. Are contaminants present or absent (qualitatively)?

2. If contaminants are present, what are the types or classes?

3. What quantities (concentrations) of contaminants are present (quantitative)?

4. What are the boundaries of contaminant sources and pathways?

5. What are the environmental/public health factors?

6. What are the source pathway contaminant characteristics with respect to migration?

The sample media that will be collected to answer these questions will be ground water, surface water, soil, sediment and air.

As stated earlier, the parameters that will be used to specify data quality requirements and to evaluate the analytical system performance are precision, accuracy, representativeness, completeness and comparability (PARCC). Table 3-1 presents definitions for these parameters.

3.2 Field Investigation Quality Objective

The objective with respect to the field investigation are to maximize the confidence in the data in terms of PARCC.

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TABLE 3-1

DEFINITIONS OF DATA QUALITY PARAMETERS

- Precision - a measure of the reproducibility of measurements under a given set of conditions.

- Accuracy - a measure of the bias that exists in a measurement system.

- Representativeness - the degree to which sample data accurately and precisely represent selected characteristics.

- Completeness - a measure of the amount of the valid data obtained from the measurement system compared to the amount that is required.

- Comparability - a measure of confidence with which one data set can be compared with another.

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In terms of precision and accuracy, Section 9 presents the frequency with which field duplicates, travel blanks, field blanks, and matrix spikes will be collected such that a specific degree of precision and accuracy can be calculated. The data quality objective for field duplicates is to achieve precision equal to or greater than laboratory duplicate precision requirements established in the EPA's Contract Laboratory Program (CLP) Statement of Work (SOW).

Precision will be calculated as relative percent difference (RPD) if there are only two (2) analytical points and percent relative standard deviation (%RSD) if there are more than two (2) analytical points. The submission of travel and field blanks will provide a check with respect to accuracy. Although accuracy is best assessed by evaluating the results of blanks, blanks do not monitor analyte losses. The submission of blanks will, however, monitor contaminants introduced with the sampling process, preservation, handling, shipping, and the analytical process. The data quality objective for travel and field blanks is to meet or exceed the Contract Required Quantitation Limits (CRQL) established in the EPA's CLP (organic and inorganic). In the event that the blanks are contaminated and/or poor precision is obtained, the associated data will be qualified as described in Section 12.3. Through the submission of field QC samples the distinction can be made between laboratory problems, sampling technique, and sample matrix variability.

Precision and accuracy for the field pH, Eh, and conductivity are dependent on the type and condition of the instrument used and the care used in the standardization and operation. The precision and accuracy objectives for the instrumentation used are as follows:

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- pH precision will be ±0.3 pH, Eh, standard units and an accuracy of ±0.3 pH standard units. pH measurements will be reported to two (2) significant figures.

- Eh precision will be ± 10 mV and an accuracy of ±10 mV. Eh measurements will be reported to two (2) significant figures.

- Conductivity precision will be ±3 umhos/cm on the 500 umhos/cm range, ±25 umhos/cm on the 5,000 umhos/cm range, and ±250 umhos/cm on the 50,000 umhos/cm range. Accuracy for the conductivity measurements is a function of the conductivity reading for the probe and instrument combined. Conductivity measurements will be reported to one (1) significant figure for values below ten and to two (2) significant figures for values above ten.

To ensure sample representativeness, all sample collection will be performed in strict accordance with EPA-recommended procedures for collection and preservation; with EPA-recommended holding times specified in EPA 600/4-79-020 (Methods for Chemical Analysis of Water and Wastes) and the Federal Register, 26 October 1984; and with the specific CLP-SOW which Lancaster Laboratories are operating under.

The data quality objective for the completeness of data with respect to the sampling (field investigation) is 100%. In the event 100% is not obtained, the effect of the uncollected data will be evaluated by the Project Manager as to its impact (if any) on project objectives. Corrective actions will be initiated to resolve any data gaps from the original objectives, found as a result of less than 100% data completeness. Every effort will be made to obtain valid data for all sampling points particularly

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those classified as critical points. In this regard, the critical point samples which are identified will necessarily be selected as subsequent QC samples (duplicate and matrix spikes) at the frequency specified in Section 9 of this QAPP.

In order to establish a degree of comparability such that observations and conclusions can be directly compared with all historical data, ERM will use standardized methods of field analysis, sample collection, holding times and preservation. In addition, field conditions will be considered as well as sampling in order to attain a high degree of data comparability.

3.3 Laboratory Data Quality Objectives

The laboratory will demonstrate analytical precision and accuracy by the analysis of laboratory duplicates and matrix spike duplicates. Precision will also be demonstrated (as well as instrument stability) by comparison of response factors for calibration standards. Laboratory accuracy will be demonstrated by the addition of surrogate and matrix spikes compounds. Accuracy will be presented as percent recovery. Precision will be presented as relative percent difference (RPD), percent relative standard deviation (% RSD), or percent difference (%D), whichever is applicable to the type or multiplicity of QC samples. Laboratory blanks will also demonstrate accuracy with respect to the analyses. The frequency of laboratory duplicates, matrix spikes and laboratory blanks are specified in Section 9 of this QAPP. As considerable reference is made to Attachment 1 in the remainder of this QAPP, it is suggested it be reviewed at this time. Lancaster Laboratories, Inc., data quality objectives are detailed in Attachment 1 to this QAPP.

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The analysis laboratory will be expected to process (purge, extract or digest) an aliquot of sample such that the analytical results will provide a high degree of representation with respect to the sampling point. In addition, the analysis laboratory will be expected to document all analytical problems encountered during the course of the investigation. This will enable ERM to achieve a 100% completeness goal through a phased sampling approach. Further, the laboratory will be required to provide all data packages in full CLP deliverables format (most recent) to ensure that analytical methods, parameters, and reporting units are compatible with other existing data.

3.4 Criteria Objectives

The quantitative objectives (criteria) that ERM will require for both field and laboratory accuracy and precision are summarized in Table 3-2.

The laboratory will be expected (as an ideal objective) to report the CLP Contract Required Quantitation Limits (CRQL) for all samples in the appropriate statistical reporting units for all analyses as stated in the most current SOW used by the analysis laboratory. However, it should be noted that actual quantitation limits are sample specific and depend on variables such as dilution factors, percent moisture, sample matrices and the specific analyte. The handling of data reported at or near the CRQL will be done judiciously since the stated data quality objectives for accuracy and precision may not "translate" well in some situations.

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TABLE 3-2

CRITERIA OBJECTIVES

Precision Objectives	Aqueous	Solid/Other
Field Duplicate/Replicates (Blind or labeled)		
TCL VOA	within 20% RPD	within 30% RPD
TCL BNA	within 25% RPD	within 40% RPD
TCL Pesticides/PCBs	within 25% RPD	within 40% RPD
TAL Inorganics	within 25% RPD	within 40% RPD
Wet Chemistry Parameters	within 25% RPD	within 40% RPD
Laboratory Duplicates (Unspiked)		
TCL VOA	within 20% RPD	within 30% RPD
TCL BNA	within 25% RPD	within 40% RPD
TCL Pesticides/PCBs	within 25% RPD	within 40% RPD
TAL Inorganics	As specified in current SOW	As specified in current SOW
TSS and Alkalinity	within 25% RPD	NA
Laboratory Duplicate (MSD)		
TCL VOA	As specified in current SOW	As specified in current SOW
TCL BNA	As specified in current SOW	As specified in current SOW
TCL Pesticide/PCB	As specified in current SOW	As specified in current SOW
BOD, TOC, COD, TSS, Alkalinity, Hardness	within 10% RPD	NA
Accuracy Objectives		
Field or trip blanks		
TCL VOA	Less than the CRQL	Less than the CRQL
TCL BNA	Less than the CRQL	Less than the CRQL
TCL Pesticides/PCBs	Less than the CRQL	Less than the CRQL
TAL Inorganics	Less than the CRQL	Less than the CRQL
Wet Chemistry Parameters	Less than the Quantitation Limit	Less than the Quantitation Limit
Laboratory Blanks		
TCL VOA	As specified in current SOW	As specified in current SOW
TCL BNA	As specified in current SOW	As specified in current SOW
TCL Pesticides/PCBs	As specified in current SOW	As specified in current SOW
TAL Inorganics	As specified in current SOW	As specified in current SOW
Wet Chemistry Parameters	Less than the Quantiation Limit	NA

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TABLE 3-2 (continued)

Accuracy Objectives (continued)	Aqueous	Solid/Other
Matrix spikes/surrogate spikes		
All TCL and TAL fractions	As specified in current SOW	As specified in current SOW
BOD, TOC, COD, TSS, Alkalinity, Hardness	79-116% recovery	NA
Post - digestion spikes		
TAL Inorganics	As specified in current SOW	As specified in current SOW

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3.5 Data Management Objectives

It is a data management objective that all aspects of the investigation from sample design, collection, shipment, analysis use/decisions, etc., be performed in conjunction with rigorous QA/QC documentation. The specific details of this documentation can be found throughout this document and the associated work plan.

It is expected that by the design of separate data quality requirements for field sampling and laboratory analysis, clear distinctions can be made such that any problems found in the system can be isolated with respect to the cause. Conversely, the data quality requirements are also designed to provide an indication of the variability inherit to the overall system.

Through the use of a phased approach of sampling, analysis, data assessment (data review), data qualification, and feedback the overall data management objective is to provide a complete data base with a high degree of confidence.

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SECTION 4

SAMPLING PROCEDURES

The numbers of samples, locations, and justifications for each sample media to be collected are presented in the Work Plan for the Textron Lycoming Site. Please refer to the Remedial Investigation/Feasibility Study Work Plan (RIFSWP) for this information. Procedures associated with the soil sampling, sediment sampling, surface water sampling, air sampling, and ground water sampling are described below. Table 4-1 summarizes the sample media to be collected, the numbers of samples to be collected, and the analyses to be performed.

4.1 Soil Sampling

The RIFSWP addresses collection of subsurface soil samples from test borings.

4.1.1 Subsurface Soil Sampling

Split barrel (split spoon) soil samples will be collected as per ASTM D-1586. Each split spoon sample will be divided into two aliquots. One aliquot will be placed (using a clean stainless steel spatula) in laboratory supplied glass bottles with a Teflon®-lined enclosure and handled as described in Section 4.4.3 of this QAPP. All soil sample containers used for the volatile organic analysis will be filled completely to minimize any

TABLE 4-1
Sample Summary Matrix
Textron Lycoming RI/FS

Matrix	Number of Samples	Number of Travel Blanks*	Number of Equipment Blanks	Number of Duplicates*	Number of Matrix Spike/Matrix Spike Duplicate Samples* ***	Total Number of Samples	Analyses	Analytical Method	Container and Preservation	Analysis Holding Time
Ground Water (Existing monitoring and new monitoring wells) - 5 new and 13 existing wells to be analyzed for full TCL and TAL. - 33 existing wells to be analyzed for TCE and DCE only.	18	3	1	1	2	25	TCL Volatiles	USEPA CLP	2-40 ml screw cap vials w/ Teflon lined septa. HCl to pH ≤ 2. Cool to 4° C.	14 days
	18	3	1	1	2	25	TCL Semivolatiles	USEPA CLP	2-1 liter amber glass w/ teflon lined enclosure. Cool to 4° C.	7 days till extraction, analysis within 40 days of extract preparation
	18	3	1	1	2	25	TCL Pest./PCBs	USEPA CLP	1 liter amber glass w/ teflon lined enclosure. Cool to 4° C.	7 days till extraction, analysis within 40 days of extract preparation
	18	3	1	1	2	25	Dissolved TAL Metals	USEPA CLP	Samples will be field filtered through a 0.45 um filter prior to preservation. 1-plastic liter. HNO3 to pH ≤ 2.	6 months, 28 days for Mercury
	18	3	1	1	2	25	Cyanide	USEPA CLP	1 glass liter. NaOH to pH≥ 12. Cool to 4°C.	14 days
	33	4	2	2	4	45	1,2-Dichloroethylene and Trichloroethylene	USEPA CLP	2-40 ml screw cap vials w/ Teflon lined septa. HCl to pH ≤ 2. Cool to 4° C.	14 days
Air	5	1	NA	1	NA	7	TCL Volatiles	Method T01 EPA-600/4-84-041	Thermal Desorption Tube (Tenax). Cool to 4°C.	7 days

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TABLE 4-1
Sample Summary Matrix
Textron Lycoming RI/FS

Matrix	Number of Samples	Number of Travel Blanks*	Number of Equipment Blanks	Number of Duplicates*	Number of Matrix Spike/Matrix Spike Duplicate Samples* ***	Total Number of Samples	Analyses	Analytical Method	Container and Preservation	Analysis Holding Time
Surface Water - 3 samples from Lycoming Creek outfalls, 2 upstream backgrounds, and 1 Cemetery Run storm sewer to be analyzed for full TCL and TAL.	6	1	1	1	2	11	TCL Volatiles	USEPA CLP	2-40 ml screw cap vials w/ Teflon lined septa. HCl to pH ≤ 2. Cool to 4° C.	14 days
	6	1	1	1	2	11	TCL Semivolatiles	USEPA CLP	2-1 liter amber glass w/ teflon lined enclosure. Cool to 4° C.	7 days till extraction, analysis within 40 days of extract preparation
	6	1	1	1	2	11	TCL PCBs	USEPA CLP	1 liter amber glass w/ teflon lined enclosure. Cool to 4° C.	7 days till extraction, analysis within 40 days of extract preparation
	6	1	1	1	2	11	Total TAL Metals	USEPA CLP	1-plastic liter. HNO3 to pH ≤ 2.	6 months, 28 days for Mercury
	6	1	1	1	2	11	Cyanide	USEPA CLP	1 glass liter. NaOH to pH≥ 12. Cool to 4°C.	14 days
Sediments - 5 sediment samples taken at surface water sampling locations and analyzed for full TCL and TAL.	5	1	1	1	2	10	TCL Volatiles	USEPA CLP	1 glass 4 oz. wide mouth w/ Teflon lined enclosure. Cool to 4° C	10 days
	5	1	1	1	2	10	TCL semivolatiles	USEPA CLP	1 glass quart w/ Teflon lined enclosure. Cool to 4° C.	7 days till extraction, analysis within 40 days of extract preparation
	5	1	1	1	2	10	TCL Pest./PCBs	USEPA CLP	can be combined into semivolatile container	7 days till extraction, analysis within 40 days of extract preparation
	5	1	1	1	2	10	TAL Metals	USEPA CLP	can be combined into semivolatile container	6 months, 28 days for Mercury
	5	1	1	1	2	10	Cyanide	USEPA CLP	can be combined into semivolatile container	14 days

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TABLE 4-1
Sample Summary Matrix
Textron Lycoming RI/FS

Matrix	Number of Samples	Number of Travel Blanks*	Number of Equipment Blanks	Number of Duplicates*	Number of Matrix Spike/Matrix Spike Duplicate Samples* ***	Total Number of Samples	Analyses	Analytical Method	Container and Preservation	Analysis Holding Time
Soil Borings - 4 samples will be analyzed for TCL volatiles and TAL metals.	20	4	1	1	2	28	TCL Volatiles	USEPA CLP	1 glass 4 oz. wide mouth w/ Teflon lined enclosure. Cool to 4° C	10 days
- 6 samples will be analyzed for TCL volatiles and PCBs. - 5 samples will be analyzed for TCL volatiles only.	5	1	1	1	2	10	TCL semivolatiles	USEPA CLP	1 glass quart w/ Teflon lined enclosure. Cool to 4° C.	7 days till extraction, analysis within 40 days of extract preparation
- 5 samples will be analyzed for full TCL and TAL.	11	2	1	1	2	17	TCL Pest./PCBs	USEPA CLP	can be combined into semivolatile container	7 days till extraction, analysis within 40 days of extract preparation
	9	2	1	1	2	15	TAL Metals	USEPA CLP	can be combined into semivolatile container	6 months, 28 days for Mercury
	5	1	1	1	2	10	Cyanide	USEPA CLP	can be combined into semivolatile container	14 days

* - see frequency requirements specified in Section 9. This number may change based on time spent in the field.
** - Equipment blanks for the soil matrices will be collected into those bottles specified under the ground water matrix for the same analytical fraction.
*** - Inorganic analyses will include a single matrix spike and a laboratory duplicate (versus a matrix spike duplicate).
NA - Not Applicable.

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headspace. Sufficient soil from the second aliquot will be placed to fill one eighth of a wide mouth liter container for headspace measurement. Immediately after the soil is placed into the container, the mouth of the jar will be lined with aluminum foil and the enclosure securely replaced.

Prior to taking a headspace Total Volatile Organic Compound (VOC) measurement, the measurement vessel containing the sample will be allowed to stand for ten minutes to equilibrate the volatile organics from the soil with the headspace. Special note will be made of ambient air temperature. At the five minute mark, the sample will be agitated (shaken) for ten seconds to aid in the disaggregation of the soil. At the completion of the ten minutes, the maximum headspace reading will be recorded using a Foxboro, Century Organic Vapor Analyzer (OVA) 128. A three-eighths (3/8) inch hole pre-drilled through the center of the plastic cap will allow the puncture of the aluminum seal with the probe of the OVA to measure total VOC content. The headspace measurements and physical observations will be used to select samples for laboratory analysis from each boring. A single sample per boring will be submitted for laboratory analysis.

4.2 Surface Water and Sediment Sampling

4.2.1 Surface Water Sampling

To minimize potential cross-contamination by suspended material in the stream from sampling activities, surface water sampling will proceed on Lycoming Creek from the farthest downstream location and proceed to upstream locations as illustrated in Figure 4-1. The stream samples will be collected from the eastern side of Lycoming Creek to reflect any bias associated with the site. The most upstream location will serve as

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a background sample. The surface water samples will be collected during typical flow conditions, not influenced by recent precipitation. Dependent upon depth and stream velocity, samples will be either collected directly into the appropriate sample containers at a point upstream of the samplers position or through the use of a long-handled polyethylene grab sampler from the east bank of the stream. The single sewer sample to be taken at the location illustrated in Figure 4-1 will also be taken with a polyethylene grab sampler.

Stream velocity and flow characteristics will be noted at each sampling location. Stream velocity will be measured using a Mead Pigmy HP-302 open channel velocity meter. The stream velocity will be measured at a point mid-depth of the stream at each sampling location. Flow will be determined based on the calculated cross-section area at the stream sampling station. The cross-sectional area will be determined by measuring the depth to the bottom of the stream at five points evenly spaced along a transect through the sampling station.

4.2.2 Stream Sediment Sampling

At each Lycoming Creek surface water sampling location a sediment sample will also be collected. If present, a composite of equal volumes of fine sediments (surface) from two points in the vicinity of the surface water location will be homogenized on an enamel pan with a stainless steel spatula and an appropriately sized volume transferred to the sample containers. The composite sample will be comprised of new depositional material on the stream side closest to the potential contaminant source (east side). Samples for volatile organic analysis will be collected as grab samples from each of the locations illustrated in Figure 4-1.

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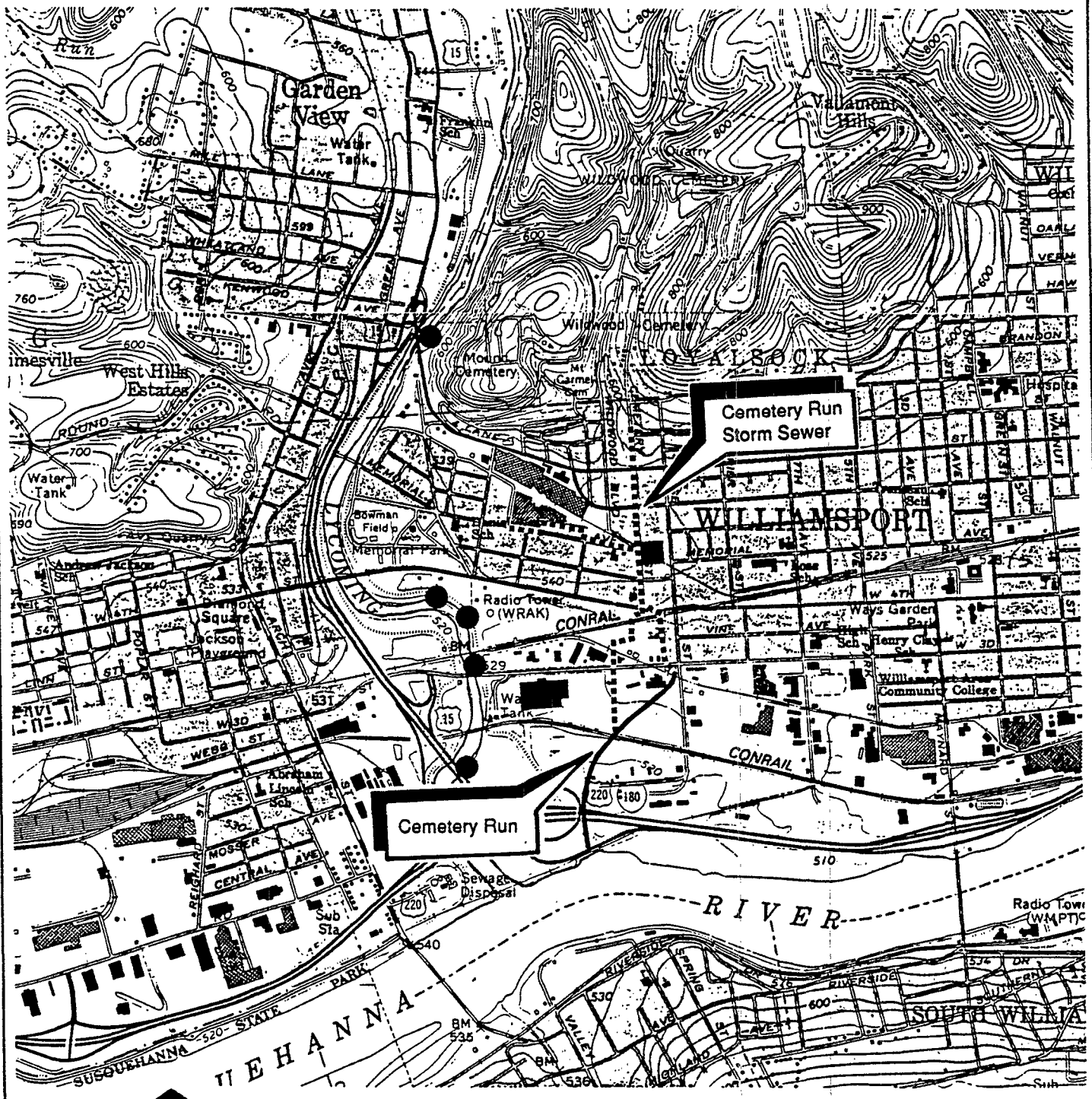
Figure 4-1
Surface Water and Sediment Sample Locations
Textron Lycoming



USGS 7.5 minute Topographic Quadrangles: Williamsport, PA; Cogan Station, PA.

WO#	Drawn by / Date: JG 2.13.89		L. Hoose 2.13.89	The ERM Group
72301.01.01	Revised by / Date:	AR300320	Checked by / Date:	

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Sediments will be collected with a stainless steel dipper and dewatered as much as possible prior to placement into the sample containers. These sediment samples will be collected immediately after the surface water is sampled at each location.

4.3 Ground Water Sampling Procedures

4.3.1 Preparation for Sampling

Preparation for sampling includes the acquisition of all necessary monitoring equipment and site-specific information to perform the required monitoring. A location map for the monitoring wells proposed to be installed for the Textron Lycoming RI/FS will be developed before entering the field. Prior to initiating any sampling activities, a complete round of depth to water levels will be measured to the nearest one hundredth of a foot for all wells in the sampling event. All new wells will have a permanent mark placed on the top of the well casing to signify the surveyed elevation and to standardize the measuring point.

Monitoring wells are to be evacuated and sampled proceeding from the suspected least to most contaminated well to minimize potential cross-contamination. The sampling order of the wells from least to most contaminated will be based on ground water flow directions, well location with respect to the suspected source areas, historical data, and field OVA readings on soil borings. Total well depths necessary to calculate the required purge volumes will be tabulated in Table 4-2 after the completion of the installations.

TABLE 4-2

TOTAL WELL DEPTHS FOR THE
TEXTRON LYCOMING SITE

Well No.	Total Depth (feet)

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4.3.2 Well Evacuation

Monitoring wells will be evacuated of three volumes of water standing in the well casing or until the well goes dry prior to sample acquisition. All purge water will be containerized and disposed of through the permitted on-site ground water air-strippers.

A stainless steel body, ISCO Model 2600 bladder pump or stainless steel body Fultz pump with polyethylene tubing will be used to evacuate all accessible two-inch monitoring wells. Pump placement depth will be dependent on well yields. Small diameter pump flow rates are typically low ($\leq$ 1.5 gpm), necessitating placement of the pump intake at the top of the water column in high yielding wells. Low well yields require pump placement to be at the bottom of the well. Proper pump placement will insure complete and proper evacuation. Upon completion of the required purge volume, the pumping system will be removed from the well. Wells that are inaccessible with the pump system will be hand bailed using a bottom-loading stainless steel bailer.

A stainless steel, Grundfos™ submersible pump with PVC tubing will be used to evacuate all the newly installed six-inch monitoring wells identified to be sampled in the RISFWP. Pump placement depth will be dependent on well yields. Moderate to high well yields necessitate placement of the pump intake at the top of the water column. Low well yields require pump placement to be at the bottom of the well. Proper pump placement will insure complete and proper evacuation. Upon completion of the required purge volume, the pumping system will be removed from the well.

A check valve placed immediately above the pump prevents purge water in the tubing from re-entering the well when the pump is turned off. Pump placement depth is again dependent on well yields (see above paragraph). An Up-Z-Dazy® pump puller is used to install and retrieve the pump in the well. Wells that are inaccessible with the pump system will be hand bailed using a stainless steel bailer.

4.3.3 Sample Acquisition

Dedicated one and one-quarter (1-1/4) inch, bottom-loading PVC bailers will be used to collect grab ground water samples for transfer into the proper sample containers. A monofilament polypropylene or Teflon-coated single strand stainless steel wire will be used to raise and lower the bailer. If well yields are low at the site, the samples will be collected as the well recovers and provides a sufficient volume for sample collection.

4.4 Air Sampling Procedures

Air sampling will be performed at each of the three on-site and two off-site air stripper stacks, only if a Phase II air monitoring program is required as discussed in the RIFSWP. Samples will be collected by trapping the volatile components of the stripper stack exhaust on thermal desorption tube sampling cartridges packed with Tenax™ adsorbent. Each sample will be generated by pumping approximately 20 liters of stack exhaust through an adsorbent cartridge over a 5 hour period using a flow calibrated Alpha™ 1 personal sampling pump. The pump will be calibrated before and after sample collection and the average between the two measurements will be used in subsequent sample volume calculation. The duration of sampling will depend on the calibrated pumping rate. To relate analytical results to

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emission rates, the velocity of air leaving each stack shall be determined using a Pitot Tube gauge and manometer. Stack dimensions shall also be recorded for flow rate determinations.

4.5 Decontamination and Post-Sampling Procedures

4.5.1 Drilling Equipment Decontamination

Drilling equipment will be decontaminated prior to initial use, between boring locations, and at the completion of drilling activities. Items necessary to decontaminate include:

- back of drilling rig
- auger flights
- down-hole equipment
- well casing and screen

A manual scrubbing to remove foreign material followed by a thorough steam cleaning will be used for decontamination of the above items. Drilling equipment, well screen, and well casing will be stored in a contaminant free location above ground on wooden supports after decontamination, and covered with plastic until use.

4.5.2 Sampling Equipment Decontamination

All non-disposable equipment (bailers, split spoon samplers, hand trowels, etc.) will be decontaminated according to the procedures described below:

- manual scrub with a non-phosphate soap solution
- tap water rinse
- 10% nitric acid rinse

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- Pesticide grade methanol or acetone rinse
- triple rinse with distilled water
- air dry

Each dedicated bailer will be individually wrapped in plastic trash bags and sealed following decontamination, and stored on-site at a contaminant free location or at ERM's warehouse for future use.

The submersible pump system will be decontaminated between wells by flushing with approximately 50 gallons of clean tap water. The outside of the pump, discharge tubing and power line cords will be thoroughly rinsed with distilled water using a hand-held pressure sprayer.

4.5.3 Sample Preparation and Preservation

Surface water samples will be submitted for total (unfiltered) metals analysis and ground water samples will be submitted for dissolved (filtered) metals analysis. Water samples collected for dissolved metals analysis will be field-filtered through a 0.45 um pore size filter prior to preservation. The 0.45 um filters will be rinsed with distilled water prior to use. The filtering system used will be a Millipore®, OM100 Hazardous Waste Filtration System. This filtering system is constructed of all stainless steel and Teflon material. The ground water sample will be decanted into the filtering system containing a new 0.45 um pore sized filter. The sample is filtered under pressure using inert nitrogen gas. The sample will be filtered directly into the sample container with the necessary preservation already added. Duplicate water samples will be collected which will not be filtered to provide total metals analysis.

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Immediately after collection, samples will be transferred to properly labeled (see Section 5 of this QAPP) sample containers with all necessary preservatives added. Sample containers are supplied by I-Chem of Hayward, California and will be Type II grade (to meet EPA requirements) and preservatives are Ultrex grade quality. Table 4-1 lists the proper container material, volume requirement, and preservation needed for the Textron Lycoming RI/FS analyses. Preservation will be checked in the field with pH paper and additional chemical preservatives added if needed. Samples requiring refrigeration for preservation will be immediately transferred to coolers packed with ice or ice packs. Proper chain-of-custody documentation will be maintained as discussed in Section 5 of this QAPP.

Field measurements for pH, specific conductance, and temperature will be obtained on ground water samples immediately following sample collection. A grab sample collected in a beaker will be used to obtain these measurements. Surface water samples will be measured for pH, Eh, DO, temperature, and specific conductance in situ. A one to one (1:1) sediment to distilled water slurry will be used to measure sediment pH, DO, temperature, Eh, and specific conductance in a beaker.

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SECTION 5

SAMPLE CUSTODY

The primary objective of sample custody procedures is to create an accurate written record which can be used to trace the possession and handling of all samples from the moment of their collection, through analysis, until their final disposition. Sample custody for samples collected during this investigation will be maintained by the Field Operations Manager (FOM) or the field personnel collecting the samples. The FOM or field personnel are responsible for documenting each sample transfer and maintaining custody of all samples until they are shipped to the laboratory.

ERM will use Series 200 bottles obtained from I-CHEM of Hayward, California, for use as sample containers. All necessary chemical preservatives will be added to the bottles prior to the sampling event. Custody of the sample bottles will be maintained by the FOM. Sample bottles needed for a specific sampling task will then be relinquished by the FOM to the sampling team after the FOM has verified the integrity of the bottles and assured that the proper bottles have been assigned to the task to be conducted.

A self-adhesive sample label will be affixed to each container before sample collection. At a minimum, the sample label will contain the information as shown on Figure 5-1.

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- Client - Job Name (Textron Lycoming)
- ERM Traffic Report Number
- Sample identification - place of sampling
- Data and time collected
- Sampler's initials
- Testing required
- Preservatives added

Immediately after sample collection, each sample bottle will be sealed in an individual plastic bag. Samples will then be placed immediately into an insulated cooler for shipment to the laboratory. ERM field Chain-of-Custody records (Figure 5-2) and an ERM Traffic Report (Figure 5-3) completed at the time of sample collection will accompany the samples inside the cooler for shipment to the laboratory. The samples will be properly relinquished on the field Chain-of-Custody record by the sampling team. These record forms will be sealed in a ziplock plastic bag to protect them against moisture. Each cooler will contain sufficient ice and/or ice packs to ensure that proper temperature is maintained, and will be packed in a manner to prevent damage to sample containers. The FOM will then initial and custody seal (Figure 5-4) each sample cooler. All coolers will be shipped by an overnight courier according to current US DOT regulations. Prior to releasing the coolers, the FOM will require the courier to sign an ERM Cooler Transfer Acknowledgment (Figure 5-5). Upon receiving the samples, the laboratory Sample Custodian will inspect the condition of the samples, compare the information on the sample labels against the field Chain-of-Custody record and Traffic Reports, assign a Lancaster Laboratory control number,

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FIGURE 5-1
SAMPLE CONTAINER LABEL

Client/W.O.#:

Traffic Report #:

Sample Identification:

Collection Information: ☐ *Composite* ☐ *Grab

Date: *Time:* *By:*

Testing Required:

Preservative:

L1-806

Environmental Resources Management, Inc.
855 Springdale Dr. • Exton, PA 19341 • (215) 524-3500

The ERM Group

Client/W.O. #

Traffic Report/Sample I.D.

Collection Information:
Date: *By:* *Time:*

Preservatives:

Environmental Resources Management, Inc. Exton, Pennsylvania • (215) 524-3500

The ERM Group

The ERM Group

Sample Chain of Custody

W.O.No.: | Project Name:

Sampler:

ERM Sample Number	Date	Time	COMP	GRAB	Station Location	Number of Containers							Remarks

Sample Relinquished by:	Date	Time	Sample Received by:	Date	Time	Reason for Transfer

COPIES: White & Yellow copies accompany sample shipment to laboratory. Yellow copy retained by laboratory. White copy to be returned to ERM for files. Pink copy retained by sampler. Gold copy extra copy as needed (warehouse).

FIGURE 5-2
ERM CHAIN OF CUSTODY RECORD

Section: 5
Revision No.: 0
Date: 1 May 1989

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FIGURE 5-3
ERM TRAFFIC REPORT FORM

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Traffic Report

1 Project W.O.	**2** Sample Concentration	S425
Project Name/Location	☐ Low Concentration	
	☐ Medium Concentration	**3** Ship to:
	5 Sampling Personnel Contact	
4 Sample Matrix	Sampler:	
☐ Liquid ☐ Solid	Project Manager	
☐ Other	Phone No. (215) 524-3500	Attn:

6 Shipping Information	**7** Specify Type of Analyses, Number of Containers, Approx. Volume		
(Name of Carrier)	Analyses / Method Requested	No. of Bottles	Total Volume
(Date Shipped)			
(Airbill Number)			
8 Sample Location			
Date:			
Time:			

9 Sample Description		**10** Special Handling (e.g. Safety Procedures/Hazardous)
☐ Surface Water	☐ Soil	
☐ Ground Water	☐ Solid	
☐ Leachate	☐ Other:	Additional comments: (Specify data package, rush work, special detection limits, etc.)
☐ Sediment		

11 Condition of Samples Received (to be completed by Laboratory Log-in.)	
☐ Samples received intact	
☐ Samples at 4 degrees (C)	Log-In Person's Signature
☐ Samples not leaking	
☐ Container numbers match as specified in Item 7	
☐ Container tags match Chain of Custody	
☐ Cooler received with Custody Seals intact	☐ Samples contained within plastic bags

Copies: White & Yellow copies accompany sample shipment to laboratory. Yellow copy retained by labor[illegible] for files. Pink copy retained by sampler. Gold copy extra copy as needed (warehouse).

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FIGURE 5-4
ERM CUSTODY SEAL

The ERM Group

OFFICIAL
CUSTODY SEAL

Name _____

Date _____

The ERM Group

FIGURE 5-5
ERM COOLER TRANSFER
ACKNOWLEDGEMENT

Section: 5
Revision No.: 0
Date: 1 May 1989

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ERM COOLER TRANSFER ACKNOWLEDGEMENT

DATE / TIME	CLIENT / PROJECT / CLIENT NUMBER	NUMBER OF COOLERS	ERM RELEASE (SIGNATURE)	RECEIVED BY (SIGNATURE)	DATE / TIME

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and log the control number into the computer sample inventory system.

The preparation of all sample bottles (cleaning technique, preservative added, etc.) will be documented. When samples requiring preservation by either acid or base are received at the laboratory, the pH will be measured and documented. The Laboratory Sample Custodian will then store the sample in a secure sample storage cooler maintained at a maximum temperature of 4°C and maintain custody until the sample is assigned to an analyst for analysis. Custody will be maintained until disposal of the analyzed samples.

The Laboratory Sample Custodian will note any damaged sample containers or discrepancies between the sample label and information on the field Chain-of-Custody record when logging the sample and will note any discrepancies in Section 11 of the ERM Traffic Report. This information will also be communicated to the FOM or field personnel so proper action can be taken. The Chain-of-Custody form will be signed by both the relinquishing and receiving parties each time the sample changes hands, and the reason for the transfer indicated.

An internal Chain-of-Custody form will be used by Lancaster Laboratories to document sample possession from laboratory Sample Custodian to Analysts and final disposition. All Chain-of-Custody information will be supplied with the data packages for inclusion in the document control file.

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SECTION 6

CALIBRATION PROCEDURES AND FREQUENCY

6.1 Laboratory Calibration

Laboratory calibration and frequency for the required methods are specified in the current statement of work (SOW) for both inorganics and organics under the CLP program and presented in Attachment 1, Section III.

6.2 Field Calibration

In addition to the laboratory analyses conducted during the course of this investigation, field measurements of pH, specific conductance, and temperature will be taken for all surface and ground water samples. Temperature, pH, Eh, and dissolved oxygen (DO) measurements will also be conducted on surface water and sediment samples.

The frequency of field calibration procedures will, at a minimum, include the following:

- The Eh, pH, DO, and specific conductance meters will be calibrated a minimum of once daily and documented in the calibrator's field book (see Section 8). Calibration will be checked as necessary to ensure proper measurements are taken.

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- pH meters will be calibrated using specific techniques according to the manufacturer's instructions using two standard buffer solutions (either pH 4, 7, or 10) obtained from chemical supply houses. The pH values of these buffers will be compensated for temperature according to the values supplied on the manufacturer's bottle label. The temperature (measured as below) at which the sample pH was measured will then be used to compensate for temperature on the meter.

- The Eh meter will be calibrated using a Ferrous-Ferric Redox Reference Solution as indicated in ASTM Method D1498 and according to the specific instrument manufacturer's recommendations.

- Temperature measurements will be performed using field thermometers (Thomas Science No. 9329A10).

- The DO meter will be calibrated according to the specific instrument manufacturer's recommendations. This generally involves compensation of the probe for temperature and location elevation in a moisture saturated environment.

- The Foxboro Century OVA 128 will be calibrated to a methane in air standard (87 ppm) weekly to ensure total volatile organic readings are accurate. The methane in air standard is manufactured by Liquid Carbonic and marked with its certified concentration. The standard is run directly into the intake of the pickup probe and the gain adjustment of the OVA 128 is then used to calibrate the reading to 87 ppm. Any OVA, total volatile organic readings will be reported as "X ppm methane."

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- Specific conductance meters will be calibrated using a 1413.0 umhos (KCl) solution prepared by ERM according to Standard Methods for the Analysis of Water and Wastewater, 16th Edition, 1985, Method 205, 3b, page 79. The conductivity probe cell constant will be calculated according to the formula:

$$K = \frac{\frac{1}{1413.0\ (C)}}{1 + 0.02\ (T - 25°C)}$$

Where:

K = probe cell constant (unitless)
C = measured conductance value of standard
T = temperature (°C) of standard

Table 6-1 will be used to correct for the standard solutions' conductivity value if it is not at 25°C.

Using the cell constant calculated above and the following formula, field specific conductance measurements will be corrected to 25°C.

$$S = \frac{K \cdot C}{(1 + 0.02\ (T - 25))}$$

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Where:

S = specific conductance at 25°C (umhos/cm)

K = calculated cell constant

C = field specific conductance (umhos/cm)

T = temperature (°C) of sample at which conductance was measured

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(Red)

TABLE 6-1

CONDUCTIVITY TEMPERATURE CORRECTIONS
FOR 1,413 UMHOS/CM CONDUCTIVITY STANDARD

Temperature, °C	umhos/cm
15	1,141.5
16	1,167.5
17	1,193.6
18	1,219.9
19	1,246.4
20	1,273.0
21	1,299.7
22	1,326.6
23	1,353.6
24	1,380.8
25	1,408.1
26	1,436.5
27	1,463.2
28	1,490.9
29	1,518.7
30	1,546.7

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SECTION 7

ANALYTICAL PROCEDURES

All analytical procedures to be used are officially approved EPA procedures. The appropriate references are given in Attachment 1, Section IV.

The analytical methods which are to be used for the analysis of the sample media collected at the Textron Lycoming Site will be in accordance with Contract Laboratory Program (CLP) Statement of Work (SOW) for organics and inorganics. The specific version will be the current awarded contract Lancaster Laboratories is operating under for organic analysis, and the current SOW for inorganics. These methods were chosen to provide comparability with other data typically collected for CERCLA investigations and to meet the project DQO. These methods are the most appropriate to achieve all DQO. As stated by the laboratory, these methods are applicable to ground water, soil, surface water and sediment samples.

Physical testing for select samples identified in the Work Plan will include analysis of grain size. The surface water samples will be analyzed for BOD, TOC, COD, total suspended solids (TSS), hardness and alkalinity. The methods to be employed for these analyses are summarized on Table 7-2. A laboratory has not been selected as of yet for the analysis of sediment grain size;

however, the balance of the above wet chemistry parameters will be performed by Lancaster Laboratories.

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Holding times that are required to be met are presented on Table 4-1.

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TABLE 7-1

TEXTRON LYCOMING ORGANIC COMPOUNDS
AND INORGANIC CONSTITUENTS FOR ANALYSIS
AND QUANTITATION LIMITS

Target Compound List (TCL) and
Contract Required Quantitation Limits (CRQL)

Volatiles	CAS Number	Quantitation Limits* Low Water[a] ug/l	Low Soil/Sediment[b] ug/kg
1. Chloromethane	74-87-3	10	10
2. Bromomethane	74-83-9	10	10
3. Vinyl Chloride	75-01-4	10	10
4. Chloroethane	75-00-3	10	10
5. Methylene Chloride	75-09-2	5	5
6. Acetone	67-64-1	10	10
7. Carbon Disulfide	75-15-0	5	5
8. 1,1-Dichloroethene	75-35-4	5	5
9. 1,1-Dichloroethane	75-35-3	5	5
10. 1,2-Dichloroethylene (total)	540-54-0	5	5
11. Chloroform	67-66-3	5	5
12. 1,2-Dichloroethane	107-06-2	5	5
13. 2-Butanone	78-93-3	10	10
14. 1,1,1-Trichloroethane	71-55-6	5	5
15. Carbon Tetrachloride	56-23-5	5	5
16. Vinyl Acetate	108-05-4	10	10
17. Bromodichloromethane	75-27-4	5	5
18. 1,1,2,2-Tetrachloroethane	79-34-5	5	5
19. 1,2-Dichloropropane	78-87-5	5	5
20. cis-1,3-Dichloropropene	10061-01-5	5	5
21. Trichloroethylene	79-01-6	5	5
22. Dibromochloromethane	124-48-1	5	5
23. 1,1,2-Trichloroethane	79-00-5	5	5
24. Benzene	71-43-2	5	5
25. trans-1,3-Dichloropropene	10061-02-6	5	5

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TABLE 7-1
(Continued)

Volatiles	CAS Number	Quantitation Limits* Low Water[a] ug/l	Low Soil/Sediment[b] ug/kg
26. Bromoform	75-25-2	5	5
27. 2-Hexanone	591-78-6	10	10
28. 4-Methyl-2-pentanone	108-10-1	10	10
29. Tetrachloroethene	127-18-4	5	5
30. Toluene	108-88-3	5	5
31. Chlorobenzene	108-90-7	5	5
32. Ethyl Benzene	100-41-4	5	5
33. Styrene	100-42-5	5	5
34. Total Xylenes	100-42-5	5	5

[a]Medium Water Contract Required Detection Limits (CRQL) for Volatile TCL Compounds are 100 times the individual Low Water CRQL.

[b]Medium Soil/Sediment Contract Required Detection Limits (CRQL) for Volatile TCL Compounds are 100 times the individual Low Soil/Sediment CRQL.

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TABLE 7-1
(Continued)

Semi-Volatiles	CAS Number	Quantitation Limits* Low Water[c] ug/l	Low Soil/Sediment[d] ug/kg
35. Phenol	108-95-2	10	330
36. bis(2-Chloroethyl)ether	111-44-4	10	330
37. 2-Chlorophenol	95-57-8	10	330
38. 1,3-Dichlorobenzene	541-73-1	10	330
39. 1,4-Dichlorobenzene	106-46-7	10	330
40. Benzyl Alcohol	100-51-6	10	330
41. 1,2-Dichlorobenzene	95-50-1	10	330
42. 2-Methylphenol	95-48-7	10	330
43. bis(2-Chloroisopropyl) ether	39638-32-9	10	330
44. 4-Methylphenol	106-44-5	10	330
45. N-Nitroso-Dipropylamine	621-64-7	10	330
46. Hexachloroethane	67-72-1	10	330
47. Nitrobenzene	98-95-3	10	330
48. Isophorone	78-59-1	10	330
49. 2-Nitrophenol	88-75-5	10	330
50. 2,4-Dimethylphenol	105-67-9	10	330
51. Benzoic Acid	65-85-0	50	1600
52. bis(2-Chloroethoxy) methane	111-91-1	10	330
53. 2,4-Dichlorophenol	120-83-2	10	330
54. 1,2,4-Trichlorobenzene	120-82-1	10	330
55. Naphthalene	91-20-3	10	330
56. 4-Chloroaniline	106-47-8	10	330
57. Hexachlorobutadiene	87-68-3	10	330
58. 4-Chloro-3-methylphenol	59-50-7	10	330
59. 2-Methylnapthalene	91-57-6	10	330
60. Hexachlorocyclopentadiene	77-47-4	10	330
61. 2,4,6-Trichlorophenol	88-06-2	10	330
62. 2,4,5-Trichlorophenol	95-95-4	50	1600

ORIGINAL (Red)

TABLE 7-1
(Continued)

Semi-Volatiles	CAS Number	Quantitation Limits* Low Water[c] ug/l	Low Soil/Sediment[d] ug/kg
63. 2-Chloronapthalene	91-58-7	10	330
64. 2-Nitroaniline	88-74-4	50	1600
65. Dimethyl Phthalate	131-11-3	10	330
66. Acenaphthylene	208-96-8	10	330
67. 3-Nitroaniline	99-09-2	50	1600
68. Acenaphthene	83-32-9	10	330
69. 2,4-Dinitrophenol	51-28-5	50	1600
70. 4-Nitrophenol	100-02-7	50	1600
71. Dibenzofuran	132-64-9	10	330
72. 2,4-Dinitrotoluene	121-14-2	10	330
73. 2,6-Dinitrotoluene	606-20-2	10	330
74. Diethylphthalate	84-66-2	10	330
75. 4-Chlorophenyl Phenyl ether	7005-72-3	10	330
76. Fluorene	86-73-7	10	330
77. 4-Nitroaniline	100-01-6	50	1600
78. 4,6-Dinitro-2-methylphenol	534-52-1	50	1600
79. N-nitrosodiphenylamine	86-30-6	10	330
80. 4-Bromophenyl Phenyl ether	101-55-3	10	330
81. Hexachlorobenzene	118-74-1	10	330
82. Pentachlorophenol	87-86-5	50	1600
83. Phenanthrene	85-01-8	10	330
84. Anthracene	120-12-7	10	330
85. Di-n-butylphthalate	84-74-2	10	330
86. Fluoranthene	206-44-0	10	330
87. Pyrene	129-00-0	10	330
88. Butyl Benzyl Phthalate	85-68-7	10	330
89. 3,3'-Dichlorobenzidine	91-94-1	20	660
90. Benzo(a)anthracene	56-55-3	10	330
91. bis(2-ethylhexyl)phthalate	117-81-7	10	330

TABLE 7-1
(Continued)

ORIGINAL (Red)

Semi-Volatiles	CAS Number	Quantitation Limits* Low Water[c] ug/l	Low Soil/Sediment[d] ug/kg
92. Chrysene	218-01-9	10	330
93. Di-n-octyl Phthalate	117-84-0	10	330
94. Benzo(b)fluoranthene	205-99-2	10	330
95. Benzo(k)fluoranthene	207-08-9	10	330
96. Benzo(a)pyrene	50-32-8	10	330
97. Indeno(1,2,3-cd)pyrene	193-39-5	10	330
98. Dibenz (a,h)anthracene	53-70-3	10	330
99. Benzo(g,h,i)perylene	191-24-2	10	330

[c]Medium Water Contract Required Detection Limits (CRQL) for Semi-Volatile TCL Compounds are 100 times the individual Low Water CRQL.

[d]Medium Soil/Sediment Contract Required Detection Limits (CRQL) for Semi-Volatile TCL Compounds are 60 times the individual Low Soil/Sediment CRQL.

TABLE 7-1
(Continued)

ORIGINAL
(Red)

Pesticides/PCBs	CAS Number	Quantitation Limits** Water ug/l	Low Soil/Sediment[d] ug/kg
100. alpha-BHC	319-84-6	0.05	8.0
101. beta-BHC	319-85-7	0.05	8.0
102. delta-BHC	319-86-8	0.05	8.0
103. gamma-BHC (Linda	58-89-9	0.05	8.0
104. Heptachlor	76-44-8	0.05	8.0
105. Aldrin	309-00-2	0.05	8.0
106. Heptachlor Epoxide	1024-57-3	0.05	8.0
107. Endosulfan I	959-98-8	0.05	8.0
108. Dieldrin	60-57-1	0.10	16.0
109. 4,4'-DDE	72-55-9	0.10	16.0
110. Endrin	72-20-8	0.10	16.0
111. Endosulfan II	33213-65-9	0.10	16.0
112. 4,4'-DDD	72-54-8	0.10	16.0
113. Endosulfan Sulfate	1031-07-8	0.10	16.0
114. 4,4'-DDT	50-29-3	0.10	16.0
115. Endrin Ketone	53494-70-5	0.10	16.0
116. Methoxychlor	72-43-5	0.5	80.0
117. alpha-chlordane	5103-71-9	0.5	80.0
118. gamma-chlordane	5103-74-2	0.5	80.0
119. Toxaphene	8001-35-2	1.0	160.0
120. Aroclor-1016	12674-11-2	0.5	80.0
121. Aroclor-1221	11104-28-2	0.5	80.0
122. Aroclor-1232	11141-16-5	0.5	80.0
123. Aroclor-1242	53469-21-9	0.5	80.0
124. Aroclor-1248	12672-29-6	0.5	80.0
125. Aroclor-1254	11097-69-1	1.0	160.0
126. Aroclor-1260	11086-82-5	1.0	160.0

ORIGINAL (Red)

TABLE 7-1
(Continued)

Elements Determined by Inductively Coupled
Plasma Emission or Atomic Adsorption Spectroscopy

Element (TAL Metals)	Contract Required Quantitation Limit (ug/l)
Aluminum	200
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Calcium	5000
Chromium	10
Cobalt	50
Copper	25
Iron	100
Lead	5
Magnesium	5000
Manganese	15
Mercury	0.2
Nickel	40
Potassium	5000
Selenium	5
Silver	10
Sodium	5000
Thallium	10
Vanadium	50
Zinc	20

TABLE 7-1
(Continued)

ORIGINAL
(Red)

Cyanide Determination

TAL Inorganic	Contract Required Quantitation Limit (ug/l)
Cyanide	10

Additional Analyses

Parameter	Quantitation Limit (mg/l)
BOD	6
COD	50
TOC	1
TSS	4
Hardness	1
Alkalinity	1

TABLE 7-2

ANALYTICAL METHODOLOGY FOR ADDITIONAL PARAMETERS

ORIGINAL (Red)

Parameter	Solid Samples	Ground Water	Surface Water
Physical Testing:			
Grain Size	ASTM Method D442-63	NA	NA
Additional Analyses:			
BOD	NA	NA	405.1(1)
TOC	NA	NA	415.2(1)
TSS	NA	NA	160.2(1)
COD	NA	NA	410.1(1)
Hardness	NA	NA	130.2(1)
Alkalinity	NA	NA	310.1(1)

ASTM - American Society of Testing Materials Methods of Analysis.

1 - EPA 600 4/79-020, Methods for Chemical Analysis of Water and Wastes, March 1983.

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TABLE 7-3

RECOMMENDED HOLDING TIMES FOR ANALYSES TO BE CONDUCTED ON SAMPLES FOR THE TEXTRON LYCOMING RI/FS

ORIGINAL (Red)

	Sample Analysis	Holding Time: Water[1]	Holding Time: Solid/Soils
1.	Target Compound List Volatile Organics	14 days	10 days[2]
2.	Target Compound List Semivolatile Organics	7 days until extraction 40 days after extraction	7 days until extraction 40 days until extraction
3.	Target Compound List Pesticides/PCBs	7 days until extraction 40 days after extraction	7 days until extraction 40 days until extraction
4.	Metals	6 months (28 days for Hg)	6 months (28 days for Hg)
5.	Cyanide	14 days	14 days
6.	Field pH, Eh, DO, temperature, and conductivity	Measured immediately after sample collection	
7.	BOD	48 hours	NA
8.	TOC	28 days	NA
9.	TSS	7 days	NA
10.	Hardness	6 months	NA
12.	Alkalinity	14 days	NA

1 Unless otherwise specified, Federal Register, Friday, October 26, 1984.
2 This holding time is also pertinent to the analysis of air samples.

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SECTION 8

DATA REPORTING, VALIDATION, AND REDUCTION

Data validation practices will be followed to ensure that raw data are not altered and that an audit trail is developed for those data which require reduction. All the field data, such as those generated during field measurements, observations and field instrument calibrations, will be entered directly into a bound field notebook. Each project team member will be responsible for proofing all data transfers made, and the Field Operation Manager will proof at least ten percent of all data transfers.

Upon receipt of the sample data packages, the laboratory data will again be quantitatively and qualitatively validated by ERM's Senior Quality Assurance Chemist. Data validation is discussed in detail in Section 12.

ERM's data reduction for this investigation will be minimal and will consist primarily of tabulating analytical results from Lancaster Laboratories' Form I (Analytical Reports) onto summary tables through the use of computerized spreadsheet software. All reduced data will be assigned document control identification numbers and placed in the central file maintained by the Project Manager.

ORIGINAL (Red)

All analytical data obtained during the course of the investigation for ground water and surface water will be reported as ug/l. Analytical data for soil and sediment samples will be reported as ug/kg. Data packages associated with the analyses of samples collected during the RI will be prepared utilizing full CLP deliverables. The required deliverables are stated in Section B of the CLP SOWs currently in use by Lancaster Laboratories.

All raw field data will be summarized, reduced or tabulated for use in the RI or EA reports. All laboratory analytical data will be summarized and tabulated upon receipt, validated and qualified (see Section 12) and the final data submitted to the project team for use in the RI and EA reports.

ERM will require a rigorous data control program that will ensure that all documents for the investigations are accounted for when they are completed. Accountable documents include items such as log books, field data records, correspondence, chain-of-custody records, analytical reports, data packages, photographs, computer disks, and reports. The Project Manager is responsible for maintaining a central file in which all accountable field-related documents will be inventoried. The Laboratory Coordinator is responsible for maintaining a central file in which all accountable sample analysis and chain-of-custody related documents will be inventoried.

To maintain control in the transfer of data, all copies of raw data from the field notebooks, and the data as received from the laboratory, will be entered into a data file and assigned an appropriate document control identification number. The data file will serve as the ultimate archive for all information and data generated during this investigation.

ORIGINAL (Red)

The documentation of sample collection will include the use of bound field log books in which all information on sample collection and field instrument calibration will be entered in indelible ink. Appropriate information will be entered to reconstruct the sampling event, including site name (top of each page), sample identification, brief description of sample, date and time of collection, sampling methodology, field measurements and observations, and sampler's initials (bottom of each page, and dated). An example of a field log is presented in Figure 8-1. ERM's Sampling Notebook SOP is photocopied and attached to the front cover of all field books issued. This ensures all required information is recorded. A copy of the SOP is presented as Figure 8-2.

FIGURE 8-1

Typical Logbook Entries

Acme Waste Company

Joe Smith-EPA Region V	(315)672-3396
Marin Astare-PADER	(717)629-3396
Peter Shoperton -Site Owner	(215)276-9377
Paul Detchic-Project Manager	(215)687-9560
Joe Perryton-Geologist	(215)687-9560
Pauline Jenlan-Sampler	(215)687-9560

Checked out traffic reports 1600-1609 with 3 chain of custody 8/25/87 _ bottles delivered by lab courier 8/22/87. JP took bottle custody. Arrived on site 8/27/87 @ 11:00. Cool (57F), Sunny, Entire site on a slight slope to the north. Met Joe Smith, Marin Astare & Peter Shoperton for site recon.
<u>OVA Backround Levels</u> 0ppm. Stable

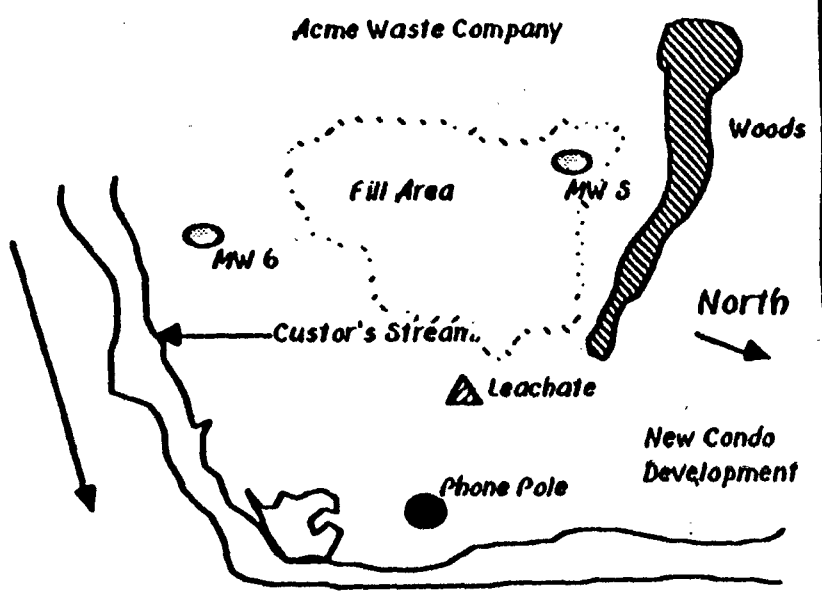
-OVA calibrated 8/25/87 see log entry page 2

12:10 Pauline sampling leachate TR 1601 photo 3, sample smells like sulfur and is rainbow in color with an oily sheen. Leachate was observed 3 feet west of the phone on site.

12:50 Joe P. samples a seep at the base of Custor's Stream TR 1602 seep is bright red and has the viscosity similar to motor oil, Photo 4.

page 3

Paul Detchic



13:00 Paul is Purging Monitoring well #5 while Joe is preparing to collect a grab sample.
14:00 Joe is bailing the well #5 and @ 14:13 is filtering for metals (dissolved).
Sample acidified w/HNO_3 pH<2 after filteration was complete TR 1603 Photo 5

15:30 Sampling from well #5 completed in triplicate so an MS and MSD can be submitted for well #5, (1604-MS, 1605-MSD)

16:50 Team left site.

Paul Detchic

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FIGURE 8-2

SOP SAMPLING LOGBOOKS

ORIGINAL (Red)

One or more bound books will be maintained for each site; the book(s) will remain with the site evidence file. Copies should be made for the person who made the entries and the PM if requested.

All entries in the Logbook must be made in ink.

First Page should contain:

- Site name and number
- Date and time started
- Personnel on site

Next page(s) depth to water (DTW) for all wells if required by the sampling plan. S/N of the DTW meter.

Each new day should contain:

- Date and time started
- Weather
- Personnel on site - including any non-ERM personnel
- Sampling information (see next page)
- Initials of notekeeper

* Note when a mistake is made in the Log, put a single line through it in ink and initial and date.

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FIGURE 8-2 (continued)

ORIGINAL (Red)

SAMPLE INFORMATION

- Sample # (Traffic Report)
- Date and Time Sample collected
- Source of Sample (well, stream, domestic well, field etc.)
- Purged Well - type of equipment, purge volume, rate of purge, and decon procedures
- Location of Sample - document with a site sketch and/or written description, where sample was taken so that it could be found again.
- How was sample taken? (bailer, trowel, SS spoon, thief, etc.)
- Analysis and QA/QC required (601, 602, Metals, Tier I, Tier II, etc.)
- Chemical Preservation used (HNO_3, H_2SO_4, NaOH, etc.)
- Field instrument calibration including date of calibration, standards used and their source, results of calibration and any corrective actions taken.
- Field Data (pH, DO, spec. and temp., etc.)
- Field Observations - significant observation should be documented.
    - Sample condition (color, odor, turbidity, oil, sheen)
    - Site condition (stressed vegetation, exposure of buried wastes, erosion problems, etc.)
- How sample was shipped, date, time and where to, and if legal seals were attached to transport container(s).
- Comments - Any observation or event that occurred that would be relevant to the site; for example, weather changes or effect it had on sampling, conversations with the client, public official or private citizen; instrument calibration, equipment problems, etc.

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SECTION 9

INTERNAL QUALITY CONTROL CHECKS

9.1 Laboratory Internal Quality Control Checks

Lancaster Laboratories' Internal Quality Control Checks are presented in Attachment 1, Section IV. These will be a continuation of ERM's Field Internal Quality Control Checks presented below.

9.2 Field Internal Quality Control Checks

Field Internal Quality Control Checks will be utilized during this investigation through the use of the following:

- Travel Blanks - These blanks consist of ultrapure, deionized water contained in each sample container with any preservatives required for that analysis. ERM produces ultrapure deionized water by use of a Hydros® Deionized Water System. These blanks will accompany the samplers during the sampling process and will serve as QC check on container cleanliness, external contamination, and the analytical method. Travel blanks will be submitted blind using a fictitious sample location once per day per analytical fraction for ground water, and surface water.

ORIGINAL (Red)

Pretested, clean, sterilized play sand will be used as travel blank material for solid/soil samples. Solid travel blanks will also be submitted blind using a fictitious sample location and will be analyzed for the organic fractions only. Deionized water from the source mentioned above will be used for the solid travel blank inorganic analyses.

- Equipment Rinsate Blank - Equipment rinsate blanks will be collected to ensure that sampling equipment is clean and that the potential for cross-contamination has been minimized by the equipment decontamination procedures. These blanks will be collected by decontaminating the sampling device and then pouring ultrapure deionized water (from the Hydro® Ultrapure Water System) over the device. This rinsate water will be collected into a clean stainless steel bowl and then transferred to the appropriate sample containers. An equipment rinsate blank will be collected for each major sampling event to include the soil boring sampling, surface water sampling, sediment sampling and ground water sampling. The equipment rinsate blank will be analyzed for identical parameters as the samples.

- Duplicate Samples - Blind duplicate samples will be collected to allow determination of analytical precision. One duplicate sample in every twenty (20) ground water, surface water, and solid/soil samples will be collected and submitted for the required analyses.

- Matrix Spike Sample - Matrix spike/matrix spike duplicates samples will also be submitted as further QC checks. These will be collected at the same frequency as

ORIGINAL (Red)

stated above for the duplicate samples. These will allow accuracy to be determined by the recovery rates of compounds (the matrix spike and/or surrogate spike compounds defined in the analytical methods). Precision will also be assessed by comparison of matrix spike duplicate recoveries. The purpose of these laboratory spikes is to monitor any possible matrix effects specific to samples collected from the subject site. The addition of known concentrations of compounds/constituents into the sample also monitors extraction/digestion efficiency.

Matrix spike/matrix spike duplicate sample aliquots will be acquired for ground water and surface water by providing triple the necessary sample volume. Matrix spike/matrix spike duplicate sample aliquots for solid/soil analyses will be split from the designated sample location at the laboratory. The laboratory will select aliquots that are as homogeneous with respect to one another as possible to avoid precision problems related from sample inhomogeneity. The specific sample location which will be used for matrix spikes and blind duplicates will be chosen by the Field Operations Manager with direction from the Senior Quality Assurance Chemist. Homogenizing is discouraged prior to splitting duplicates to avoid the loss of volatile organic compounds.

SECTION 10

PERFORMANCE AND SYSTEM AUDITS

(Red)

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10.1 On-Site Audit

An on-site system audit will be performed during ground water sampling to review all field-related quality assurance activities. The system audit will be conducted by ERM's Field Service Manager. Figure 10-1 presents ERM's Quality Assurance Audit forms. The acceptance criteria for the field audit will be in adherence to the protocols presented throughout the QAPP. Deficiencies found during the audits will be brought to the attention of the responsible individuals and corrective action will be initiated as per Section 13 of this QAPP. Copies of the audits will be distributed to all project personnel.

Specific elements of the on-site audit include the verification of:

- Completeness and accuracy of sample Chain-of-Custody forms, including documentation of times, dates, transaction descriptions, and signatures.

- Completeness and accuracy of sample identification labels, including notation of time, date, location, type of sample, person collecting sample, preservation method used, and type of testing required.

FIGURE 10-1

ERM QUALITY ASSURANCE AUDIT

ORIGINAL (Red)

PROJECT _____ W.O.# _____

DATE _____ TIME _____

AUDITOR(S): _____

_____

ON-SITE SAMPLING PERSONNEL: _____

_____

Audit Conducted on the Following:

_____ Soil Sampling
_____ Surface Water/Sediment
_____ Ground Water
_____ Decontamination

Y = Yes N = No N/A = Not Applicable N/D = Not Determined

Sample Collection:

Do sampling locations agree with those specified in the Work Plan/Sampling Plan? _____

Is the sampling location either documented sufficiently or marked to allow it to be found/sampled again in the future? _____

Are sampling times, ERM Traffic Report Numbers and sample description noted in the FNB? _____

Is sampling proceeding from the suspected least contaminated area to the most contaminated area? _____

Have all field measurements been properly taken as per Sampling Plan? _____

Have sample bottles been labeled properly? _____

Have proper containers and preservatives been used? _____

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Are proper sample volumes procured? _____

Have MS & MSD(s) been collected as per QA-QC Plan? _____

Does a travel blank exist for each matrix present? _____

Are samples being refrigerated/iced immediately after collection? _____

Has condition of sample been recorded in the FNB and in the traffic report? _____

Does the potential for sample cross-contamination exist based on procedures observed? _____

Have legal seal(s) been properly filled out and attached to the shipping container(s)? _____

Soil Sampling (Check if not applicable _____):
Type: _____ Hand _____ Auger or Rig

Are samples being collected at proper depths? _____

Are samples being screened with an OVA (if specified in Work Plan and applicable)? _____

Is a description of soils/materials being logged? _____

Have soils been homogenized where applicable? (specified by the Sampling Plan)? _____

Surface Water/Sediment Sampling (Check if not applicable _____):

Have stream flow and velocity parameters been noted? _____
Estimated _____ or Measured _____

Has sampling proceeded from downstream to upstream locations? _____

Has the sampler acquired the water sample upstream of his position to minimize suspended sediment from entering the sample? _____

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Have water samples been collected in the mixing zone, not stagnant areas? _____

Have sediments been characterized as to type and size distribution? _____

Has the proper sediment fraction (fine, depth) been sampled for the analyses of interest? _____

Ground Water Sampling (Check if not applicable _____):

Have depth to water level readings been taken for all wells? _____

Have the well specifications been noted properly (i.e., total depth, casing diameter, depth-to-water to the nearest one-hundredth of a foot, etc.)? _____

Has the purge volume been calculated properly? _____

Have OVA readings been obtained when the well head was opened? _____

What evacuation method has been used?

_____ Bailer _____ Submersible _____ Bladder pump
_____ Other (_____)
_____ Foltz pump

If metals are being analyzed, have the samples been field filtered? _____

Are field pH, conductivity, and temperature being measured and documented? _____ Is there documentation of calibrating the instruments? _____

Has well yield been properly evaluated to determine when sample aquisition should take place (i.e., does well go dry and needs to recover)? _____

Is bailer line and bailer dedicated to each well and line disposed of after use? _____
Bailer type _____ Line type _____

Have appropriate measures been taken to dispose of contaminated purge water, pump lines, bailers, etc? _____

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For Domestic Wells - Has as much information on the well and distribution system been obtained, i.e., depth, casing type, diameter, treatment present, etc.? _____

Has the sample been collected prior to treatment and as close to the well head as possible? _____

Has the domestic well been purged sufficiently to reach temperature stabilization? _____

Have any fixtures been removed from the domestic well before the sample was taken? _____

Have the weather conditions been recorded? _____

Decontamination:

Has sampling equipment been decontaminated properly for the given analytes as per QA Plan? _____

Have the proper decontamination solutions been used? _____

For large equipment (backhoes, drill rigs), has decontamination taken place in an appropriate area? _____

Has decontaminated water/solution been collected for proper disposal? _____ Where disposed? _____

Has disposable equipment, that is contaminated, been properly deconned and disposed of? _____

Have decon samples been taken from the sampling equipment as per Sampling Plan? _____

General:

Has all appropriate information been recorded in the FNB? _____

Are employees conducting the investigation in a professional manner? _____

Are the objectives of the sampling activities understood by the field personnel? _____

Are weather conditions affecting sample quality? _____

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Audit Summary and Comments:

Signed by:

Sampler: _____ Print Name: _____

_____ _____

Auditor: _____ _____

_____ _____

Date: _____

DB/gnl

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- Completeness and accuracy of field notebooks, including documentation of times, dates, drillers' names, sampling method used, sampling locations, number of samples taken, name of person collecting samples, types of samples, results of field measurements, soil logs, and any problems encountered during sampling.

- Adherence to health and safety guidelines outlined in the Site Health and Safety Plan including wearing of proper protective clothing.

- Adherence to decontamination procedures outlined in Section 4 of this QAPP, including proper decontamination of pumps and pump tubing, bailers, and sampling equipment.

- Adherence to sample collection, preparation, preservation, and storage procedures.

10.2 Laboratory Audit

10.2.1 Internal Laboratory Audits

Lancaster Laboratories performs regular systems and performance audits, and these are described in Attachment 1, Section VII.

10.2.2 ERM's Performance Audit of Lancaster Laboratories

As Lancaster Laboratories is a participant in the EPA's Contract Laboratory Program (CLP) under a contract for organic analyses, a performance audit sample need not be submitted for organic analyses. ERM shall submit a performance audit sample to Lancaster Laboratories for inorganic analysis. Both these

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results, and the Laboratory's most recent EPA and New York State Performance Evaluation sample results will be reviewed to evaluate the laboratory accuracy. Acceptance criteria for the performance audit sample will be equivalent to that for successful analysis of the CLP Performance Evaluation sample.

Results of the evaluation of all field and laboratory audits will be submitted to ERM's Project Manager for review and incorporation into the status reports prepared by ERM.

If the results of the audit necessitate further action, the Project Manager will be notified of such and will be appraised of any corrective action taken.

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SECTION 11

PREVENTIVE MAINTENANCE

11.1 Laboratory Maintenance

A typical standard operating procedure for maintenance, including specific routine and preventive procedures, and maintenance logs for the gas chromatograph/mass spectrometer is given in Attachment 1, Exhibit XI.

11.2 Field Maintenance

ERM's field equipment is maintained through the use of a tracking system incorporating the tagging of each equipment item. This tag identifies its most recent maintenance, battery charge, and condition. When damaged or equipment in need of repair is returned to the equipment warehouse, it is appropriately flagged for the required maintenance to be performed. This process ensures only operable and maintained equipment enters the field. Routine daily maintenance procedures conducted in the field will include:

- Removal of surface dirt and debris from exposed surfaces of the sampling equipment and measurement systems.

ORIGINAL (Red)

- Cleansing of filters in the organic vapor analyzer.

- Storage of equipment away from the elements.

- Daily inspections of sampling equipment and measurement systems for possible problems (e.g., cracked or clogged lines or tubing or weak batteries).

- Check instrument calibrations as described in Section 6.2 of this QAAP.

- Charging any battery packs for equipment when not in use.

Spare and replacement parts stored in the field to minimize downtime include:

- Appropriately sized batteries

- Locks

- Extra sample containers and preservatives

- OVA igniters and filters

- OVA H_2 gas, battery charger, and support equipment

- Extra samples coolers, packing material, and sample location stakes.

- Additional supply of health and safety equipment i.e., respirator cartridges, boots, gloves, tyvek, ect.

- Additional equipment as necessary for the field tasks.

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SECTION 12

SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

12.1 Overall Project Assessment

Overall data quality will be assessed by a thorough understanding of the data quality objectives which are stated during the design phase of the investigation. By maintaining thorough documentation of all decisions made during each phase of sampling, performing field and laboratory audits, thoroughly reviewing (validating) the analytical data as it is generated by the laboratory, and providing appropriate feedback as problems arise in the field or at the laboratory, ERM will closely monitor data accuracy, precision and completeness.

12.2 Field Quality Assessment

To ensure that all field data are collected accurately and correctly, specific written instructions will be issued to all personnel involved in field data acquisition by the Project Manager. The Field Services Coordinator will perform a field audit during an initial sampling of the investigation to document that the appropriate procedures are being followed with respect to sample (and blank) collection. These audits will include a thorough review of the field books used by the Project personnel

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to ensure that all tasks were performed as specified in the instructions. The field audits will necessarily enable the data quality to be assessed with regard to the field operations.

The evaluation (data review) of field blanks, and other field QC samples will provide definitive indications of the data quality. If a problem that can be isolated arises, corrective actions can be instituted for future field efforts.

12.3 Laboratory Data Quality Assessment

Specific measures that will be taken by Lancaster Laboratories to assess data quality are presented in Attachment 1, Section VIII.

12.4 ERM's Laboratory Data Assessment

12.4.1 ERM Data Validation

All analytical data generated during the investigation will undergo a rigorous ERM data review. This review will be performed in accordance with general guidance in the "Laboratory Data Validation Functional Guidelines for the Evaluation of Organic (and Inorganic) Analysis" (with modification for EPA Region III).

A preliminary review will be performed to verify that all necessary paperwork (chain-of-custodies, traffic reports, analytical reports, laboratory personnel signatures) and deliverables (as stated in the current organic and inorganic SOWs) are present.

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A detailed quality assurance review will be performed by the ERM Quality Assurance Chemist to verify the qualitative and quantitative reliability of the data as it is presented. This review will include a detailed review and interpretation of all data generated by Lancaster Laboratories. The primary tools which will be used by experienced data review chemists will be guidance documents, established (contractual) criteria, and professional judgement. Table 12-1 presents the items examined during the quality assurance review.

Based upon the review of the analytical data, an organic and inorganic quality assurance report will be prepared which will state in a technical yet "user friendly" fashion the qualitative and quantitative reliability of the analytical data. The report will consist of a general introduction section, followed by qualifying statements that should be taken into consideration for the analytical results to be appropriately utilized. Based upon the quality assurance review, qualifier codes will be placed next to specific sample results on the sample data table. These qualifier codes will serve as an indication of the qualitative and quantitative reliability.

During the course of the data review, an organic and inorganic support documentation package is prepared which will provide the backup information that will accompany all qualifying statements presented in the quality assurance review.

Once the review has been completed, the Senior Quality Assurance Chemist will verify the technical accuracy of the review and then submit these data to the Project Manager. These approved data tables and quality assurance reviews will be signed and dated by the Senior Quality Assurance Chemist.

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TABLE 12-1

ITEMS REVIEWED DURING THE ERM DATA VALIDATION

Areas Examined	Applicability (organic, inorganic, both)
ERM and Laboratory Chain of Custodies (Traffic Reports, Field Notes, Etc)	Both
Laboratory Narrative and QC Summaries	
Holding Times	Both
Extraction/Digestion Logs	Both
Blanks - field and laboratory (accuracy)	Both
Instrument Tune	Organic
Standards	Both
Linearity	Both
Sensitivity/Stability	Both
Selectivity/Specificity	Both
EPA Criteria (SPCC & LCS)	Both
Variability of Technique (internal standards)	Organic
Analyte Breakdown	Organic
Analytical Sequence	Organic
ICP Interference	Inorganic
Control Standards	Inorganic
Samples	
Detection Limits	Both
Instrument Printouts	Both
ICP data	Inorganic
AA data	Inorganic
GC data	Organic
GG/MS data	Organic
Autoanalyzer data	Inorganic
Qualitative Identification	Both
Mass spectra	Organic
Pesticide/PCB results	Organic
Tentatively identified compounds	Organic

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TABLE 12-1 (Continued)

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Quantitative Reliability	Both
Calculations/Equations	Both
Matrix spikes (accuracy)	Both
Bias	
Matrix spike duplicates	Organic
Bias	
Accuracy & Precision	
Surrogate Spikes	Organic
Bias	
Duplicates (field and laboratory)	Both
Precision	
Representativeness	
Post-Digestion Spikes	Inorganic
Matrix Effects	

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12.5 Data Management Quality Assessment

As the analytical data generated from the subject investigation are validated, qualified and submitted to the Project Manager, the quality of the data will be assessed from an overall management perspective by direct comparison of analytical results obtained from previous samplings. Information that can be obtained includes comparison of results obtained from samples taken within the same general vicinity, and the identification of missing data points. By examination of the data during the final stage of the process, the data quality can be assessed with respect to representativeness, precision, compatibility and completeness.

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SECTION 13

CORRECTIVE ACTION

13.1 Lancaster Laboratorie's Corrective Action

Correcctive actions for Lancaster Laboratries are presented in Attachnment 1, Section IX. Lancaster Laboratories will provide documeentation as to what, if any, corrective actions were initiaated concerning this study and report them to ERM's Senior Qualitty Assurance Chemist.

13.2 ERM's Corrective Action

Field quality assurance activities will be reported topically to ERM's Project Manager. Problems encountered during the study affecting quality assurance will be reported on a Corrective Actionn Form as presented in Figure 13-1. The Project Manager will bbe responsible for initiating the corrective actions and for ensuring that the actions are taken in a timely manner, and that the desired results are produced. The Project Manager will reportt to the Senior Quality Assurance Chemist and Quality Assuraance Chemist on all necessary corrective actions taken, the outcomme of these actions, and their affect on data produced. All correcctive action taken will be reported to Textron Lycoming.

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FIGURE 13-1

Corrective Action Form

Date:
Job Name:
Initiator's Name and Title:
Problem Description:

Reported To:

Corrective Action:

Reviewed and Implemented By:

cc: Project Manager-
QA Manager -
QA Officer-

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SECTION 14

QUALITY ASSURANCE REPORTS TO MANAGEMENT

After project initiation, the Project Manager, in conjunction with the Senior Quality Assurance Chemist, will submit a progress report summary of all applicable quality assurance activities. These summaries shall contain at least the following types of information:

- The status and coverage of various laboratory and field quality assurance project activities.

- Data quality assurance reviews including assessment of accuracy, precision, completeness, representativeness, and comparability.

- Significant quality assurance problems discovered, corrective actions taken, progress and improvements, plans, and recommendations for further implementation or updating of the investigative QAPP.

- Any significant field observations noted in the field notebook during the sampling procedure.

- Results of performance and system audit reports.

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ATTACHMENT 1

LANCASTER LABORATORIES' QUALITY ASSURANCE PLAN
FOR THE TEXTRON LYCOMING SITE RI/FS

The ERM Group

Lancaster Laboratories

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LABORATORY QUALITY ASSURANCE PLAN

MODIFIED
FEBRUARY 22, 1989

WARNING: The information contained herein is of a highly confidential and proprietary nature. Lancaster Laboratories, Inc. specifically prohibits the dissemination or transfer of this information to any person or organization not directly affiliated with the project for which it was prepared.

2425 New Holland Pike, Lancaster, PA 17601-5994
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LABORATORY QUALITY ASSURANCE PLAN

This document provides the laboratory portion of the response to EPA's "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans" QAMS - 005/80, Sections 5.5 - 5.15 as revised December 29, 1980.

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I. QA OBJECTIVES (QAMS-005/80 SECTION 5.5)

A. QA Objectives for Inorganics

1. The inorganics to be determined (Exhibit I) will either be from the priority pollutant list or the Target Analyte List (TAL) or as specified by the client. Analytical results will be tabulated on our analytical report form and the CLP report forms (see Exhibit II).

2. A preparation blank will be run with every batch of samples. (A batch is 20 samples or less.) Initial and continuing calibration blanks will be analyzed after every initial and continuing calibration verification.

3. One duplicate will be run for each batch. The Relative Percent Difference (RPD) will be reported according to the following equation:

$$RPD = \frac{D_2 - D_1}{(D_1 + D_2)/2} \times 100$$

D_1 = First sample value
D_2 = Second sample value

A control limit of $\pm$ 20% for RPD shall be used for sample values greater than five times the reporting limit (RL) and $\pm$ RL for values less than five times the RL as per EPA Contract Lab Program (CLP) Statement of Work (SOW) 7/87.

4. Initial calibration will be performed as described in CLP SOW 7/87. Check standards which represent the midpoint of the calibration range will be run with no less frequency than one in ten.

The following acceptance criteria will apply to the calibration verification as per EPA CLP, July, 1987.

Method	% of True Value
ICP, Flame, or Furnace AAS	90-110
Cold Vapor AA	80-120
Other (cyanide)	85-115

5. Matrix spikes will be performed on one sample per batch. The acceptance criteria for the spike recovery shall be 75-125%. This criteria does not apply when the sample concentration exceeds the spike concentration by a factor of four or more.

$$\% \text{ Recovery} = \frac{(SSR-SR)}{SA} \times 100$$

SSR = Spiked Sample Results
SR = Sample Result
SA = Spike Added

6. The following will be performed as described in CLP SOW 7/87: initial calibration verification, instrument detection limit determination, calibration blank analysis, ICP linear range determination, ICP interference checks, ICP serial dilutions, laboratory control sample analysis.

7. The analytical method sources, RLs and typical accuracy and precision data are listed in Exhibit I.

8. Typical QC summary forms which will be completed for inorganics are presented as Exhibit III.

B. QA Objectives for Organics

1. Analytical results will be tabulated on our analytical report form and the CLP report forms (Exhibit II). The list of organic compounds determined will be either the priority pollutants or the Target Compound List (TCL) or as specified by the client. See Exhibit IV for typical reporting limits. If EPA CLP methodology is requested, the data will be reported on the forms specified in the referenced SOW.

2. For extractable compounds, a method blank will be prepared with every group of samples or every 20 samples, whichever is more frequent. Volatiles blanks will be analyzed every 12 hours.

3. The GC/MS initial calibration will be performed using a blank and five levels of standards for the CLP methods. Check standards for the volatiles and semivolatiles are run once per every 12 hour run for CLP. The QC acceptance criteria contained in Exhibit V will be used to verify the acceptability of the check standard for CLP methods.

4. Matrix spike duplicates (see Exhibit VI) will be run on at least 5% of the samples. The acceptance criteria for the accuracy spike shall be within the ranges specified in the 7/87 Organics SOW.

$$\% \text{ Recovery} = \frac{(SSR-SR)}{SA} \times 100$$

SSR = Spiked Sample Results
SR = Sample Result
SA = Spike Added

The acceptance criteria shall be those listed in Exhibit VI.

$$RPD = \frac{D_2 - D_1}{(D_1 + D_2)/2} \times 100$$

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D_1 = First sample value
D_2 = Second sample value

5. Surrogate standards (Exhibit VII) will be run with each organics sample. The acceptance criteria are those listed in the Exhibit.

6. The specific analytical methods to be used are those from SOW 7/87.

7. Typical QC summary forms which will be completed for the organics are found in Exhibit IX.

8. Specific examples of GC/MS matrix spikes and quality control charts as generated by Lancaster Laboratories, Inc. are listed in Exhibit X.

9. Exhibit XI contains a typical maintenance SOP for GC/MS systems.

II. SAMPLE CUSTODY - LABORATORY OPERATIONS (SECTION 5.7B)

A. Laboratory Sample Custody Procedures

Kathy Hallquist (1st shift) and Alfred Flowers (2nd shift) (717-656-2301) will act as the sample custodians at Lancaster Laboratories, Inc. (LLI) for this project. We will use laboratory chain-of-custody sheets to document sample transfer within the laboratory, see Exhibit XVIII. When samples requiring preservation by either acid or base are received at the laboratory, the pH will be measured and documented. Samples requiring refrigeration will be stored in our walk-in cooler which is maintained at 4°C. The use of our computer system in tracking the sample in the laboratory is discussed in Section V.C below. A list of containers, preservatives, and holding times is in Exhibit XXI.

III. CALIBRATION PROCEDURES AND FREQUENCY (SECTION 5.8)

A. Calibration and Recalibration Procedures:

The calibration procedures are those required by the various methods (CLP or SW 846). In general, the calibration curves consist of a minimum of a blank and at least three levels of standards. Five levels of standards are used for GC/MS calibration. Refer to Exhibits XII and

XIII for a typical GC/MS tuning and calibration procedure and the typical AAS calibration procedure. EPA Method 200.7 is presented in Exhibit XIV and contains calibration and recalibration information for the ICP. Recalibration will be performed as listed in our discussion of Section 5.5.

B. Source of Calibration Standards:

The calibration standards used are obtained from chemical supply houses who document their traceability. LLI also obtains the QC samples available through EPA (EMSL - Cincinnati, Ohio) and runs them periodically as a check on the standards obtained from the chemical supply houses.

IV. ANALYTICAL PROCEDURES (SECTION 5.9)

All the analytical procedures to be used for organics are those listed in the CLP SOW 7/87. The inorganics procedures are those indicated by the CLP SOW 7/87. Glassware cleanup is detailed in Exhibit XIX.

V. DATA REDUCTION, VALIDATION AND REPORTING (SECTION 5.10)

A. Sample Calculations:

For samples analyzed by CLP methodology, calculation will be performed according to the SOW. Examples of other calculations are given below:

1. GC/MS

$$\text{Final Result} = \frac{(Q)(D)}{C}$$

Q = Amount reported on software generated quantitation report -- ppm for extractables, ppb for volatiles. Software utilizes the internal standard method of calculation.
D = Dilution factor (unitless)
C = Concentration factor (unitless - see note below)

NOTE: For extractables, "C" refers to the shakeout (or sonication) of the sample in methylene chloride (CH_2Cl_2)

$$\text{For soils, } C = 30 = \frac{30g \text{ sample}}{1ml\ CH_2Cl_2}$$

$$\text{For waters, } C = 1000 = \frac{1000ml \text{ sample}}{1ml\ CH_2Cl_2}$$

2. Pesticides and PCBs for GC (water samples)

$$\text{Concentration (ug/l)} = \frac{(A_x)(I_s)(V_t)(DF)}{(A_s)(V_i)(V_s)}$$

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Where A_x = Peak height (response, corrected for blank) for the parameter being measured
A_s = Peak height for the external standard
V_t = Volume of total extract (ul)
DF = Dilution factor (unitless)
I_s = Amount of standard injected in nanograms
V_i = Volume of extract injected (ul)
V_s = Volume of water extracted (ml)

3. Metals (water samples)

$$\text{Concentration (mg/l)} = (A)(D)\frac{E}{F}$$

Where A = AAS reading (mg/l)
D = Dilution factor (unitless)
E = Final sample volume (ml)
F = Original sample volume (ml)

B. **Acceptance Criteria, Treatment of Outliers:**

The principle criteria used to validate the data will be the acceptance criteria outlined under Section I above. The group leaders (see Section V.D, below) will check all data generated by their group to determine that it falls inside the acceptance criteria. Any samples that fall outside will be repeated to establish and correct (if possible) the cause for the outlier, or flagged as indicated by the CLP SOW (7/87 for inorganics, 7/87 for organics). For more information, see Exhibit XXII.

C. **Sample and Data Flow and Reporting Scheme:**

Samples are entered onto the computerized sample management system as described in LLI SOP QA-14 (Exhibit XV). Use of the sample management system is described in Section V of the Qualification Manual. See Exhibit XVI for a summary of typical sample and data routing at LLI.

D. **Key Personnel:**

See Exhibit VIII for Division organization chart and resumes of key personnel.

VI. INTERNAL QUALITY CONTROL CHECKS (SECTION 5.11)

Every twentieth sample will be collected in triplicate to allow the laboratory to run that sample in duplicate and to also run a matrix spike. The blanks, calibration standards and surrogate standards to be run have already been discussed in Section I.

VII. PERFORMANCE AND SYSTEM AUDITS (SECTION 5.12)

System audits are conducted on each department at Lancaster Laboratories, Inc. by the Quality Assurance Director. The audits include checks on methodology, reagent preparation, equipment calibration and maintenance, quality control samples, and training of personnel. The results of the audits and corrective action, where necessary, are relayed to laboratory personnel and management by means of a written report, see Exhibit XX.

Performance audits consist of both intra-laboratory and inter-laboratory check samples. A wastewater sample is prepared in bulk and preserved with acid for metals analysis. The sample is submitted blind to the analysts on a biweekly basis by the QA director. Results are tabulated and used to develop Shewhart control charts. Two samples of transformer oil fluid are also submitted blind for PCB analysis with similar data handling. In addition, QA samples from EMSL-Cincinnati are also introduced into the system periodically. These samples are known to the analyst as QC samples, but the frequency of these is limited since EPA has reduced their availability.

Lancaster Laboratories, Inc. also participates in a number of inter-laboratory performance evaluation studies. Inorganics, pesticide/herbicide compounds, trihalomethanes and corrosivity in drinking water are analyzed in support of our Pennsylvania Department of Environmental Resources certification. The states of New Jersey and New York offer accreditation for wastewater parameters as well as drinking water. Proficiency samples for these certifications include priority pollutant organics and inorganics. All of these studies involve the submission of blind check samples to our laboratory at least once per year. The results of the latest EPA study are attached as Exhibit XVII.

VIII. PROCEDURES FOR QUALITY ASSURANCE ASSESSMENT (SECTION 5.14)

Sections I, VI and VIII provide the specific procedures that will be used to access the data in the laboratory.

IX. CORRECTIVE ACTION (SECTION 5.15)

If any of the data generated falls outside the acceptance criteria specified in Section I, the appropriate corrective action will be initiated. For example, should the calibration verification standard fall outside the acceptable range, the instrument will be recalibrated. Similarly, samples that fail the spike, duplicate or surrogate standard criteria will be repeated to determine whether a matrix problem exists, or flagged as indicated in the CLP SOW. All data shall be subject to final review by our QA Director.

Element	Wavelength AAS[1] (nm)	Wavelength ICP[1] (nm)	Reporting Limits[5] Water (ug/l)	Reporting Limits[5] Soil/Sediment (mg/kg)	Accuracy[3] (%)	Precision[4]
Aluminum	309.2	308.2	200	20.	100	± .39
Antimony	217.6	206.8	60	6.	96	.08
Arsenic[2]	193.7	--	10	1.	93	.0009
Barium	553.5	493.4	200	20.	104	.13
Beryllium	234.9	313.0	5	0.5	98	.001
Cadmium	228.8	226.5	5	0.5	99	.021
Calcium	422.7	317.9	5000	500	--	--
Chromium	357.9	267.7	10	1.	93	.13
Cobalt	240.7	228.6	50	5.	98	.01
Copper	324.7	324.7	25	2.5	101	.056
Iron	248.3	259.9	100	10.	100	.13
Lead[2]	283.3	220.3	5	0.5	97	.13
Magnesium	285.2	279.0	5000	500	--	--
Manganese	279.5	257.6	15	1.5	101	.031
Mercury	253.7	--	0.2	0.1	95	.0036
Nickel	232.0	231.6	40	4.	97	.02
Potassium	766.5	766.4	5000	500	--	--
Selenium[2]	196.0	--	5.	0.5	101	.0029
Silver	328.1	328.0	10	1.	90	.0088
Sodium	589.6	589.5	5000	500	--	--
Thallium[2]	276.8	377.5	10	1.	100	.018
Vanadium	318.5	292.4	50	5.	97	.10
Vanadium	318.5	292.4	50	5.	--	.10
Zinc	213.9	213.8	20	2.	107	.028
Cyanide	--	--	10	1.	--	--

1 = Flame AA or ICP will be used where appropriate.

2 = These elements typically are determined by graphite furnace AAS when CLP methods are used. When using SW 846, hydride generation AA or ICP may be used.

3 = As measured by spike recoveries using EPA - 600/4-79-020, Methods for Chemicals Analysis of Water and Wastes.

4 = Standard deviation at ten times the detection limit of the EPA methods.

5 = Reporting limits listed are those required under CLP. The reporting limits for SW 846 methods may be different in some cases.

EXHIBIT I

AIR300391

Exhibit II

U.S. EPA - CLP

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1

INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix (soil/water): _____ Lab Sample ID: _____

Level (low/med): _____ Date Received: _____

% Solids: _____

Concentration Units (ug/L or mg/kg dry weight): _____

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				
7440-36-0	Antimony				
7440-38-2	Arsenic				
7440-39-3	Barium				
7440-41-7	Beryllium				
7440-43-9	Cadmium				
7440-70-2	Calcium				
7440-47-3	Chromium				
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron				
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese				
7439-97-6	Mercury				
7440-02-0	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium				
7440-28-0	Thallium				
7440-62-2	Vanadium				
7440-66-6	Zinc				
	Cyanide				

Color Before: _____ Clarity Before: _____ Texture: _____

Color After: _____ Clarity After: _____ Artifacts: _____

Comments:

_____

_____

_____

_____

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) _____ Lab Sample ID: _____

Sample wt/vol: _____ (g/mL) ____ Lab File ID: _____

Level: (low/med) _____ Date Received: _____

% Moisture: not dec. _____ Date Analyzed: _____

Column: (pack/cap) _____ Dilution Factor: _____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) _____	Q
74-87-3	Chloromethane		
74-83-9	Bromomethane		
75-01-4	Vinyl Chloride		
75-00-3	Chloroethane		
75-09-2	Methylene Chloride		
67-64-1	Acetone		
75-15-0	Carbon Disulfide		
75-35-4	1,1-Dichloroethene		
75-34-3	1,1-Dichloroethane		
540-59-0	1,2-Dichloroethene (total)		
67-66-3	Chloroform		
107-06-2	1,2-Dichloroethane		
78-93-3	2-Butanone		
71-55-6	1,1,1-Trichloroethane		
56-23-5	Carbon Tetrachloride		
108-05-4	Vinyl Acetate		
75-27-4	Bromodichloromethane		
78-87-5	1,2-Dichloropropane		
10061-01-5	cis-1,3-Dichloropropene		
79-01-6	Trichloroethene		
124-48-1	Dibromochloromethane		
79-00-5	1,1,2-Trichloroethane		
71-43-2	Benzene		
10061-02-6	trans-1,3-Dichloropropene		
75-25-2	Bromoform		
108-10-1	4-Methyl-2-Pentanone		
591-78-6	2-Hexanone		
127-18-4	Tetrachloroethene		
79-34-5	1,1,2,2-Tetrachloroethane		
108-88-3	Toluene		
108-90-7	Chlorobenzene		
100-41-4	Ethylbenzene		
100-42-5	Styrene		
1330-20-7	Xylene (total)		

ORIGINAL (Red)

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) _____ Lab Sample ID: _____

Sample wt/vol: _____ (g/mL) ____ Lab File ID: _____

Level: (low/med) _____ Date Received: _____

% Moisture: not dec. _____ dec. _____ Date Extracted: _____

Extraction: (SepF/Cont/Sonc) _____ Date Analyzed: _____

GPC Cleanup: (Y/N) ___ pH: ____ Dilution Factor: _____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) _____	Q
108-95-2	Phenol		
111-44-4	bis(2-Chloroethyl)ether		
95-57-8	2-Chlorophenol		
541-73-1	1,3-Dichlorobenzene		
106-46-7	1,4-Dichlorobenzene		
100-51-6	Benzyl alcohol		
95-50-1	1,2-Dichlorobenzene		
95-48-7	2-Methylphenol		
108-60-1	bis(2-Chloroisopropyl)ether		
106-44-5	4-Methylphenol		
621-64-7	N-Nitroso-di-n-propylamine		
67-72-1	Hexachloroethane		
98-95-3	Nitrobenzene		
78-59-1	Isophorone		
88-75-5	2-Nitrophenol		
105-67-9	2,4-Dimethylphenol		
65-85-0	Benzoic acid		
111-91-1	bis(2-Chloroethoxy)methane		
120-83-2	2,4-Dichlorophenol		
120-82-1	1,2,4-Trichlorobenzene		
91-20-3	Naphthalene		
106-47-8	4-Chloroaniline		
87-68-3	Hexachlorobutadiene		
59-50-7	4-Chloro-3-methylphenol		
91-57-6	2-Methylnaphthalene		
77-47-4	Hexachlorocyclopentadiene		
88-06-2	2,4,6-Trichlorophenol		
95-95-4	2,4,5-Trichlorophenol		
91-58-7	2-Chloronaphthalene		
88-74-4	2-Nitroaniline		
131-11-3	Dimethylphthalate		
208-96-8	Acenaphthylene		
606-20-2	2,6-Dinitrotoluene		

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1C
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) _____ Lab Sample ID: _____

Sample wt/vol: _____ (g/mL) ____ Lab File ID: _____

Level: (low/med) _____ Date Received: _____

% Moisture: not dec. _____ dec. _____ Date Extracted: _____

Extraction: (SepF/Cont/Sonc) _____ Date Analyzed: _____

GPC Cleanup: (Y/N) ___ pH: ____ Dilution Factor: _____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) _____	Q
99-09-2	3-Nitroaniline		
83-32-9	Acenaphthene		
51-28-5	2,4-Dinitrophenol		
100-02-7	4-Nitrophenol		
132-64-9	Dibenzofuran		
121-14-2	2,4-Dinitrotoluene		
84-66-2	Diethylphthalate		
7005-72-3	4-Chlorophenyl-phenylether		
86-73-7	Fluorene		
100-01-6	4-Nitroaniline		
534-52-1	4,6-Dinitro-2-methylphenol		
86-30-6	N-Nitrosodiphenylamine (1)		
101-55-3	4-Bromophenyl-phenylether		
118-74-1	Hexachlorobenzene		
87-86-5	Pentachlorophenol		
85-01-8	Phenanthrene		
120-12-7	Anthracene		
84-74-2	Di-n-butylphthalate		
206-44-0	Fluoranthene		
129-00-0	Pyrene		
85-68-7	Butylbenzylphthalate		
91-94-1	3,3'-Dichlorobenzidine		
56-55-3	Benzo(a)anthracene		
218-01-9	Chrysene		
117-81-7	bis(2-Ethylhexyl)phthalate		
117-84-0	Di-n-octylphthalate		
205-99-2	Benzo(b)fluoranthene		
207-08-9	Benzo(k)fluoranthene		
50-32-8	Benzo(a)pyrene		
193-39-5	Indeno(1,2,3-cd)pyrene		
53-70-3	Dibenz(a,h)anthracene		
191-24-2	Benzo(g,h,i)perylene		

(1) - Cannot be separated from Diphenylamine

ORIGINAL (Red)

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name:_____ Contract:_____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water)_____ Lab Sample ID: _____

Sample wt/vol: _____(g/mL)____ Lab File ID: _____

Level: (low/med) _____ Date Received: _____

% Moisture: not dec._____ dec._____ Date Extracted:_____

Extraction: (SepF/Cont/Sonc) _____ Date Analyzed: _____

GPC Cleanup: (Y/N)___ pH:____ Dilution Factor: _____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg)_____	Q
319-84-6	alpha-BHC		
319-85-7	beta-BHC		
319-86-8	delta-BHC		
58-89-9	gamma-BHC (Lindane)		
76-44-8	Heptachlor		
309-00-2	Aldrin		
1024-57-3	Heptachlor epoxide		
959-98-8	Endosulfan I		
60-57-1	Dieldrin		
72-55-9	4,4'-DDE		
72-20-8	Endrin		
33213-65-9	Endosulfan II		
72-54-8	4,4'-DDD		
1031-07-8	Endosulfan sulfate		
50-29-3	4,4'-DDT		
72-43-5	Methoxychlor		
53494-70-5	Endrin ketone		
5103-71-9	alpha-Chlordane		
5103-74-2	gamma-Chlordane		
8001-35-2	Toxaphene		
12674-11-2	Aroclor-1016		
11104-28-2	Aroclor-1221		
11141-16-5	Aroclor-1232		
53469-21-9	Aroclor-1242		
12672-29-6	Aroclor-1248		
11097-69-1	Aroclor-1254		
11096-82-5	Aroclor-1260		

Exhibit III

U.S. EPA - CLP

5A
SPIKE SAMPLE RECOVERY

EPA SAMPLE NO.

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix (soil/water): _____ Level (low/med): _____

Concentration Units (ug/L or mg/kg dry weight): _____

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Aluminum									
Antimony									
Arsenic									
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Mercury									
Nickel									
Potassium									
Selenium									
Silver									
Sodium									
Thallium									
Vanadium									
Zinc									
Cyanide									

Comments:

U.S. EPA - CLP

ORIGINAL (Red)

6
DUPLICATES

EPA SAMPLE NO.

ab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

atrix (soil/water): _____ Level (low/med): _____

% Solids for Sample: _____ % Solids for Duplicate: _____

Concentration Units (ug/L or mg/kg dry weight): _____

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	M
Aluminum								
Antimony								
Arsenic								
Barium								
Beryllium								
Cadmium								
Calcium								
Chromium								
Cobalt								
Copper								
Iron								
Lead								
Magnesium								
Manganese								
Mercury								
Nickel								
Potassium								
Selenium								
Silver								
Sodium								
Thallium								
Vanadium								
Zinc								
Cyanide								

EXHIBIT IV

Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL)*

Volatiles	CAS Number	Quantitation Limits** Water ug/L	Low Soil/Sediment[a] ug/Kg
1. Chloromethane	74-87-3	10	10
2. Bromomethane	74-83-9	10	10
3. Vinyl Chloride	75-01-4	10	10
4. Chloroethane	75-00-3	10	10
5. Methylene Chloride	75-09-2	5	5
6. Acetone	67-64-1	10	10
7. Carbon Disulfide	75-15-0	5	5
8. 1,1-Dichloroethene	75-35-4	5	5
9. 1,1-Dichloroethane	75-34-3	5	5
10. 1,2-Dichloroethene (total)	540-59-0	5	5
11. Chloroform	67-66-3	5	5
12. 1,2-Dichloroethane	107-06-2	5	5
13. 2-Butanone	78-93-3	10	10
14. 1,1,1-Trichloroethane	71-55-6	5	5
15. Carbon Tetrachloride	56-23-5	5	5
16. Vinyl Acetate	108-05-4	10	10
17. Bromodichloromethane	75-27-4	5	5
18. 1,2-Dichloropropane	78-87-5	5	5
19. cis-1,3-Dichloropropene	10061-01-5	5	5
20. Trichloroethene	79-01-6	5	5
21. Dibromochloromethane	124-48-1	5	5
22. 1,1,2-Trichloroethane	79-00-5	5	5
23. Benzene	71-43-2	5	5
24. trans-1,3-Dichloropropene	10061-02-6	5	5
25. Bromoform	75-25-2	5	5
26. 4-Methyl-2-pentanone	108-10-1	10	10
27. 2-Hexanone	591-78-6	10	10
28. Tetrachloroethene	127-18-4	5	5
29. Toluene	108-88-3	5	5
30. 1,1,2,2-Tetrachloroethane	79-34-5	5	5

(continued)

Volatiles	CAS Number	Quantitation Limits** Water ug/L	Low Soil/Sediment[a] ug/Kg
31. Chlorobenzene	108-90-7	5	5
32. Ethyl Benzene	100-41-4	5	5
33. Styrene	100-42-5	5	5
34. Xylenes (Total)	1330-20-7	5	5

[a]Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 125 times the individual Low Soil/Sediment CRQL.

*Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

**Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

AR300400

ORIGINAL (Red)

Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL)*

Semivolatiles	CAS Number	Quantitation Limits** Water ug/L	Low Soil/Sediment[b] ug/Kg
35. Phenol	108-95-2	10	330
36. bis(2-Chloroethyl) ether	111-44-4	10	330
37. 2-Chlorophenol	95-57-8	10	330
38. 1,3-Dichlorobenzene	541-73-1	10	330
39. 1,4-Dichlorobenzene	106-46-7	10	330
40. Benzyl alcohol	100-51-6	10	330
41. 1,2-Dichlorobenzene	95-50-1	10	330
42. 2-Methylphenol	95-48-7	10	330
43. bis(2-Chloroisopropyl) ether	108-60-1	10	330
44. 4-Methylphenol	106-44-5	10	330
45. N-Nitroso-di-n-dipropylamine	621-64-7	10	330
46. Hexachloroethane	67-72-1	10	330
47. Nitrobenzene	98-95-3	10	330
48. Isophorone	78-59-1	10	330
49. 2-Nitrophenol	88-75-5	10	330
50. 2,4-Dimethylphenol	105-67-9	10	330
51. Benzoic acid	65-85-0	50	1600
52. bis(2-Chloroethoxy) methane	111-91-1	10	330
53 2,4-Dichlorophenol	120-83-2	10	330
54. 1,2,4-Trichlorobenzene	120-82-1	10	330
55. Naphthalene	91-20-3	10	330
56. 4-Chloroaniline	106-47-8	10	330
57. Hexachlorobutadiene	87-68-3	10	330
58. 4-Chloro-3-methylphenol (para-chloro-meta-cresol)	59-50-7	10	330
59. 2-Methylnaphthalene	91-57-6	10	330
60. Hexachlorocyclopentadiene	77-47-4	10	330
61. 2,4,6-Trichlorophenol	88-06-2	10	330
62. 2,4,5-Trichlorophenol	95-95-4	50	1600
63. 2-Chloronaphthalene	91-58-7	10	330
64. 2-Nitroaniline	88-74-4	50	1600

(continued)

ORIGINAL
(Red)

Semivolatiles	CAS Number	Quantitation Limits** Water ug/L	Low Soil/Sediment[b] ug/Kg
65. Dimethylphthalate	131-11-3	10	330
66. Acenaphthylene	208-96-8	10	330
67. 2,6-Dinitrotoluene	606-20-2	10	330
68. 3-Nitroaniline	99-09-2	50	1600
69. Acenaphthene	83-32-9	10	330
70. 2,4-Dinitrophenol	51-28-5	50	1600
71. 4-Nitrophenol	100-02-7	50	1600
72. Dibenzofuran	132-64-9	10	330
73. 2,4-Dinitrotoluene	121-14-2	10	330
74. Diethylphthalate	84-66-2	10	330
75. 4-Chlorophenyl-phenyl ether	7005-72-3	10	330
76. Fluorene	86-73-7	10	330
77. 4-Nitroaniline	100-01-6	50	1600
78. 4,6-Dinitro-2-methylphenol	534-52-1	50	1600
79. N-nitrosodiphenylamine	86-30-6	10	330
80. 4-Bromophenyl-phenylether	101-55-3	10	330
81. Hexachlorobenzene	118-74-1	10	330
82. Pentachlorophenol	87-86-5	50	1600
83. Phenanthrene	85-01-8	10	330
84. Anthracene	120-12-7	10	330
85. Di-n-butylphthalate	84-74-2	10	330
86. Fluoranthene	206-44-0	10	330
87. Pyrene	129-00-0	10	330
88. Butylbenzylphthalate	85-68-7	10	330
89. 3,3'-Dichlorobenzidine	91-94-1	20	660
90. Benzo(a)anthracene	56-55-3	10	330
91. Chrysene	218-01-9	10	330
92. bis(2-Ethylhexyl)phthalate	117-81-7	10	330
93. Di-n-octylphthalate	117-84-0	10	330
94. Benzo(b)fluoranthene	205-99-2	10	330

(continued)

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Semivolatiles	CAS Number	Quantitation Limits** Water ug/L	Low Soil/Sediment[b] ug/Kg
95. Benzo(k)fluoranthene	207-08-9	10	330
96. Benzo(a)pyrene	50-32-8	10	330
97. Indeno(1,2,3-cd)pyrene	193-39-5	10	330
98. Dibenz(a,h)anthracene	53-70-3	10	330
99. Benzo(g,h,i)perylene	191-24-2	10	330

[b]Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Semi-Volatile TCL Compounds are 60 times the individual Low Soil/Sediment CRQL.

*Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

**Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL)*

Pesticides/PCBs	CAS Number	Quantitation Limits** Water ug/L	Quantitation Limits** Low Soil/Sediment[c] ug/Kg
100. alpha-BHC	319-84-6	0.05	8.0
101. beta-BHC	319-85-7	0.05	8.0
102. delta-BHC	319-86-8	0.05	8.0
103. gamma-BHC (Lindane)	58-89-9	0.05	8.0
104. Heptachlor	76-44-8	0.05	8.0
105. Aldrin	309-00-2	0.05	8.0
106. Heptachlor epoxide	1024-57-3	0.05	8.0
107. Endosulfan I	959-98-8	0.05	8.0
108. Dieldrin	60-57-1	0.10	16.0
109. 4,4'-DDE	72-55-9	0.10	16.0
110. Endrin	72-20-8	0.10	16.0
111. Endosulfan II	33213-65-9	0.10	16.0
112. 4,4'-DDD	72-54-8	0.10	16.0
113. Endosulfan sulfate	1031-07-8	0.10	16.0
114. 4,4'-DDT	50-29-3	0.10	16.0
115. Methoxychlor	72-43-5	0.5	80.0
116. Endrin ketone	53494-70-5	0.10	16.0
117. alpha-Chlordane	5103-71-9	0.5	80.0
118. gamma-Chlordane	5103-74-2	0.5	80.0
119. Toxaphene	8001-35-2	1.0	160.0
120. Aroclor-1016	12674-11-2	0.5	80.0
121. Aroclor-1221	11104-28-2	0.5	80.0
122. Aroclor-1232	11141-16-5	0.5	80.0
123. Aroclor-1242	53469-21-9	0.5	80.0
124. Aroclor-1248	12672-29-6	0.5	80.0
125. Aroclor-1254	11097-69-1	1.0	160.0
126. Aroclor-1260	11096-82-5	1.0	160.0

[c]Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Pesticide/P TCL compounds are 15 times the individual Low Soil/Sediment CRQL.

*Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

**Quantitation limits listed for soil/sediment are based on wet weight. The quantitation Limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

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ORIGINAL (Red)

all compounds. This is the same check that is applied during the initial calibration (Form VI). If the minimum relative response factors are not met, the system must be evaluated and corrective action must be taken before sample analysis begins.

2.6.1 Some possible problems are standard mixture degradation, injection port inlet contamination, contamination at the front end of the analytical column, and active sites in the column or chromatography system. This check must be met before analysis begins. The minimum relative response factor (RRF) for volatile System Performance Check Compounds (SPCC) is 0.300 (0.250 for Bromoform).

2.6.2 Calibration Check Compounds (CCC)

After the system performance check is met, Calibration Check Compounds listed in Table 2.2 are used to check the validity of the initial calibration. Calculate the percent difference using Equation 2.3.

$$\% \text{ Difference} = \frac{\overline{RRF_I} - RRF_c}{\overline{RRF_I}} \times 100 \qquad \text{Eq. 2.3}$$

where

$\overline{RRF_I}$ = average relative response factor from initial calibration

RRF_c = relative response factor from current calibration check standard

2.6.2.1 If the percent difference for any compound is greater than 20%, the laboratory should consider this a warning limit. If the percent difference for each CCC is less than or equal to 25.0%, the initial calibration is assumed to be valid. If the criteria are not met (>25.0% difference), for any one calibration check compound, corrective action MUST be taken. Problems similar to those listed under SPCC could affect this criteria. If no source of the problem can be determined after corrective action has been taken, a new initial five point calibration MUST be generated. These criteria MUST be met before sample analysis begins.

TABLE 2.2. VOLATILE CALIBRATION CHECK COMPOUNDS

1,1-Dichloroethene
Chloroform
1,2-Dichloropropane
Toluene
Ethylbenzene
Vinyl Chloride

ORIGINAL (Red)

TABLE 2.3. CALIBRATION CHECK COMPOUNDS

Base/Neutral Fraction	Acid Fraction
Acenaphthene	4-Chloro-3-Methylphenol
1,4-Dichlorobenzene	2,4-Dichlorophenol
Hexachlorobutadiene	2-Nitrophenol
N-Nitroso-di-n-phenylamine	Phenol
Di-n-octylphthalate	Pentachlorophenol
Fluoranthene	2,4,6-Trichlorophenol
Benzo(a)pyrene	

2.6.3 Concentration Levels for Continuing Calibration Check

The USEPA plans to evaluate the long term stability of response factors during this program. Standardization among contract laboratories is necessary to reach these long term goals. Along with contract specified concentrations for initial calibration, the USEPA is requiring specific concentrations for each continuing calibration standard(s).

2.6.3.1 The concentration for each semivolatile TCL compound in the continuing calibration standard(s) is 50 total nanograms for all compounds.

2.7 Documentation

The contractor shall complete and submit a Form VII for each GC/MS system utilized for each twelve hour time period. Calculate and report the relative response factor and percent difference (%D) for all compounds. Ensure that the minimum RRF for semivolatile SPCC's is 0.050. The percent difference (%D) for each CCC compound must be less than or equal to 25.0 percent. Additional instructions for completing Form VII are found in Exhibit B, Section III.

PART 3 - METHOD BLANK ANALYSIS

3. Summary

A method blank is a volume of deionized, distilled laboratory water for water samples, or a purified solid matrix for soil/sediment samples, carried through the entire analytical scheme (extraction, concentration, and analysis). For soil/sediment samples, a solid matrix suitable for semivolatile analyses is available from EMSL/LV. The method blank volume or weight must be approximately equal to the sample volumes or sample weights being processed.

3.1 Method blank analysis must be performed at the following frequency.

AR300406

5.5 Documentation

The matrix spike (MS) results (concentrations) for nonspiked volatile TCL compounds shall be reported on Form I (Organic Analysis Data Sheet) and the matrix spike percent recoveries shall be summarized on Form III (MS/MSD Recovery). These values will be used by EPA to periodically update existing performance based QC recovery limits (Table 5.2).

The results for nonspiked volatile TCL compounds in the matrix spike duplicate (MSD) analysis shall be reported on Form I (Organic Analysis Data Sheet) and the percent recovery and the relative percent difference shall be summarized on Form III (MS/MSD Recovery). The RPD data will be used by EPA to evaluate the long term precision of the analytical method. Detailed instructions for the completion of Form III are in Exhibit B, Section III.

TABLE 5.2. MATRIX SPIKE RECOVERY LIMITS

Fraction	Matrix Spike Compound	Water	Soil/Sediment
VOA	1,1-Dichloroethene	61-145	59-172
VOA	Trichlorethene	71-120	62-137
VOA	Chlorobenzene	75-130	60-133
VOA	Toluene	76-125	59-139
VOA	Benzene	76-127	66-142

PART 6 - SAMPLE ANALYSIS

6. Summary

The intent of Part 6 is to provide the Contractor with a brief summary of ongoing QC activities involved with sample analysis. Specific references are provided to help the Contractor meet specific reporting and deliverables requirements of this contract.

6.1 Sample Analysis

Samples can be analyzed upon successful completion of the initial QC activities. When twelve (12) hours have elapsed since the initial tune was completed, it is necessary to conduct an instrument tune and calibration check analysis (described in Part 2 of this Section). Any major system maintenance, such as a source cleaning or installation of a new column, may necessitate a retune and recalibration irrespective of the twelve-hour requirement (see Initial Calibration, Part 2). Minor maintenance should necessitate only the calibration verification (Continuing Calibration, Part 2)

6.1.1 Internal Standards Evaluation - Internal standard responses and retention times in all samples must be evaluated immediately after or during data acquisition. If the retention time for any internal

ORIGINAL (Red)

TABLE 5.2. MATRIX SPIKE RECOVERY LIMITS

Fraction	Matrix Spike Compound	Water	Soil/Sediment
BN	1,2,4-Trichlorobenzene	39-98	38-107
BN	Acenaphthene	46-118	31-137
BN	2,4-Dinitrotoluene	24-96	28-89
BN	Pyrene	26-127	35-142
BN	N-Nitroso-Di-n-Propylamine	41-116	41-126
BN	1,4-Dichlorobenzene	36-97	28-104
Acid	Pentachlorophenol	9-103	17-109
Acid	Phenol	12-89	26-90
Acid	2-Chlorophenol	27-123	25-102
Acid	4-Chloro-3-Methylphenol	23-97	26-103
Acid	4-Nitrophenol	10-80	11-114

PART 6 - SAMPLE ANALYSIS

6. Summary

The intent of Part 6 is to provide the Contractor with a brief summary of ongoing QC activities involved with sample analysis. Specific references are provided to help the Contractor meet specific reporting and deliverables requirements of this contract.

6.1 Sample Analysis

Samples can be analyzed upon successful completion of the initial QC activities. When twelve (12) hours have elapsed since the initial tune was completed, it is necessary to conduct an instrument tune and calibration check analysis (described in Part 2 of this Section). Any major system maintenance, such as a source cleaning or installation of a new column, may necessitate a retune and recalibration (see Initial Calibration, Part 2). Minor maintenance should necessitate only the calibration verification (Continuing Calibration, Part 2).

6.1.1 Internal Standards Evaluation - Internal standard responses and retention times in all samples must be evaluated immediately after or during data acquisition. If the retention time for any internal standard changes by more than 30 seconds, the chromatographic system must be inspected for malfunctions, and corrections made as required. The extracted ion current profile (EICP) of the internal standards must be monitored and evaluated for each sample, blank, matrix spike, and matrix spike duplicate. The criteria are described in detail in the instructions for Form VIII, Internal Standard Area Summary (see Exhibit B, Section III). If the extracted ion current profile (EICP) area for an internal standard changes by more than a factor of two (-50% to

3.5 Documentation

The matrix spike (MS) results (concentrations) for nonspiked pesticide/PCB TCL compounds shall be reported on Form I (Organic Analysis Data Sheet) and the matrix spike percent recoveries shall be summarized on Form III (MS/MSD Recovery). These values will be used by EPA to periodically update existing performance based QC recovery limits (Table 5.2).

The results for nonspiked pesticide/PCB TCL compounds in the matrix spike duplicate (MSD) analysis shall be reported on Form I (Organic Analysis Data Sheet) and the percent recovery and the relative percent difference shall be summarized on Form III (MS/MSD Recovery). The RPD data will be used by EPA to evaluate the long term precision of the analytical method. Detailed instructions for the completion of Form III are in Exhibit B, Section III.

TABLE 5.2. MATRIX SPIKE RECOVERY LIMITS*

Fraction	Matrix Spike Compound	Water	Soil/Sediment
Pest.	Lindane	56-123	46-127
Pest.	Heptachlor	40-131	35-130
Pest.	Aldrin	40-120	34-132
Pest.	Dieldrin	52-126	31-134
Pest.	Endrin	56-121	42-139
Pest.	4,4'-DDT	38-127	23-134

* These limits are for advisory purposes only. They are not to be used to determine if a sample should be reanalyzed. When sufficient multi-lab data are available, standard limits will be calculated.

PART 4 - PESTICIDE QA/QC REQUIREMENTS

4. Summary

Part 4 summarizes ongong QC activities involved with pesticide/PCB analysis that were detailed in Parts 1, 2 and 3 of this Section, and describes the additional QA/QC procedures required during the analysis of pesticide/PCBs that are not covered in Parts 1, 2, and 3.

4.1 The Contractor must perform the following:

4.1.1 Method Blank analysis as per Part 1 of this Section.

ORIGINAL (Red)

TABLE 4.1. SURROGATE SPIKING COMPOUNDS

Compounds	Amount in Sample/Extract* (before any optional dilutions)		
	Fraction	Water	Low/Medium Soil
Toluene-d_8	VOA	50 ug	50 ug
4-Bromofluorobenzene	VOA	50 ug	50 ug
1,2-Dichloroethane-d_4	VOA	50 ug	50 ug

* At the time of injection.

4.2 Surrogate spike recovery must be evaluated by determining whether the concentration (measured as percent recovery) falls inside the contract required recovery limits listed in Table 4.2.

TABLE 4.2. CONTRACT REQUIRED SURROGATE SPIKE RECOVERY LIMITS.

Fraction	Surrogate Compound	Water	Low/Medium
VOA	Toluene-d_8	88-110	81-117
VOA	4-Bromofluorobenzene	86-115	74-121
VOA	1,2-Dichloroethane-d_4	76-114	70-121

4.3 Treatment of surrogate spike recovery information is according to paragraphs 4.3.1 through 4.3.2.

4.3.1 Method Blank Surrogate Spike Recovery

The laboratory must take the actions listed below if recovery of any one surrogate compound in the volatiles fraction of the method blank is outside of the required surrogate spike recovery limits.

4.3.1.1 Check calculations to ensure that there are no errors; c internal standard and surrogate spiking solutions for degradation, contamination, etc; also check instrument performance.

4.3.1.2 Reanalyze the blank or extract if steps in 4.3.1.1 fail to reveal the cause of the noncompliant surrogate re e

ORIGINAL (Red)

PART 4 - SURROGATE SPIKE (SS) ANALYSIS

4. Summary

Surrogate standard determinations are performed on all samples and blanks. All samples and blanks are fortified with surrogate spiking compounds before purging or extraction in order to monitor preparation and analysis of samples.

4.1 Each sample, matrix spike, matrix spike duplicate, and blank are spiked with surrogate compounds prior to extraction. The surrogate spiking compounds shown in Table 4.1 are used to fortify each sample, matrix spike, matrix spike duplicate, and blank with the proper concentrations. Performance based criteria are generated from laboratory results. Therefore, deviations from the spiking protocol will not be permitted.

TABLE 4.1. SURROGATE SPIKING COMPOUNDS

Compounds	Fraction	Amount in Sample Extract* (before any optional dilutions) Water	Low/Medium Soil
Nitrobenzene-d_5	BNA	50 ug	50 ug
2-Fluorobiphenyl	BNA	50 ug	50 ug
p-Terphenyl-d_{14}	BNA	50 ug	50 ug
Phenol-d_5	BNA	100 ug	100 ug
2-Fluorophenol	BNA	100 ug	100 ug
2,4,6-Tribromophenol	BNA	100 ug	100 ug

* At the time of injection.

4.2 Surrogate spike recovery must be evaluated by determining whether the concentration (measured as percent recovery) falls inside the contract required recovery limits listed in Table 4.2.

TABLE 4.2. CONTRACT REQUIRED SURROGATE SPIKE RECOVERY LIMITS

Fraction	Surrogate Compound	Water	Low/Medium Soil
BNA	Nitrobenzene-d_5	35-114	23-120
BNA	2-Fluorobiphenyl	43-116	30-115
BNA	p-Terphenyl-d_{14}	33-141	18-137
BNA	Phenol-d_5	10-94	24-113
BNA	2-Fluorophenol	21-100	25-121
BNA	2,4,6-Tribromophenol	10-123	19-122

ORIGINAL (Red)

2.2 Surrogate spike recovery must be evaluated by determining whether the concentration (measured as percent recovery) falls inside the advisory recovery limits listed in Table 4.2.

TABLE 4.2. ADVISORY SURROGATE SPIKE RECOVERY LIMITS

Fraction	Surrogate Compound	Water	Low/Medium Soil/Sediment
Pest.	Dibutylchlorendate	(24-154)*	(20-150)*

* These limits are for advisory purposes only. They are not used to determine if a sample should be reanalyzed. When sufficient data becomes available, the USEPA may set performance based contract required windows.

2.3 Documentation

The contractor shall report surrogate recovery data for the following:

- o Method Blank Analysis
- o Sample Analysis
- o Matrix Spike/Matrix Spike Duplicate Analyses

The surrogate spike recovery data is summarized on the Surrogate Spike Percent Recovery Summary (Form II). Detailed instructions for the completion of Form II are in Exhibit B, Section III.

PART 3 - MATRIX SPIKE/MATRIX SPIKE DUPLICATE ANALYSIS (MS/MSD)

3. Summary

In order to evaluate the matrix effect of the sample upon the analytical methodology, the USEPA has developed the standard mixes listed in Table 5.1 to be used for matrix spike and matrix spike duplicate analyses. These compounds are subject to change depending upon availability and suitability for use as matrix spikes.

3.1 MS/MSD Frequency of Analysis

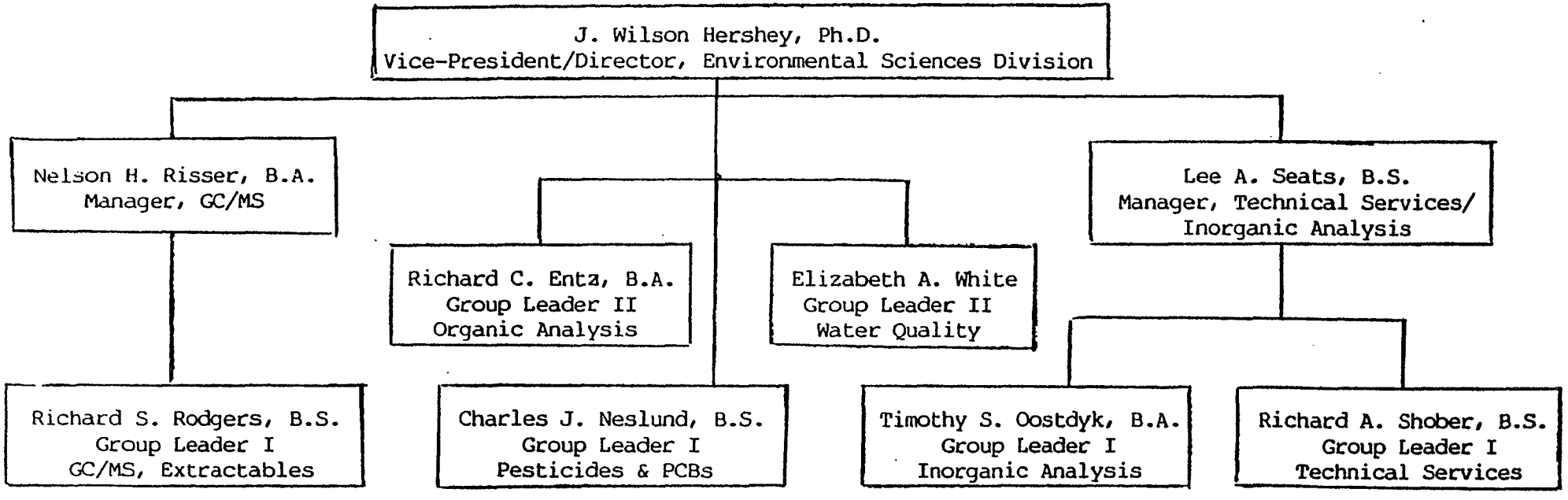
A matrix spike and matrix spike duplicate must be performed for each group of samples of a similar matrix, once:

- o each Case of field samples received, OR
- o each 20 field samples in a Case, OR
- o each group of samples of a similar concentration level (soils only), OR
- o each 14 calendar day period during which samples in a Case were received (said period beginning with the receipt of the first sample in that Sample Delivery Group),

whichever is most frequent.

EXHIBIT VIII

LANCASTER LABORATORIES, INC.
ENVIRONMENTAL SCIENCES DIVISION



AR300413

ORIGINAL (Red)

ORIGINAL (Red)

RESUMES

of

KEY PEOPLE

J. Wilson Hershey, Ph.D., Vice President/Director, Environmental Sciences Division

Education:

B.A. Chemistry, Millersville State College (1972)
M.S. Chemistry, Villanova University (1983)
Ph.D. Analytical Chemistry, Villanova University (1985)

Continuing Education:

Attended numerous technical meetings and seminars primarily in the field of instrumental analysis, including short courses in gas chromatography and atomic spectroscopy.
Carlisle-Hart Management Development Program (1984)

Professional Experience:

With Lancaster Laboratories, Inc. since 1972
Vice President/Director of Environmental Division (1987)

Publications:

Four scientific publications in analytical chemistry

Awards and Citations:

Outstanding Senior Chemistry Major Award - Millersville State College

Memberships and Appointments:

American Chemical Society
Delaware Valley Chromatography Forum

AR300414

M. Louise Hess, B.S., Director, Quality Assurance

ORIGINAL (Red)

Education:

B.S. Chemistry (cum laude), Lebanon Valley College (1978)

Continuing Education:

Several short courses in atomic absorption and gas chromatography
Women in Management, Carlisle-Hart Associates (1984)
Carlisle-Hart Management Development Program (1984)
Quality Assurance of Chemical Measurements, ACS (1985)
Quality Assurance in Microbiology, AOAC (1985)
Villanova University graduate work in analytical chemistry (1986)

Professional Experience:

With Lancaster Laboratories, Inc. since 1978
Director, Quality Assurance (1985)

Publications:

Two scientific papers on basic research in physical chemistry

Memberships and Appointments:

Society of Quality Assurance

Nelson H. Risser, B.A., Manager, GC/MS
Environmental Sciences Division

Education:

B.A. Chemistry, Shippensburg State College (1977)

Continuing Education:

Delaware Valley Chromatography Forum Capillary GC (1981)
Dionex Ion Chromatography (1983)
Finnigan MAT 1020/OWA Operation (1983)
Finnigan MAT 1020/OWA Maintenance (1983)
Finnigan MAT Mass Spectra Interpretation and GC/MS (1984)
Carlisle-Hart Management Development Program (1984)
Finnigan MAT OWA/1050 Software (1986)
Hewlett Packard 5988/5966/5970 RTE Operator's Training Course (1987)

Professional Experience:

Frederick Cancer Center, Frederick MD, Analytical Chemist (1977 - 1979)
With Lancaster Laboratories, Inc. since 1979
Manager (1987), Project Manager, U.S. EPA Contract Laboratory Program

Current Specialty:

GC/MS (4.5 years experience)

Assigned Duties for CLP:

Project Manager
VOA GC/MS Laboratory Supervisor
GC/MS Spectral Interpretation Expert

ORIGINAL (Red)

Publications:

Four scientific papers on chemical analysis of carcinogens

Memberships and Appointments:

The Chromatography Forum of the Delaware Valley
American Society for Mass Spectrometry

Richard S. Rodgers, B.S., Group Leader, GC/MS Extractables
Environmental Sciences Division

Education:

B.S. Chemistry, Millersville University (1975)

Continuing Education:

Perkin-Elmer Atomic Absorption Workshop (1977)
5985 Gas Chromatograph/Mass Spectrometer Users (1980)
Analytical Methods for Priority Pollutants (1981)
Symposium on Advances in Analytical Methods for Monitoring Organic Chemicals in the Environment - Water and Hazardous Wastes (1984)
GC/MS System Manager Training Course - User 1 (1986)
Interpretation of Mass Spectra - Short Course (1987)

Professional Experience:

Millersville State College, Department of Chemistry
Laboratory Assistant (1971 - 1972)
Chemistry Technician (1972 - 1975)
Ichthyological Associates, Inc., Analytical Chemist (1975 - 1977)
Radiation Management Corporation
GC/MS Operator, Manager (1978 - 1985)
With Lancaster Laboratories, Inc. since 1985
Group Leader (1987)

Current Specialty:

GC/MS (6 years experience)

Assigned Duties for CLP:

Extractables GC/MS Laboratory Supervisor
Sample Preparation Laboratory Supervisor
GC/MS Spectral Interpretation Expert

AR300416

Memberships and Appointments:

The Chromatography Forum of the Delaware Valley
American Chemical Society

ORIGINAL (Red)

Charles R. Bourque, B.A., Chemist I, GC/MS Extractables
Environmental Sciences Division

Education:

B.A. Chemistry and Mathematics, University of Maine at Farmington (1981)

Continuing Education:

GC Principles and Operation, Perkin Elmer Corp., Norwalk, CT (1983)
GC/MS Operations, Hewlett Packard, Inc., Rockford, IL (1984)

Professional Experience:

Planning Research Corp., Analytical Chemist (1981 - 1982)
E.C. Jordan Co., Environmental Laboratory, GC/MS Specialist (1983 - 1986)
With Lancaster Laboratories, Inc. since 1986
Chemist I, GC/MS Extractables (1987)

Current Specialty:

GC/MS (3 years experience)

Assigned Duties for CLP:

GC/MS Operator
GC/MS Spectral Interpretation Expert

Wanda J. Stoltzfus, B.A., Chemist II, GC/MS Volatiles
Environmental Sciences Division

Education:

B.A. Chemistry, Warren Wilson College (1982)

Continuing Education:

Entry-level Management Development Program (1985)

Professional Experience:

Warren Wilson College, Laboratory Assistant (1982)
With Lancaster Laboratories, Inc. since 1983
Chemist II (1987)

Current Specialty:

GC/MS (1.5 years)

AR300417

Assigned Duties for CLP:

GC/MS Operator

ORIGINAL (Red)

David A. Hoppman, Associate Chemist, GC/MS
Environmental Sciences Division

Current Specialty:

GC/MS (3 years)

Assigned Duties for CLP:

GC/MS Operator

Leslie Erb, B.A., Senior Technician II, GC/MS
Environmental Sciences Division

Education:

B.A. Biology, Eastern Mennonite College (1982)

Current Specialty:

GC/MS (1 year experience)

Assigned Duties for CLP:

GC/MS Operator

Charles J. Neslund, B.S., Group Leader, Pesticides and PCBs
Environmental Sciences Division

Education:

B.S. Chemistry, University of Pittsburgh (1982)
Organic Chemistry (1983)

Continuing Education:

Entry-level Management Development Program (1985)

Professional Experience:

Magee Women's Hospital, Pittsburgh, Laboratory Technician (1981 - 1984)
With Lancaster Laboratories, Inc. since 1984
Group Leader (1987)

Current Specialty:

Pesticide/PCB Analysis (3.5 years experience)

AR300418

Assigned Duties for CLP:

GC Laboratory Supervisor

ORIGINAL (Red)

Jenifer E. Hess, B.S., Chemist II/Coordinator, Organic Analysis
Environmental Sciences Division

Education:

B.S. Chemistry, University of Delaware (1984)

Continuing Education:

Entry-level Management Development Program (1987)

Professional Experience:

J. M. Huber Corporation, Research Chemist (1984 - 1985)
With Lancaster Laboratories, Inc. since 1985
Chemist II (1987)

Current Specialty:

Pesticide/PCB Analysis (2.5 years experience)

Assigned Duties for CLP:

Pesticide Sample Preparation Laboratory Supervisor
Pesticide Residue Analysis Expert

Memberships:

Chromatography Forum of Delaware Valley

Tamra Sprout, B.S., Chemist I, Pesticides and PCBs
Environmental Sciences Division

Education:

B.S. Chemistry (cum laude), Millersville University (1985)

Continuing Education:

Masters Chemistry Program at Villanova University

Professional Experience:

With Lancaster Laboratories, Inc. since 1985
Chemist I (1987)

AR300419

Current Specialty:

Pesticide/PCB Analysis

Assigned Duties for CLP:

Pesticide Residue Analysis Expert

Memberships and Appointments:

Delaware Chromatography Forum

Nancy Saunders, B.S., Associate Chemist, Pesticides and PCBs
Environmental Sciences Division

Education:

B.A. Chemistry, Syracuse University (1985)

Professional Experience:

Senior Lab Technician, Cayuga County Lab, Auburn, NY (1967 - 1985)
With Lancaster Laboratories, Inc. since 1986

Current Specialty:

Pesticides/PCB's (1 year experience)

Assigned Duties for CLP:

Pesticide Residue Analyst

Tara Spaide, Senior Technician II, GC/MS
Environmental Sciences Division

Assigned Duties for CLP:

Extraction/Concentration Expert - GC/MS (1.5 years experience)

Andrew Strebel, Senior Technician II, GC/MS
Environmental Sciences Division

Assigned Duties for CLP:

Extraction/Concentration Expert - GC/MS (1 year experience)

Denise Brooks, Senior Technician II, Pesticides and PCBs
Environmental Sciences Division

ORIGINAL (Red)

Assigned Duties for CLP:

Extraction/Concentration Expert - Pesticides/PCBs (6 years experience)

Deborah Nace, Senior Technician II, Pesticides and PCBs
Environmental Sciences Division

Assigned Duties for CLP:

Extraction/Concentration Expert - Pesticides/PCBs (1 year experience)

Susan Ely, Technician II, Pesticides and PCBs
Environmental Sciences Division

Assigned Duties for CLP:

Extraction/Concentration Expert - Pesticides/PCBs (1 year experience)

Jeanette Buller, B.A., Administrator I, Data Packages
Environmental Sciences Division

Education:

B.A. Chemistry, Goshen College (1976)

Assigned Duties for CLP:

Sample Custodian (1 year experience)

Anneliese Hutchison, B.S., Data Package Coordinator, Data Packages
Environmental Sciences Division

Education:

B.S. Molecular and Cell Biology, Pennsylvania State University (1986)

Professional Experience:

With Lancaster Laboratories, Inc. since 1986
Data Package Coordinator (1987)

Current Specialty:

Data Package Preparation (1 year experience)

AR300421

Assigned Duties for CLP:

Document Control Officer

ORIGINAL (Red)

Timothy S. Oostdyk, B.A., Group Leader, Inorganic Analysis
Environmental Sciences Division

Education:

B.A. Chemistry (cum laude), Franklin and Marshall College (1985)

Continuing Education:

ICP Seminar (1985)
Entry-level Management Development Program (1986)

Professional Experience:

Nabisco Brands Technology Center, Technician (Summer 1983)
With Lancaster Laboratories, Inc. since 1985
Group Leader (1987)

Current Specialty:

AAS/ICP (2.5 years experience)

Assigned Duties for CLP:

Inorganic Analysis Laboratpry Supervisor
ICP Spectroscopist

Publications:

One scientific publication in analytical chemistry

Awards and Citations:

Phi Beta Kappa, cum laude, Franklin and Marshall College

Betsy S. Menefee, B.S., Chemist II/Coordinator, Inorganic Analysis, Second Shift Leader
Environmental Sciences Division

Education:

B.S. Chemistry, Salem College (Winston-Salem, NC) (1958)

Continuing Education:

Entry-level Management Development Program (1985)

Professional Experience:

Duke University, Research Assistant (1958 - 1959)
With Lancaster Laboratories, Inc. since 1979
Chemist II (1987)

Current Specialty:

AA (5 years experience)
ICP (1 year experience)

ORIGINAL (Red)

Assigned Duties for CLP:

ICP Spectroscopist
Atomic Absorption Operator

Publications:

Two scientific publications in analytical chemistry

Debora K. Gifford, B.S., Chemist I, Inorganic Analysis
Environmental Sciences Division

Education:

B.S. Health and Physical Education, Ursinus College (1977)

Continuing Education:

General, Organic and Analytical Chemistry Courses, Muhlenberg College (1979 - 1981)
Calculus Course, Villanova University (1983)
Physics I and II, Ursinus College (1985)

Professional Experience:

Eastern PA Health Care Foundation, Special Projects Coordinator (1978 - 1981)
BCM Lab, Technical Supervisor (instrumentation) (1981 - 1985)
With Lancaster Laboratories, Inc. since 1985
Chemist I (1987)

Current Specialty:

AA (4 years experience)
ICP (1 year experience)

Assigned Duties for CLP:

ICP Spectroscopist
Atomic Absorption Operator

Beatrice M. Joseph, B.S., Chemist I, Inorganic Analysis
Environmental Sciences Division

Education:

B.S. Chemistry, College of Pharmacy and Chemistry, Iraq (1953)

Continuing Education:

Three-day Training Course on Atomic Absorption Spectrometry

Professional Experience:

St. Joseph's Hospital, Research Institute, Laboratory Technician (1969 - 1976)
With Lancaster Laboratories, Inc. since 1976
Chemist I (1977)

Current Specialty:

ORIGINAL (Red)

AA (7 years experience)

Assigned Duties for CLP:

Atomic Absorption Operator

James K. Kushubar, Associate Chemist, Inorganic Analysis
Environmental Sciences Division

Professional Experience:

With Lancaster Laboratories, Inc. (1979 - 1985, 1986 - Present)
Technician 1979 - 1985
Senior Technician III 1986 - 1987
Associate Chemist 1987 - Present

Current Specialty:

AA (4 years experience)
ICP (2 years experience)

Assigned Duties for CLP:

ICP Spectroscopist
AA Operator

Jenifer Wenger-Mahoney, Technician II, Inorganic Analysis
Environmental Sciences Division

Assigned Duties for CLP:

AA Operator (7 months experience)

Max E. Snavely, B.S., Chemist I, Inorganic Analysis
Environmental Sciences Division

Education:

B.S., Chemistry, Lebanon Valley College (1977)

Donna Sackett, Associate Chemist, Inorganic Analysis
Environmental Sciences Division

ORIGINAL (Red)

Current Specialty:

AA (3 years experience)
ICP (6 months experience)

Assigned Duties for CLP:

ICP Operator
AA Operator

Robin Bingeman, Senior Technician II, Inorganic Analysis
Environmental Sciences Division

Assigned Duties for CLP:

Inorganic Sample Preparation Specialist (5 years experience)

Jackie Hostetter, Technician II, Inorganic Analysis
Environmental Sciences Division

Assigned Duties for CLP:

Inorganic Sample Preparation Specialist (1.5 years experience)

Minnie Wiker, Technician I, Inorganic Analysis
Environmental Sciences Division

Assigned Duties for CLP:

Inorganic Sample Preparation Specialist (1 year experience)

Lynn Knepper, Technician I, Inorganic Analysis
Environmental Sciences Division

Assigned Duties for CLP:

Inorganic Sample Preparation Specialist (1 year experience)

Doug Graham, Technician I, Inorganic Analysis
Environmental Sciences Division

Assigned Duties for CLP:

Inorganic Sample Preparation Specialist (6 months experience)

Professional Experience:

Sterling Drug, Inc., Quality Control Chemist (1977 - 1980)
Andrew S. McCreath & Sons, Inc., Analytical Chemist (1980 - 1987)
With Lancaster Laboratories, Inc. since 1987

Current Specialty:

AA (1 year experience)

ORIGINAL (Red)

Assigned Duties for CLP:

AA Operator

Cynthia Smith, B.S., Associate Chemist, Inorganic Analysis
Environmental Sciences Division

Education:

B.S. Chemistry, Shippensburg University (1987)

Professional Experience:

With Lancaster Laboratories, Inc. since 1987

Current Specialty:

AA Operator (9 months experience)

Assigned Duties for CLP:

AA Operator

Eric Cuba, B.S., Associate Chemist, Inorganic Analysis
Environmental Sciences Division

Education:

B.S. Chemistry, King's College (1985)

Professional Experience:

With Lancaster Laboratories, Inc. since 1986

Current Specialty:

AA/ICP (1 year experience)

Assigned Duties for CLP:

ICP Operator
AA Operator

Ramona Wendt, B.S., Chemist I/Coordinator, Inorganic Analysis
Environmental Sciences Division

Education:

B.S. Chemistry, Grove City College (1984)

Continuing Education:

Entry-level Management Development Course (1987)

Professional Experience:

With Lancaster Laboratories, Inc. since 1979
Chemist I (1987)

ORIGINAL (Red)

Terry Schuck, Associate Chemist, Inorganic Analysis
Environmental Sciences Division

Assigned Duties for CLP:

Classical Techniques Analyst (3 years experience)

Bryan Fern, Laboratory Technician II, Inorganic Analysis
Environmental Sciences Division

Assigned Duties for CLP:

Classical Techniques Analyst (6 months experience)

Exhibit IX

2A
WATER VOLATILE SURROGATE RECOVERY

ORIGINAL (Red)

Lab Name:_____ Contract:_____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

	EPA SAMPLE NO.	S1 (TOL) #	S2 (BFB) #	S3 (DCE) #	OTHER	TOT OUT
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

		QC LIMITS
S1 (TOL)	= Toluene-d8	(88-110)
S2 (BFB)	= Bromofluorobenzene	(86-115)
S3 (DCE)	= 1,2-Dichloroethane-d4	(76-114)

Column to be used to flag recovery values

* Values outside of contract required QC limits

D Surrogates diluted out

page __ of __

FORM II VOA-1

1/87 Rev.

2B
SOIL VOLATILE SURROGATE RECOVERY

Lab Name:_____ Contract:_____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Level:(low/med) _____

	EPA SAMPLE NO.	S1 (TOL) #	S2 (BFB) #	S3 (DCE) #	OTHER	TOT OUT
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

		QC LIMITS
S1 (TOL)	= Toluene-d8	(81-117)
S2 (BFB)	= Bromofluorobenzene	(74-121)
S3 (DCE)	= 1,2-Dichloroethane-d4	(70-121)

Column to be used to flag recovery values

* Values outside of contract required QC limits

D Surrogates diluted out

page __ of __

FORM II VOA-2

1/87 Rev

AR300429

2C

WATER SEMIVOLATILE SURROGATE RECOVERY

ORIGINAL (Red)

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

	EPA SAMPLE NO.	S1 (NBZ) #	S2 (FBP) #	S3 (TPH) #	S4 (PHL) #	S5 (2FP) #	S6 (TBP) #	OTHER	TOT OUT
01									
02									
03									
04									
05									
06									
07									
08									
09									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

		QC LIMITS
S1 (NBZ)	= Nitrobenzene-d5	(35-114)
S2 (FBP)	= 2-Fluorobiphenyl	(43-116)
S3 (TPH)	= Terphenyl-d14	(33-141)
S4 (PHL)	= Phenol-d6	(10-94)
S5 (2FP)	= 2-Fluorophenol	(21-100)
S6 (TBP)	= 2,4,6-Tribromophenol	(10-123)

Column to be used to flag recovery values
* Values outside of contract required QC limits
D Surrogates diluted out

2D

SOIL SEMIVOLATILE SURROGATE RECOVERY

ORIGINAL (red)

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Level: (low/med) _____

	EPA SAMPLE NO.	S1 (NBZ) #	S2 (FBP) #	S3 (TPH) #	S4 (PHL) #	S5 (2FP) #	S6 (TBP) #	OTHER	TOT OUT
01									
02									
03									
04									
05									
06									
07									
08									
09									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

		QC LIMITS
S1 (NBZ)	= Nitrobenzene-d5	(23-120)
S2 (FBP)	= 2-Fluorobiphenyl	(30-115)
S3 (TPH)	= Terphenyl-d14	(18-137)
S4 (PHL)	= Phenol-d6	(24-113)
S5 (2FP)	= 2-Fluorophenol	(25-121)
S6 (TBP)	= 2,4,6-Tribromophenol	(19-122)

Column to be used to flag recovery values
* Values outside of contract required QC limits
D Surrogates diluted out

Page __ of __

FORM II SV-2

1/87 Rev.

AR300431

2E
WATER PESTICIDE SURROGATE RECOVERY

ORIGINAL (red)

Lab Name:_____ Contract:_____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.:_____

	EPA SAMPLE NO.	S1 (DBC) #	OTHER
01			
02			
03			
04			
05			
06			
07			
08			
09			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

ADVISORY QC LIMITS (24-154)

S1 (DBC) = Dibutylchlorendate

Column used to flag recovery values

* Values outside of QC limits

D Surrogates diluted out

page __ of __

FORM II PEST-1 1/87 R

AR300432

2F

SOIL PESTICIDE SURROGATE RECOVERY

ORIGINAL (Red)

Lab Name:_____ Contract:_____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Level:(low/med)_____

	EPA SAMPLE NO.	S1 (DBC)#	OTHER
01			
02			
03			
04			
05			
06			
07			
08			
09			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

ADVISORY QC LIMITS (20-150)

S1 (DBC) = Dibutylchlorendate

Column to be used to flag recovery values

* Values outside of QC limits

D Surrogates diluted out

page __ of __

FORM II PEST-2

1/87 Rev.

AR300433

3A

WATER VOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name:_____ Contract:_____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix Spike - EPA Sample No.: _____

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENTRATION (ug/L)	MS CONCENTRATION (ug/L)	MS % REC #	QC LIMITS REC.
1,1-Dichloroethene					61-145
Trichloroethene					71-120
Benzene					76-127
Toluene					76-125
Chlorobenzene					75-130

COMPOUND	SPIKE ADDED (ug/L)	MSD CONCENTRATION (ug/L)	MSD % REC #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
1,1-Dichloroethene					14	61-145
Trichloroethene					14	71-120
Benzene					11	76-127
Toluene					13	76-125
Chlorobenzene					13	75-130

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD:_____ out of _____ outside limits
Spike Recovery:_____ out of _____ outside limits

COMMENTS: _____

3B

SOIL VOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name:_____ Contract:_____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix Spike - EPA Sample No.: _____ Level:(low/med) _____

COMPOUND	SPIKE ADDED (ug/Kg)	SAMPLE CONCENTRATION (ug/Kg)	MS CONCENTRATION (ug/Kg)	MS % REC #	QC LIMITS REC.
1,1-Dichloroethene					59-172
Trichloroethene					62-137
Benzene					66-142
Toluene					59-139
Chlorobenzene					60-133

COMPOUND	SPIKE ADDED (ug/Kg)	MSD CONCENTRATION (ug/Kg)	MSD % REC #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
1,1-Dichloroethene					22	59-172
Trichloroethene					24	62-137
Benzene					21	66-142
Toluene					21	59-139
Chlorobenzene					21	60-133

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD:_____ out of _____ outside limits
Spike Recovery:_____ out of _____ outside limits

COMMENTS: _____

3C

WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name:_____ Contract:_____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix Spike - EPA Sample No.: _____

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENTRATION (ug/L)	MS CONCENTRATION (ug/L)	MS % REC #	QC LIMITS REC.
Phenol					12- 89
2-Chlorophenol					27-123
1,4-Dichlorobenzene					36- 97
N-Nitroso-di-n-prop.(1)					41-116
1,2,4-Trichlorobenzene					39- 98
4-Chloro-3-methylphenol					23- 97
Acenaphthene					46-118
4-Nitrophenol					10- 80
2,4-Dinitrotoluene					24- 96
Pentachlorophenol					9-103
Pyrene					26-127

COMPOUND	SPIKE ADDED (ug/L)	MSD CONCENTRATION (ug/L)	MSD % REC #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
Phenol					42	12- 89
2-Chlorophenol					40	27-123
1,4-Dichlorobenzene					28	36- 97
N-Nitroso-di-n-prop.(1)					38	41-116
1,2,4-Trichlorobenzene					28	39- 98
4-Chloro-3-methylphenol					42	23- 97
Acenaphthene					31	46-118
4-Nitrophenol					50	10- 80
2,4-Dinitrotoluene					38	24- 96
Pentachlorophenol					50	9-103
Pyrene					31	26-127

(1) N-Nitroso-di-n-propylamine

Column to be used to flag recovery and RPD values with an asterisk
* Values outside of QC limits

RPD:_____ out of _____ outside limits
Spike Recovery:_____ out of _____ outside limits

COMMENTS: _____

3D

SOIL SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

ORIGINAL (Red)

Lab Name:_____ Contract:_____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix Spike - EPA Sample No.: _____ Level:(low/med) _____

COMPOUND	SPIKE ADDED (ug/Kg)	SAMPLE CONCENTRATION (ug/Kg)	MS CONCENTRATION (ug/Kg)	MS % REC #	QC LIMITS REC.
Phenol					26- 90
2-Chlorophenol					25-102
1,4-Dichlorobenzene					28-104
N-Nitroso-di-n-prop.(1)					41-126
1,2,4-Trichlorobenzene					38-107
4-Chloro-3-methylphenol					26-103
Acenaphthene					31-137
4-Nitrophenol					11-114
2,4-Dinitrotoluene					28- 89
Pentachlorophenol					17-109
Pyrene					35-142

COMPOUND	SPIKE ADDED (ug/Kg)	MSD CONCENTRATION (ug/Kg)	MSD % REC #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
Phenol					35	26- 90
2-Chlorophenol					50	25-102
1,4-Dichlorobenzene					27	28-104
N-Nitroso-di-n-prop.(1)					38	41-126
1,2,4-Trichlorobenzene					23	38-107
4-Chloro-3-methylphenol					33	26-103
Acenaphthene					19	31-137
4-Nitrophenol					50	11-114
2,4-Dinitrotoluene					47	28- 89
Pentachlorophenol					47	17-109
Pyrene					36	35-142

(1) N-Nitroso-di-n-propylamine

Column to be used to flag recovery and RPD values with an asterisk
* Values outside of QC limits

RPD:_____ out of _____ outside limits
Spike Recovery:_____ out of _____ outside limits

COMMENTS: _____

3E

WATER PESTICIDE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name:_____ Contract:_____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix Spike - EPA Sample No.: _____

ORIGINAL (Red)

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENTRATION (ug/L)	MS CONCENTRATION (ug/L)	MS % REC #	QC LIMITS REC.
gamma-BHC (Lindane)					56-123
Heptachlor					40-131
Aldrin					40-120
Dieldrin					52-126
Endrin					56-121
4,4'-DDT					38-127

COMPOUND	SPIKE ADDED (ug/L)	MSD CONCENTRATION (ug/L)	MSD % REC #	% RPD #	QC LIMITS RPD	QC LIMITS REC
gamma-BHC (Lindane)					15	56-123
Heptachlor					20	40-131
Aldrin					22	40-120
Dieldrin					18	52-126
Endrin					21	56-121
4,4'-DDT					27	38-127

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD:_____ out of _____ outside limits
Spike Recovery:_____ out of _____ outside limits

COMMENTS: _____

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3F

SOIL PESTICIDE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name:_____ Contract:_____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix Spike - EPA Sample No.: _____ Level:(low/med) _____

COMPOUND	SPIKE ADDED (ug/Kg)	SAMPLE CONCENTRATION (ug/Kg)	MS CONCENTRATION (ug/Kg)	MS % REC #	QC LIMIT REC.
gamma-BHC (Lindane)					46-12
Heptachlor					35-13
Aldrin					34-13
Dieldrin					31-13
Endrin					42-13
4,4'-DDT					23-13

COMPOUND	SPIKE ADDED (ug/Kg)	MSD CONCENTRATION (ug/Kg)	MSD % REC #	% RPD #	QC LIMITS RPD	QC LIMITS REC
gamma-BHC (Lindane)					50	46-1
Heptachlor					31	35-1
Aldrin					43	34-1
Dieldrin					38	31-1
Endrin					45	42-1
4,4'-DDT					50	23-1

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD:_____ out of _____ outside limits
Spike Recovery:_____ out of _____ outside limits

COMMENTS: _____

EXHIBIT X

VOLATILE ORGANIC ANALYSIS
EPA METHOD #624
MATRIX SPIKE PERFORMANCE DATA

ORIGINAL (Red)

Parameter	Trial 1	Trial 2	Trial 3	Trial 4	Avg. Value	Std. Dev.	Avg. % Rec
Benzene	19.9	19.3	19.3	19.3	19.4	0.25	97
Bromodichloromethane	17.9	17.1	16.7	18.1	17.4	0.66	87
Bromoform	14.9	14.5	15.2	14.4	14.7	0.37	74
Bromomethane	13.2	13.0	12.0	11.4	12.4	0.85	62
Carbon tetrachloride	20.2	19.5	19.1	20.3	19.7	0.57	99
Chlorobenzene	18.3	18.2	18.8	18.4	18.4	0.26	92
Chloroethane	14.3	14.6	13.2	12.6	13.6	0.94	68
2-Chloroethylvinyl ether	16.3	15.5	15.7	15.8	15.8	0.34	79
Chloroform	19.2	18.5	18.0	18.3	18.5	0.51	93
Chloromethane	13.7	14.4	8.47	10.5	11.7	2.7	59
Dibromochloromethane	16.5	16.2	16.8	16.3	16.4	0.26	82
1,1-Dichloroethane	19.0	17.8	17.1	17.4	17.8	0.83	89
1,2-Dichloroethane	20.5	20.0	19.4	19.2	19.7	0.59	99
1,1-Dichloroethene	18.8	18.1	17.2	17.3	17.8	0.75	89
trans-1,2-Dichloroethene	18.7	18.0	17.4	17.6	17.9	0.57	90
1,2-Dichloropropane	20.4	19.6	18.8	19.9	19.6	0.67	[illegible]
cis-1,3-Dichloropropene	15.6	14.8	14.3	14.1	14.7	0.67	74
trans-1,3-Dichloropropene	4.99	4.57	4.45	4.49	4.63	0.25	83
Ethyl benzene	18.1	17.4	17.7	16.9	17.5	0.51	88
Methylene chloride	19.4	18.6	18.0	18.0	18.5	0.66	93
1,1,2,2-Tetrachloroethane	17.8	17.3	18.4	18.1	17.9	0.62	90
Tetrachloroethene	19.8	19.2	19.0	18.5	19.1	0.54	96
Toluene	19.3	18.4	18.5	18.7	18.7	0.40	94
1,1,1-Trichloroethane	20.3	19.8	18.8	19.7	19.6	0.62	98
1,1,2-Trichloroethane	19.0	18.5	18.9	18.9	18.8	0.22	94
Trichloroethene	19.3	18.6	18.7	18.5	18.7	0.36	94
Trichlorofluoromethane	19.3	18.9	17.8	18.4	18.6	0.65	93
Vinyl chloride	13.0	12.8	11.0	10.9	11.9	1.13	60

The theoretical valves for all parameters are 20 ppb except for trans-1,3-dichloropropene which is 5.6 ppb.

This table was constructed to satisfy Section 8.2 of EPA 624, Fed. Reg. October 26, 1984.

Nelson H. Risser

BASE NEUTRAL AND ACID EXTRACTABLE ANALYSIS
EPA METHOD #625
MATRIX SPIKE PERFORMANCE DATA

Parameter	Trial 1	2	3	4	Avg. Value	Std. Dev.	Avg. % Rec
Acenaphthene	86.8	81.9	83.5	82.7	83.7	2.15	83
Acenaphthylene	82.1	78.4	81.6	81.1	80.8	1.65	81
Anthracene	82.6	73.3	73.5	72.3	75.4	4.81	75
Benzo(a)anthracene	80.	75.2	69.7	77.8	75.7	4.44	76
Benzo(b)fluoranthene	83.	74.5	86.2	76.4	80.0	5.50	80
Benzo(k)fluoranthene	87.2	81.5	87.5	87.4	85.9	2.94	86
Benzo(a)pyrene	92.	87.4	96.	91.5	91.7	3.52	92
Benzo(ghi)perylene	106.	103.	118.	113.	110.	6.69	110
Benzyl butyl phthalate	89.9	84.1	85.7	86.0	86.4	2.46	86
Bis(2-chloroethyl)ether	80.6	80.7	81.5	78.6	80.4	1.23	80
Bis(2-chloroethoxy)methane	99.3	95.5	97.6	94.6	96.8	2.11	97
Bis(2-chloroisopropyl)ether	88.7	81.0	85.7	82.8	84.6	3.38	85
Bis(2-ethylhexyl)phthalate	83.7	79.3	81.1	80.4	81.1	1.87	81
4-Bromophenyl phenyl ether	71.2	75.8	67.5	68.8	70.8	3.65	71
2-Chloronaphthalene	96.	90.4	93.5	93.5	93.3	2.29	93
4-Chlorophenyl phenyl ether	92.5	88.9	91.	83.7	89.0	3.84	89
Chrysene	76.9	72.0	75.4	73.2	74.4	2.19	74
Dibenzo(a,h)anthracene	80.5	74.6	95.9	88.	84.8	9.23	85
Di-n-butyl phthalate	78.6	72.1	73.5	73.	74.3	2.92	74
1,2-Dichlorobenzene	66.7	64.5	68.1	69.7	67.3	2.21	67
1,3-Dichlorobenzene	60.1	59.5	66.2	67.	63.2	3.95	63
1,4-Dichlorobenzene	61.2	59.9	74.4	75.2	67.7	8.25	68
3,3'-Dichlorobenzidine	87.3	85.8	81.1	87.3	85.4	2.94	85
Diethyl phthalate	74.8	70.3	70.9	68.3	71.1	2.72	71
Dimethyl phthalate	68.9	67.6	67.2	67.1	67.7	0.83	68
2,4-Dinitrotoluene	85.8	78.9	81.2	78.3	81.1	3.40	81
2,6-Dinitrotoluene	86.7	79.1	76.8	82.0	81.2	4.27	81
Di-n-octylphthalate	90.8	84.1	87.6	86.6	87.3	2.77	87
Fluoranthene	88.6	80.4	87.5	92.2	87.2	4.94	87

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BASE NEUTRAL AND ACID EXTRACTABLE ANALYSIS

EPA METHOD #625

MATRIX SPIKE PERFORMANCE DATA

(Continued)

ORIGINAL (Red)

Parameter	Trial 1	Trial 2	Trial 3	Trial 4	Avg. Value	Std. Dev.	Avg % Rec
Fluorene	84.9	78.8	78.9	79.1	80.4	2.99	80
Hexachlorobenzene	67.8	64.7	69.6	68.1	67.6	2.06	68
Hexachlorobutadiene	56.5	59.1	63.7	64.5	61.0	3.80	61
Hexachloroethane	57.0	57.5	63.5	63.0	60.3	3.48	60
Indeno(1,2,3-cd)pyrene	104.	94.5	116.	105.	105.	8.79	105
Isophorone	89.0	84.0	87.8	86.4	86.8	2.15	87
Naphthalene	81.9	78.1	82.9	81.4	81.1	2.08	81
Nitrobenzene	106.	100.	99.7	100.	101.	3.05	101
N-Nitrosodi-n-propylamine	98.4	92.8	97.0	98.0	96.6	2.57	97
Phenanthrene	109.	97.9	91.1	99.6	99.4	7.38	99
Pyrene	76.3	72.6	75.3	75.9	75.0	1.67	75
1,2,4-Trichlorobenzene	85.	81.3	91.5	90.8	87.2	4.87	[illegible]
4-Chloro-3-methylphenol	76.	78.	78.	86.	80.	4.43	80
2-Chlorophenol	79.	76.	34.	87.	82.	4.93	82
2,4-Dichlorophenol	83.	81.	85.	88.	84.	2.99	84
2,4-Dimethylphenol	39.	43.	33.	53.	42.	8.41	42
2,4-Dinitrophenol	86.	93.	92.	94.	91.	3.59	91
2-Methyl-4,6-dinitrophenol	87.	93.	91.	95.	92.	3.42	92
2-Nitrophenol	81.	82.	84.	89.	84.	3.56	84
4-Nitrophenol	44.	47.	50.	54.	49.	4.27	49
Pentachlorophenol	86.	92.	86.	90.	89.	3.00	89.
Phenol	36.	36.	39.	41.	38.	2.45	38.
2,4,6-Trichlorophenol	85.	87.	88.	91.	88.	2.50	88.

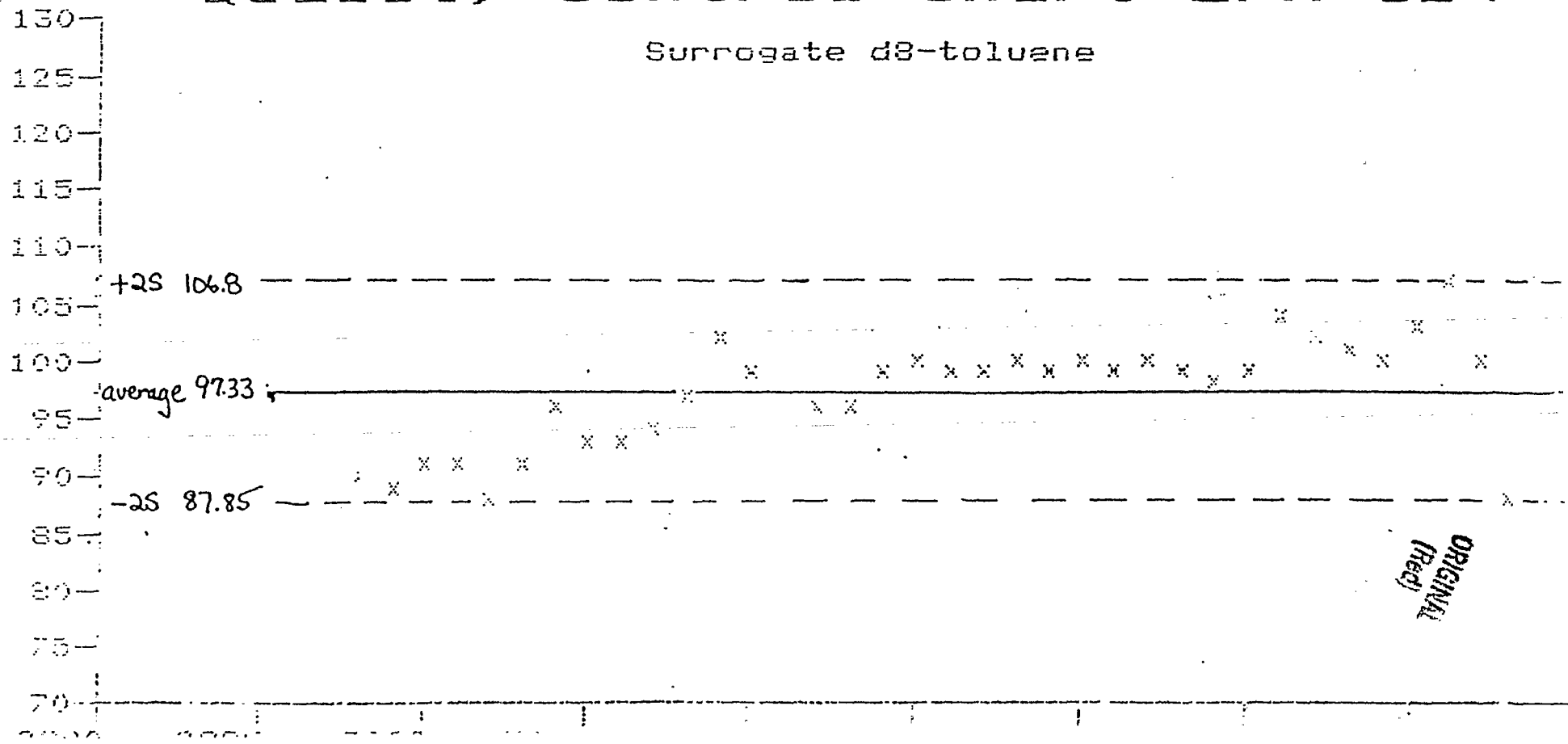
The theoretical values for all parameters are 100 ppb.

This table was constructed to satisfy Section 8.2 of EPA 625, Federal Register, October 26, 1984.

 Nelson H. Risser 8/9

Quality Control Chart EPA 624

Surrogate d8-toluene



ORIGINAL (Red)

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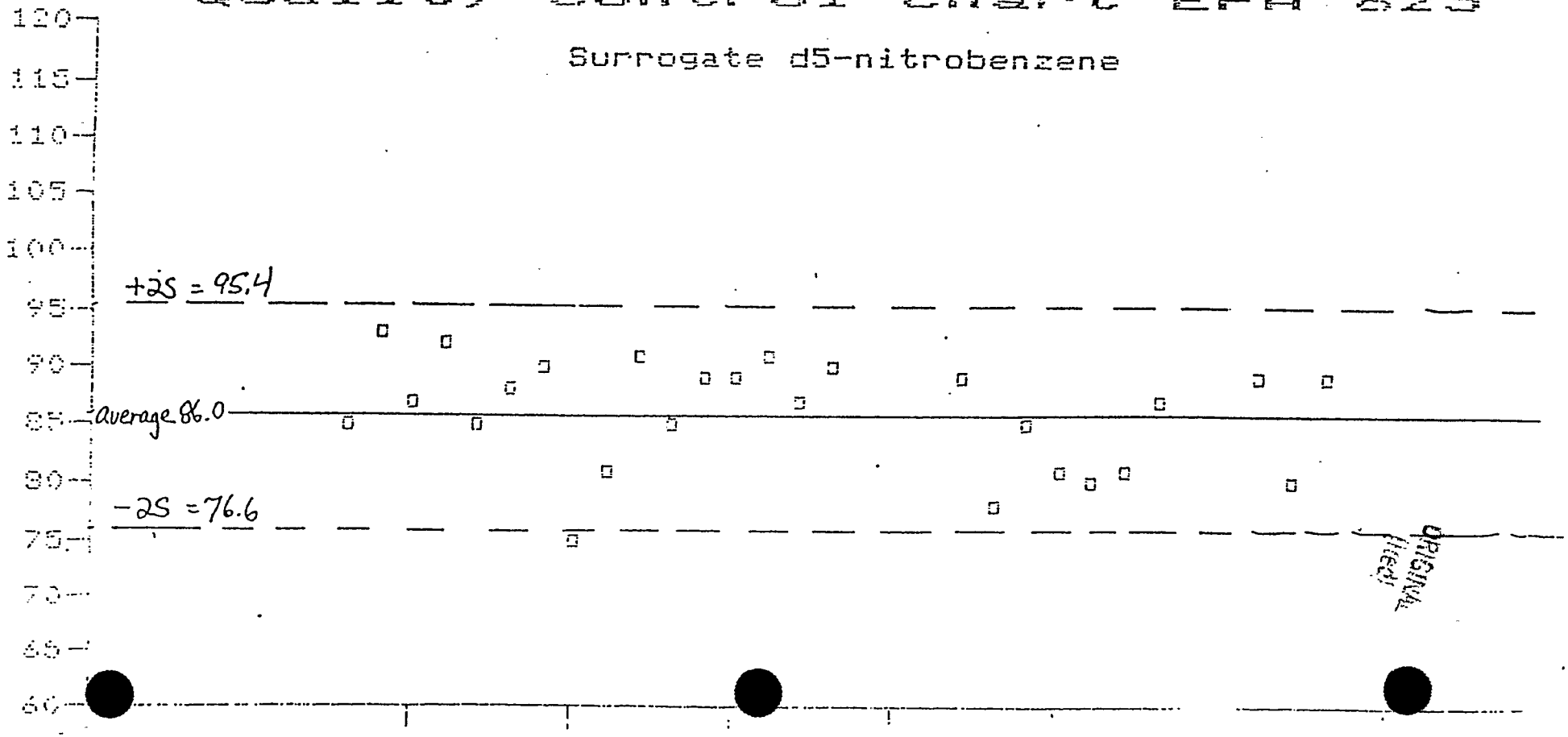
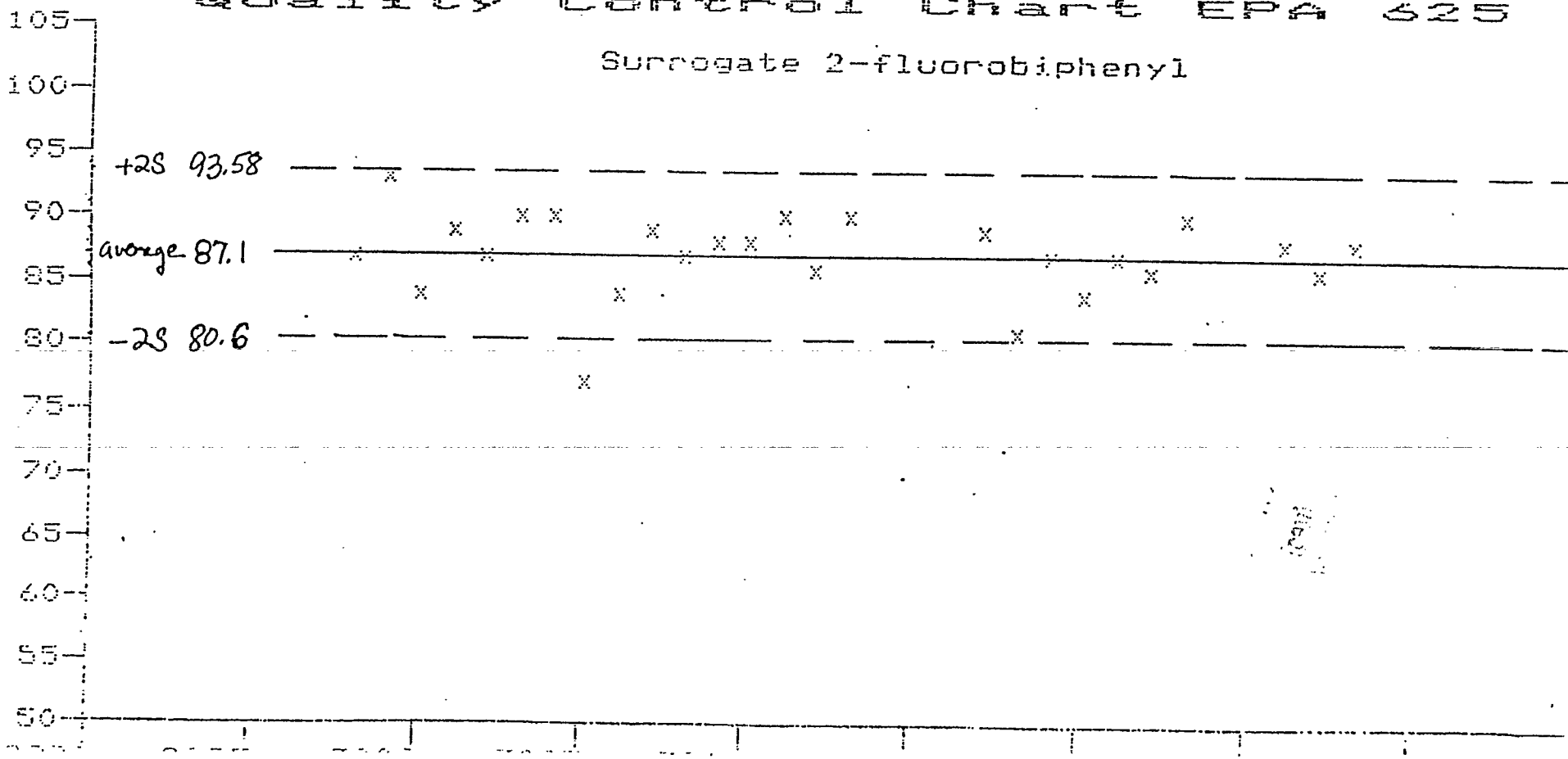

Quality Control Chart EPA 625
Surrogate d5-nitrobenzene
120
115
110
105
100
95
90
85
80
75
70
65
60
+2S = 95.4
average 86.0
-2S = 76.6
ORIGINAL (Red)

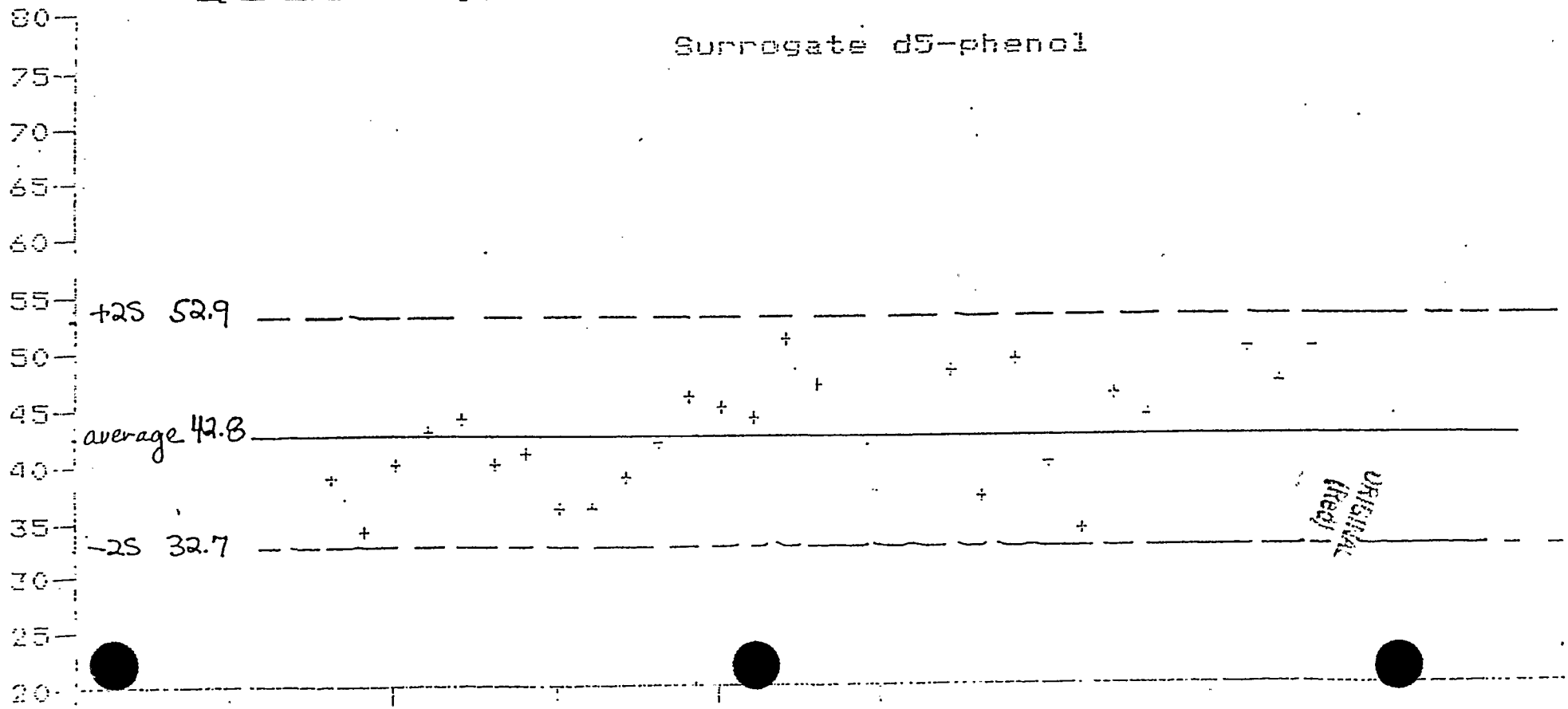
AR300445

C1

Quality Control Chart EPA 625

Surrogate 2-fluorobiphenyl




Quality Control Chart EPA 625
Surrogate d5-phenol
80
75
70
65
60
55
50
45
40
35
30
25
20
+2S 52.9
average 42.8
-2S 32.7
ORIGINAL (Red)

AR300447

Quality Control Chart EPA 625

Surrogate 2-fluorophenol

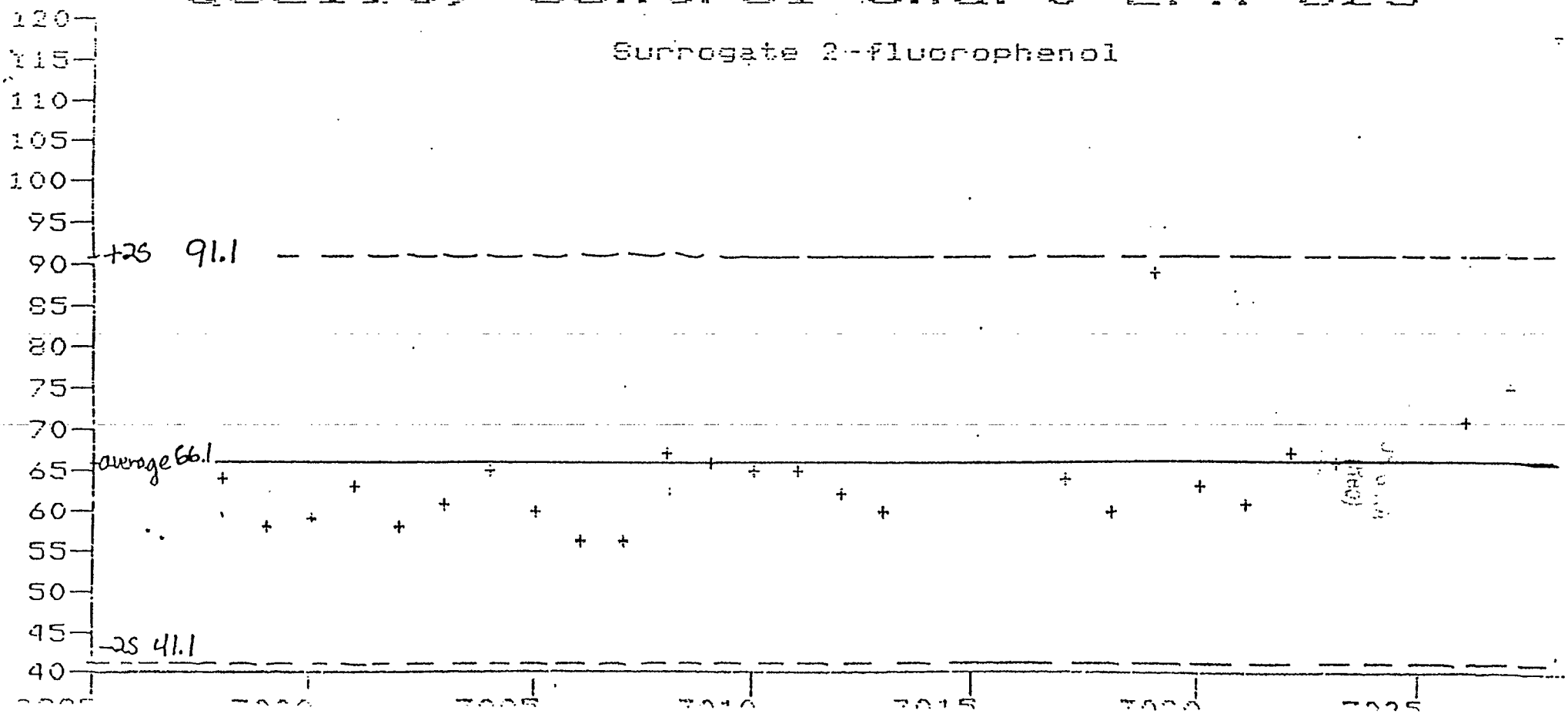


EXHIBIT XI

ORIGINAL (Red)

SOP FOR THE MAINTENANCE OF GAS CHROMATOGRAPH/MASS SPECTROMETER SYSTEMS

This SOP outlines both routine and non-routine maintenance procedures to be used in the GC/MS lab at Lancaster Laboratories, Inc. The Group Leader of GC/MS shall be responsible for the implementation of this SOP.

I. Instrumentation

This SOP shall apply to the following instrumentation.

1. Finnigan OWA/1020 GC/MS System Serial number 12777-0982 installed at LLI October, 1983.

2. Finnigan 1020 GC/MS System Serial number 13270-0784 installed at LLI August, 1984.

II. Routine Maintenance

Routine maintenance procedures are outlined in "Finnigan MAT 1000 Series GC/MS System Operator's Manual" in the Operator's Maintenance Section, page 4-1. More detailed information can be found in "OWA/1020 Series Organics in Water Analyzer/1000 Series GC/MS Service Manual".

The routine maintenance procedures when completed shall be entered onto the "GC/MS Routine Maintenance Log" sheet (Figure 1) by entering initials of person doing the work and the date on which it was completed. A signed entry including the date and a detailed description of the maintenance performed shall also be made in the Instrument Maintenance Log of the appropriate instrument.

Weekly Maintenance

The GC septum (teflon face silicon rubber) shall be changed at least once a week or whenever maintenance is performed on the GC inlet system.

[illegible] on the GC injector and/or GC column is indicated by not being able to met specifications for the tailing factor of benzidine and pentachlorophenol as specified in EPA Method #625. Another indication for injector maintenance is that poor peak shape (badly tailing peaks) are observed for the relatively active phenolic compounds, especially benzidine, 4-nitrophenol, and 2,4-dinitrophenol. The first step in cleaning the injector is to remove the glass liner from the injector and heating it in a muffle furnace at 500C for at least 3 hours or overnight. This oxidizes organics adsorbed onto the liner. After cooling, the liner is rinsed with toluene, soaked in Sylon CT for approximately 1 minute (Sylon/CT is a silylation reagent available from Supelco), rinsed with toluene, and finally rinsed in methanol to neutralize any residual Sylon CT reagent. This cleaned liner is then inserted into the GC capillary injector. If the chromatography remains poor after this procedure, perhaps the activity in the chromatographic system is in the GC column. Since the active sites are generally in the front section of the column, they can be removed by cutting off approximately 12-15 inches of the column head and discarding it. After assembly of the shortened column in the injector and the subsequent injection of a test compound (BN or Acid Standard), and the activity problem remains, the column can be solvent rinsed as per instructions that accompany the column when received from the column vendor. If solvent rinsing does not solve this activity problem, the column must be replaced.

In order to assure that the mechanical pump oil remains free of volatile compounds, the mechanical fore pumps shall be purged according to page 4-13 of the OWA/1020 Operations Manual once per week.

ORIGINAL (Red)

AR300449

Monthly Maintenance

ORIGINAL (Red)

Several filter and fan units are located on the GC/MS System. The filters must be checked once per month to be sure that they are not clogged or are restricting air flow across the electronic components the air is to cool. If the filters are dirty, they shall be cleaned by blowing compressed air in the opposite direction of normal air flow to dislodge dust particles. If the filter cannot be cleaned, it must be replaced. The filters to which this applies are located on the bottom of the card cage module and the filter inside the front grill on the disk drive. The heat exchanging radiator of the recirculating cooler used to cool the turbopump bearings must also be checked to be sure there are no obstructions to air exchange and flow. The fans in the card cage, the power module, and the computer must also be checked to be sure they are functioning normally.

Quarterly Maintenance

The mechanical rotary vane pump oil must be changed on a quarterly basis as outlined on page 4-13 or 1020 Operator's Manual. The oil used is Inland 15 Vacuum Pump Oil.

The absolute filter on the CMD disk drive shall be changed on a quarterly basis as outlined on pages 10-16 of the "Cartridge Module Disk Drive for Finnigan MAT Incos and 1000 Series Data Systems" in the options section of the 1020 Operator's Manual.

Bimonthly Maintenance

During the routine analysis of samples on the GC/MS system, the ion source becomes coated with neutralized compounds which prevents proper interaction of the various charged surfaces of the source with the charged analyte ions.

AR300450

Therefore, the ion source must be periodically disassembled, cleaned and re-assembled. Ion source cleaning is generally indicated by poor sensitivity and/or the inability to tune the source to EPA tuning criteria.

ORIGINAL (Red)

The ion source shall be cleaned at a minimum on a bimonthly basis or more often as instrument performance would dictate. Ion source cleaning is outlined in the Maintenance Section of the 1020 Operator's Manual on pages 4-6 to 4-12. After ion source cleaning and reassembly of the ion source and pumping down the system, the analyst shall check various parameters as indicated on the Post Maintenance Checklist in the 1020/OWA Operations Course Manual page 10-7.

Semi-Annual Maintenance

The turbo pump oil shall be changed on a semi-annual basis. Instructions of how to perform this are found in the "Pfeiffer Manual Operating Instructions - Turbo Molecular Pump TPH 330, TPH 510", page 28 for the OWA (Ser. #12777) turbo pump. The instructions for changing the bearing oil in the 1020 (Serial # 13270) turbo pump are found on page 25 of the "Pfeiffer Manual Operating Instructions - Turbo-Molecular Pump, TPH 170, TPU 170". The oil used in this procedure is Pfeiffer OiT12.

III. Non Routine Maintenance

Even with proper preventive maintenance performed on a routine basis, equipment failure is inevitable when working with GC/MS systems.

Although it is not possible to anticipate every sort of equipment failure, the following general approach should be used when encountering non-routine maintenance situations.

1. Check through the 1020/OWA Operator's Manual, Service Manual, and Reference Manual for troubleshooting helps that address the problem with which you are dealing. After studying the manuals, follow procedures described in an effort to solve the problem.

ORIGINAL (Red)

2. Technical help can also be obtained from Finnigan MAT Technical Support by calling either (800) 354-9731 (Cincinnati, OH) or (800) 327-1061 (San Jose, CA). If Technical Support cannot help you, a service call is necessary.

3. To schedule service, call (301) 948-3817 (Rockville, MD) and ask for "service". David Painter is currently (August, 1985) the service manager for this area.

4. In the event that replacement parts are indicated, these can be ordered from San Jose, CA, by calling the Finnigan MAT Parts Center at (408) 946-4848 with the Finnigan MAT part number, part description and a Lancaster Laboratories, Inc. P.O. Number. The parts generally can be obtained Federal Express next day service.

It is imperative that all service calls, maintenance and repairs be recorded in the appropriate instrument maintenance log. The log entry shall include the date, a detailed description of the action taken, and a full signature of the Lancaster Laboratories, Inc. personnel involved.

In the event that a GC/MS system is inoperable, the following persons shall be notified; GC/MS Group Leader, Organic Analysis Group Leader, Manager of Instrumental/ Environmental Chemistry, and the Manager of Sample Administration. This will allow for proper monitoring of the incoming workload and notification of possible turnaround time increases to prospective clients. When the instrument is again functioning properly, the same persons shall be notified.

GCMS ROUTINE MAINTENANCE LOG
for
FINNIGAN MODEL # _____
SERIAL # _____

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Record initials and actual date service was performed

Weekly

change gc septum										
purge vaccuum pumps										
change gc septum										
purge vaccuum pumps										
change gc septum										
purge vaccuum pumps										
change gc septum										
purge vaccuum pumps										

Monthly

clean card cage filter									
clean prefilter on CMD									
check fans in power mod, card cage and computer									
check coolflow radiator									

Bimonthly

clean source.					

Quarterly

change oil in vacuum pumps.				
change absolute filter in CMD.				

Semi-annually

change oil in turbopump		
replace card cage filter		

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Safety Precautions:

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound should be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available. The following parameters have tentatively been classified as known or suspected carcinogens: benzene, carbon tetrachloride, chloroform, 1,4-dichlorobenzene, and vinyl chloride.

Procedure:

A. Instrumental Set-up:

The GC/MS is maintained in a stand-by condition when it is not acquiring data. Generally, the computer remains powered up in the stand-by mode. Should the computer have to be turned on, it can be booted up by typing 11A 100160, carriage return, 11A, L. from the virtual console mode after the CMD disk drive is turned on. The terminal, scope, and printer must also be turned on. After booting up and the system is in the MSDS executive (>) the proper parameters are entered into the data system using SCAN, GC, SYST, and ACQU before data acquisition and data manipulation can be performed. Typical setting for these programs are in Figures 2 and 3. The electrometer should then be turned on for about 15 minutes by typing ON in MSDS and allow it to equilibrate. The electrometer can then be zeroed by entering >MTUN and manually adjusting EZ so that the proper amount of signal noise is observed. Figure 1 illustrates a proper zero setting using scan EZ to monitor noise of mass 403. Following the zeroing, mass calibration is accomplished by the CAH command. The cal gas override switch must be in the off position during the mass calibration and then turned on after CAH is completed. By using program SCAN, check to be sure the correct scan program is entered as indicated on Figure 2. The mass spectrometer is now ready to acquire data.

The GC is set for the volatile organic analysis by installing the 6 ft. x 1/8 in. glass column packed with 1% SP1000 on Carbopack B and setting the carrier flow to 30 cc/min. By using the MSDS program GC, the following parameters are entered: zone temp. = 175, initial temp. = 45, final temp. = 220, initial time = 2 min. temp. program = 10C/min., final time = 10 min., separator temp = 250, manifold temp = 80, inj. mode = packed, fil/mul mode: auto as indicated on Figure 2, GC descriptor.

The Tekmar LSC-2 Liquid Sample Concentrator is set-up manually by using the following conditions: purge pressure = 20 psi, purge flow = 40 ml/min., purge = 11, desorb = 04 x 1, bake = 07, SP1 = 30C, SP2 = 45C, SP3 = 45C, SP4 = 180C, SP5 = 210C, auto/step/hold = auto, desorb ready/desorb preheat = hold, bake = auto. The sorbent trap must be packed as described in reference 1.

To be sure the system is ready for data acquisition and that the heated zones are at proper temperatures, MSDS program SS should be run. Take note of the number of sectors remaining on the removable disk and be sure that adequate disk space is available. Disk space can also be checked using > STAT/D and in ACQU. If the disk is too full and must be changed, install old data disk, and prepare for use according to Appendix A.

Before acquisition of calibration standards or sample data, the mass spectrometer must be checked for proper tuning. This is done by analyzing an internal standard blank as described in Section D. Sample Analysis, which contains about 50 ppb of 4-bromofluorobenzene (BFB). The relative intensities of the observed ions for BFB must fall within the following ranges:

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Mass	Relative Abundance
50	15 - 40% mass 95
75	30 - 60% mass 95
95	base peak - 100%
96	5 - 9% mass 95
173	<2% mass 174
174	>50% mass 95
175	5 - 9% mass 174
176	>95% but <101% mass 174
177	5 - 9% mass 176

The relative intensities of the BFB spectrum can be viewed by running the procedure BFBCHECK or by manually obtaining a BFB spectrum in the CHRO program and using the L subcommand to obtain a mass listing at the apex of the BFB GC peak or to obtain an averaged or background corrected listing. To see if the BFB tuning intensity criteria listed above are satisfied, type B in the LIST program. If the BFB does not meet the criteria listed above, the source must be retuned in program MTUNE and the internal standard blank reacquired. This process is repeated until the BFB criteria are met. Some guidelines for tuning an OWA are given in Appendix B. The area of mass 128 of bromochloromethane of the internal standard blank must be >20,000 area counts to assure adequate sensitivity for all the analytes in this method.

B. Instrumental Calibration:

Individual stock standard solutions may be prepared for instrumental calibration from pure standard materials by pipeting approximately 0.5 g (± .0001 g) of each pure standard material listed in Table 1 into separate 10 ml volumetric flasks that contain about 9.8 ml of MeOH. The volumetric flask must be dry around the top stopper joint so that accurate weights can be obtained. After the weight of the standard material is known, fill flask to 10 ml mark. Acrolein,

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acrylonitrile, and 2-chloroethylvinylether are prepared as described below as a separate mix due to the relative instability of these compounds. After all the individual solutions are made, the concentration of each is calculated in the following manner: mg of analyte/0.010 l = mg/l or ppm of analyte in solution. A calculation of what volumes of these approximately 50,000 ppm primary stock solutions have to be combined and diluted to 50 ml to obtain a 1000 ppm secondary stock mix in methanol is then calculated:

(ppm of primary stock solution) (X ml) = (1000 ppm) (50 ml)

X ml = 50,000/ppm of primary stock.

The 1000 ppm secondary stock mixture is then sealed in 1 ml glass ampules by using a propane torch. Standard stocks of the Table 1 compounds prepared and sealed in ampules as described above have been successfully used up to 6 months after preparation. Each vial is labeled and stored in the freezer until it is needed.

The acrolein, acrylonitrile, and 2-chloroethylvinylether standard is prepared fresh weekly by weighing out 0.01 g ± .0001 g, which is about 1 drop of each compound in the same 10 ml volumetric flask containing about 9.8 ml methanol to yield a stock solution of approximately 1000 ppm when brought to volume with methanol. Typical volumes used in standard preparation are given in Table 5.

A volatile organic internal-surrogate standard stock mixture is made by weighing out in separate 10 ml volumetric flasks containing 9.8 ml of MeOH (as described above) 0.01 g (± 0.0001 g which is 1 drop) of bromochloromethane, d_4-1,2-dichloroethane, 1,4-difluorobenzene, $d_5$chlorobenzene, d_8-toluene, and 4-bromofluorobenzene (BFB). This will yield a

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primary stock of approximately 1,000 ppm for each compound. A working internal standard mixture is then made by pipeting a calculated volume of the primary internal standard stocks into 25 ml of methanol which results in a 25 ppm surrogate-internal standard working mix containing the six compounds. This mix is then sealed in glass ampules and a fresh vial is opened on a weekly basis or more frequently as needed. When 10 microliters of this working internal standard are spiked into 5 ml of sample, the resultant spike level will be 50 ppb for all compounds. An alternative source of this spiking solution is Supelco. (Catalog #4-8876, 4-8835).

After preparation of the standard solutions, the instrument is calibrated using the internal standard technique. The calibration standards are prepared immediately before use as they are generally not stable for over 1/2 hour in the volumetric flask with headspace. The volumes used in standard preparation are described in Table 5 to prepare the three levels of standards. It is important that the microliter volumes of stock solutions are spiked as far down into the bulbous portion of the flask with a fast, reproducible plunger stroke. After inverting the volumetric flask three or four times, fill a 5 ml syringe with standard and spike with 10 microliters of the working internal standard solution. Inject the 5 ml standard into the purge vessel and push the start button to start the purge flow for the 11 minute purge cycle.

At this point, the data system must be set-up to acquire data. This is done using the AC program as described in full in the 5100 Series Application Software Operators Manual, Scanning and Acquisition Section. Under the conditions of this method, 1000 scans of data must be collected. Files are named in accordance with the guidelines established in Appendix C.

When the purge cycle is complete, the acquisition is set-up on the data system, and the white ready light is illuminated on the GC, the data acquisition can be started by flipping the

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desorb ready/desorb preheat switch momentarily to auto and then return to the hold position. The data system then displays ACQU: If you desire to observe the real time data, type E which gets you to the >, then type MAP/C and display 1000 Scans (D1,1000). When 1000 scans of data have been acquired, the file is complete and can be processed using the AUTOQUAN software of the OWA. A full discussion of the AUTOQUAN program and the QUAN programs are found in the 5100 Applications Software Operator's Manual, Quantitation Section. Appendix D contains the actual procedure used to calibrate the system. The objective of using these programs is to create a 3 point calibration response list with a RSD <35% as described in Reference 1.

C. Sample Preparation:

There is no sample preparation step for the analysis of water.

For soil analysis, 20 g (± .01 g) is weighed out into a 40 ml glass teflon sealed screw top vial after which 20.0 ml of methanol is added. The soil-solvent is then shaken for 2 minutes. The soil is then allowed to settle and the methanolic extract is ready to be analyzed as described below.

D. Sample Analysis

For a water sample, 5 ml of water to be analyzed is poured gently into a 5 ml syringe with the barrel removed. The plunger is then put in place and the volume adjusted to 5.0 ml. Ten microliters of working internal standard are then spiked into the syringe and the contents of the syringe injected through the 3 way valve of the purge and trap into the purge vessel. The purge flow is started and the data acquired as described in the Instrumental Calibration Section.

EXHIBIT XIII

STANDARD OPERATING PROCEDURE
FOR CALIBRATION AND MAINTENANCE
INORGANIC ANALYSIS GROUP

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Protocol for the Operation and Maintenance of the Varian SpectrAA - 10

Before flame operation of the Varian SpectrAA - 10 commences, a back-up copy of the flame system disc should be made employing the procedure outlined in Section 9 of the Operation Manual, p. 97. This must only be done once, and the back-up copy stored for future use if necessary. Insertion and removal of the flame system disc should be carried out in accordance with section 2.6 of the Operation Manual, p. 15.

Ignition and extinguishing of the air/acetylene and N_2O/acetylene flame should be in accordance with the Operation Manual, Sections 3.17 and 3.18, pp. 33-36. Routine operation of the Varian SpectrAA - 10 is in accordance with Section 6 of the Operation Manual, pp. 59-62, using a duplicate of the flame system disc. The flame emission procedure is detailed in Section 6.6B of the Operation Manual, p. 67.

Generation of hard copy is accomplished by the use of a Citizen MSP-90 printer. The procedure for storing and printing data is contained in Sections 6, p. 59; and 6.12 through 6.13, pp. 70-72.

Methods routinely performed by the Varian SpectrAA - 10:

140	153	167	251	265	347
141	154	168	252	266	422
142	155	169	253	267	525
143	156	170	254	268	
144	157	172	255	269	
146	158	243	256	270	
147	160	244	257	271	
149	161	246	258	272	
150	162	247	260	283	
151	165	249	261		
152	166	250	262		

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Materials:

Materials required to perform routine analyses include Varian SpectrAA - 10, Citizen MSP-10 printer, DI water, Baker instra-analyzed acids, and standards prepared using stock solutions traceable to NBS or confirmed by either titrimetry or gravimetry. Instrumental conditions for each method may be found in the Varian Analytical Methods for Flame Spectroscopy Manual. Required conditions and materials are detailed in Sections 3.2 through 3.15, pages 17-33, of the Operation Manual.

Daily usage of the Varian SpectrAA - 10 is documented in the Curve Validation Data Notebook. (In addition, hard copy may be obtained as required by using the print screen option to print the instrument parameters and/or the optimization page(s).)

Calibration:

Materials required for calibration include standards, as required, and a blank. The calibration procedure is carried out in accordance with Sections 6.8, p. 68; 6.14, p. 72; and 6.15, p. 73, of the Operation Manual. Documentation of calibration is found in the Curve Validation Notebook. Calibration must include a blank and at least three standards (calibration with five standards is recommended). The instrument is calibrated each time a method is performed. Instrumental drift may be corrected as detailed in Section 6.14 of the Operation Manual.

Maintenance:

Maintenance logbooks will be kept in accordance with Standard Operating Procedure QA-7 found in the department

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operations manual. Non-routine maintenance is documented in the maintenance record. For maintenance procedures, consult Section 10 of the Operation Manual, pp. 99-104. Sections 14.2 - 14.3 of the Operation Manual detail operational status and error messages. For non-routine maintenance or equipment failures, consult the Varian SpectrAA - 10 Service Manual.

VARSPECT
IN-HOUSE SOPs #1

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EXHIBIT XIV

ATTACHMENT 3

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Method 200.7 CLP-M*
INDUCTIVELY COUPLED PLASMA-ATOMIC EMISSION SPECTROMETRIC METHOD
FOR TRACE ELEMENT ANALYSIS OF WATER AND WASTES

1. Scope and Application

1.1 Dissolved elements are determined in filtered and acidified samples. Appropriate steps must be taken in all analyses to ensure that potential interferences are taken into account. This is especially true when dissolved solids exceed 1500 mg/L. (See 5.)

1.2 Total elements are determined after appropriate digestion procedures are performed. Since digestion techniques increase the dissolved solids content of the samples, appropriate steps must be taken to correct for potential interference effects. (See 5.)

1.3 Table 1 lists elements along with recommended wavelengths and typica estimated instrumental detection limits using conventional pneumatic nebulization. Actual working detected limits are sample dependent and as the sample matrix varies, these concentrations may also vary. In time, other elements may be added as more information becomes available and as required.

1.4 Because of the differences between various makes and models of satisfactory instruments, no detailed instrumental operating instructions can be provided. Instead, the analyst is referred to the instructions provided by the manufacturer of the particular instrument.

2. Summary of Method

2.1 The method describes a technique for the simultaneous or sequential multielement determination of trace elements in solution. The basis of the method is the measurement of atomic emission by an optical spectroscopic technique. Samples are nebulized and the aerosol that is produced is transported to the plasma torch where excitatior occurs. Characteristic atomic-line emission spectra are produced by a radio-frequency inductively coupled plasma (ICP). The spectra are dispersed by a grating spectrometer and the intensities of the line are monitored by photomultiplier tubes. The photocurrents from the photomultiplier tubes are processed and controlled by a computer system. A background correction technique is required to compensate for variable background contribution to the determination of trace elements. Background must be measured adjacent to analyte lines on

*CLP-M Modified for the Contract Laboratory Program

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samples during analysis. The position selected for the background intensity measurement, on either or both sides of the analytical line, will be determined by the complexity of the spectrum adjacent to the analyte line. The position used must be free of spectral interference and reflect the same change in background intensity as occurs at the analyte wavelength measured. Background correction is not required in cases of line broadening where a background correction measurement would actually degrade the analytical result. The possibility of additional interferences named in 5.1 (and tests for their presence as described in 5.2) should also be recognized and appropriate corrections made.

3. Definitions

3.1 Dissolved — Those elements which will pass through a 0.45 um membrane filter.

3.2 Suspended — Those elements which are retained by a 0.45 µm membrane filter.

3.3 Total — The concentration determined on an unfiltered sample following vigorous digestion.

3.4 Instrumental detection limits — See Exhibit E, pages 2 - 4.

3.5 Sensitivity — The slope of the analytical curve, i.e. functional relationship between emission intensity and concentration.

3.6 Instrument check standard — A multielement standard of known concentrations prepared by the analyst to monitor and verify instrument performance on a daily basis. (See 7.6.1.)

3.7 Interference check sample — A solution containing both interfering and analyte elements of known concentration that can be used to verify background and interelement correction factors. (See 7.6.2.

3.8 Quality control sample — A solution obtained from an outside source having known concentration values to be used to verify the calibration standards. (See 7.6.3.)

3.9 Calibration standards — A series of known standard solutions used by the analyst for calibration of the instrument (i.e., preparation of the analytical curve). (See 7.4.)

3.10 Linear dynamic range — The concentration range over which the analytical curve remains linear as determined in Exhibit E.

3.11 Reagent blank — A volume of deionized, distilled water containing the same acid matrix as the calibration standards carried through the entire analytical scheme. (See 7.5.2.)

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3.12 Calibration blank — A volume of deionized, distilled water acidifi with HNO_3 and HCl. (See 7.5.1.)

3.13 Method of standard addition — The standard addition technique involves the use of the unknown and the unknown-plus-a-known amount of standard by adding known amounts of standard to one or more aliquots of the processed sample solution.

4. Safety

4.1 The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound should be treated as a potential health hazard. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of material handling data sheets should also be made available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available and have been identified (11.7, 11.8 and 11.9) for the information of the analyst.

5. Interferences

5.1 Several types of interference effects may contribute to inaccuracies in the determination of trace elements. They can be summarized as follows:

5.1.1 Spectral interferences can be categorized as 1) overlap of a spectral line from another element; 2) unresolved overlap of molecular band spectra; 3) background contribution from continuous or recombination phenomena; and 4) background contribution from stray light from the line emission of hig concentration elements. The first of these effects can be compensated by utilizing a computer correction of the raw data, requiring the monitoring and measurement of the inter fering element. The second effect may require selection of an alternate wavelength. The third and fourth effects can usually be compensated by a background correction adjacent to the analyte line. In addition, users of simultaneous multi-element instrumentation must assume the responsibilit of verifying the absence of spectral interference from an element that could occur in a sample but for which there is no channel in the instrument array. Listed in Table 2 are some interference effects for the recommended wavelengths given in Table 1. The data in Table 2 are intended for use only as a rudimentary guide for the indication of potential spectral interferences. For this purpose, linear relations between concentration and intensity for the analytes and th interferents can be assumed. The interference information, which was collected at the Ames Laboratory[1], is expressed a

[1]Ames Laboratory, USDOE, Iowa State University, Ames Iowa 50011

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analyte concentration equivalents (i.e. false analyte concentrations) arising from 100 mg/L of the interferent elemen The suggested use of this information is as follows: Assume that arsenic (at 193.696 nm) is to be determined in a sample containing approximately 10 mg/L of of aluminum. According to Table 2, 100 mg/L of aluminum would yield a false signal for arsenic equivalent to approximately 1.3 mg/L. Therefore, 10 mg/L of aluminum would result in a false signal for arseni equivalent to approximately 0.13 mg/L. The reader is caution that other analytical systems may exhibit somewhat different levels of interference than those shown in Table 2, and that the interference effects must be evaluated for each individua system. Only those interferents listed were investigated and the blank spaces in Table 2 indicate that measurable interferences were not observed from the interferent concentration listed in Table 3. Generally, interferences were discernible if they produced peaks or background shifts corresponding to 2-5% of the peaks generated by the analyte concentrations als listed in Table 3.

At present, information on the listed silver and potassium wavelengths are not available but it has been reported that second order energy from the magnesium 383.231 nm wavelength interferes with the listed potassium line at 766.491 nm.

5.1.2 Physical interferences are generally considered to be effects associated with the sample nebulization and transport processes. Such properties as change in viscosity and surface tension can cause significant inaccuracies especially in samples which may contain high dissolved solids and/or acid concentrations. The use of a peristaltic pump may lessen these interferences. If these types of interferences are operative, they must be reduced by dilution of the sample and/ or utilization of standard addition techniques. Another problem which can occur from high dissolved solids is salt buildup at the tip of the nebulizer. This affects aerosol flow rate causing instrumental drift. Wetting the argon prior to nebulization, the use of a tip washer, or sample dilution have been used to control this problem. Also, it has been reported that better control of the argon flow rate improves instrument performance. This is accomplished with the use of mass flow controllers.

5.1.3 Chemical interferences are characterized by molecular compound formation, ionization effects and solute vaporization effects. Normally these effects are not pronounced with the ICP technique, however, if observed they can be minimized by careful selection of operating conditions (that is, incident power, observation position, and so forth), by buffering of the sample, by matrix matching, and by standard addition procedures. These types of interferences can be highly dependent on matrix type and the specific analyte element.

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5.2 For each group of samples of a similar matrix type and concentration (i.e., low, medium) for each Case of samples, or for each 20 samples received, whichever is more frequent, the following tests must be performed prior to reporting concentration data for analyte elements.

5.2.1 Serial dilution — If the analyte concentration is sufficiently high (minimally a factor of 10 above the instrument detection limit after dilution), an analysis of a 1:4 dilutio must agree within 10 percent of the original determination. Serial dilution results must be reported on QC Report Form IX Samples identified as Field Blanks cannot be used for serial dilution analysis.

If the dilution analysis is not within 10%, a chemical or physical interference effect should be suspected, and the data must be flagged with an "E".

6. Apparatus

6.1 Inductively Coupled Plasma-Atomic Emission Spectrometer.

6.1.1 Computer controlled atomic emission spectrometer with background correction.

6.1.2 Radiofrequency generator.

6.1.3 Argon gas supply, welding grade or better.

6.2 Operating conditions — Because of the differences between various makes and models of satisfactory instruments, no detailed operating instructions can be provided. Instead, the analyst should follow the instructions provided by the manufacturer of the particular instrumen Sensitivity, instrumental detection limit, precision, linear dynamic range, and interference effects must be investigated and established for each individual analyte line on that particular instrument. All measurements must be within the instrument linear range where correction factors are valid. It is the responsibility of the analyst to verify that the instrument configuration and operating conditions used satisfy the analytical requirements and to maintain quality control data confirming instrument performance and analytical results.

7. Reagents and standards

7.1 Acids used in the preparation of standards and for sample processing must be ultra-high purity grade or equivalent. Redistilled acids are acceptable.

7.1.1 Acetic acid, conc. (sp gr 1.06).

7.1.2 Hydrochloric acid, conc. (sp gr 1.19).

7.1.3 Hydrochloric acid, (1+1): Add 500 mL conc. HCl (sp gr 1.19) to 400 mL deionized, distilled water and dilute to 1 liter.

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7.1.4 Nitric acid, conc. (sp gr 1.41).

7.1.5 Nitric acid, (1+1): Add 500 mL conc. HNO_3 (sp gr 1.41) to 400 mL deionized, distilled water and dilute to 1 liter.

7.2 Deionized, distilled water: Prepare by passing distilled water through a mixed bed of cation and anion exchange resins. Use deionized, distilled water for the preparation of all reagents, calibration standards and as dilution water. The purity of this water must be equivalent to ASTM Type II reagent water of Specification D 1193 (14.6).

7.3 Standard stock solutions may be purchased or prepared from ultra high purity grade chemicals or metals. All salts must be dried for 1 h at 105° unless otherwise specified.

(CAUTION: Many metal salts are extremely toxic and may be fatal if swallowed. Wash hands thoroughly after handling.) Typical stock solution preparation procedures follow:

7.3.1 Aluminum solution, stock, 1 mL = 100 ug Al: Dissolved 0.100 g of aluminum metal in an acid mixture of 4 mL of (1+1) HCl and 1 mL of conc. HNO_3 in a beaker. Warm gently to ef[illegible] solution. When solution is complete, transfer quantitat[illegible] to a liter flask, add an additional 10 mL of (1+1) HCl and dilute to 1000 mL with deionized, distilled water.

7.3.2 Antimony solution stock, 1 mL = 100 ug Sb: Dissolve 0.2669 g $K(SbO)C_4H_4O_6$ in deionized distilled water, add 10 mL (1+1) HCl and dilute to 1000 mL with deionized, distilled water.

7.3.3 Arsenic solution, stock, 1 mL = 100 ug As: Dissolve 0.1320 g of As_2O_3 in 100 mL of deionized, distilled water containin 0.4 g NaOH. Acidify the solution with 2 mL conc. HNO_3 and dilute to 1,000 mL with deionized, distilled water.

7.3.4 Barium solution, stock, 1 mL = 100 ug Ba: Dissolve 0.1516 g $BaCl_2$ (dried at 250°C for 2 hrs) in 10 mL deionized, distill[illegible] water with 1 mL (1+1) HCl. Add 10.0 mL (1+1) HCl and dilute to 1,000 mL with deionized, distilled water.

7.3.5 Beryllium solution, stock, 1 mL = 100 ug Be: Do not dry. Dissolve 1.966 g $BeSO_4 \cdot 4H_2O$, in deionized, distilled water, add 10.0 mL conc. HNO_3 and dilute to 1,000 mL with deionized distilled water.

7.3.6 Boron solution, stock, 1 mL = 100 ug B: Do not dry. Dis[illegible] 0.5716 g anhydrous H_3BO_3 in deionized, distilled water a[illegible] dilute to 1,000 mL. Use a reagent meeting ACS specification. keep the bottle tightly stoppered and store in a desiccator to prevent the entrance of atmospheric moisture.

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7.3.7 Cadmium solution, stock, 1 mL = 100 ug Cd: Dissolve 0.1142 g CdO in a minimum amount of (1+1) HNO_3. Heat to increase rate of dissolution. Add 10.0 mL conc. HNO_3 and dilute to 1,000 mL with deionized, distilled water.

7.3.8 Calcium solution, stock, 1 mL = 100 ug Ca: Suspend 0.2498 g $CaCO_3$ dried at 180°C for 1 h before weighing in deionized, distilled water and dissolve cautiously with a minimum amour of (1+1) HNO_3. Add 10.0 mL conc. HNO_3 and dilute to 1,000 r with deionized, distilled water.

7.3.9 Chromium solution, stock, 1 mL = 100 ug Cr: Dissolve 0.192: g of CrO_3 in deionized, distilled water. When solution is complete acidify with 10 mL conc. HNO_3 and dilute to 1,000 r with deionized, distilled water.

7.3.10 Cobalt solution stock, 1 mL = 10 ug Co: Dissolve 0.1000 g of cobalt metal in a minimum amount of (1+1) HNO_3. Add 10.(mL (1+1) HCl and dilute to 1,000 mL with deionized, distille water.

7.3.11 Copper solution, stock, 1 mL = 100 ug Cu: Dissolve 0.1252 g CuO in a minimum amount of (1+1) HNO_3. Add 10.0 mL conc. HNO_3 and dilute to 1,000 mL with deionized, distilled water

7.3.12 Iron solution, stock, 1 mL = 100 ug Fe: Dissolve 0.1430 g Fe_2O_3 in a warm mixture of 20 mL (1+1) HCl and 2 mL of conc. HNO_3. Cool, add an additional 5 mL of conc. HNO_3 and dilute to 1,000 mL with deionized, distilled water.

7.3.13 Lead solution, stock, 1 mL = 100 ug Pb: Dissolve 0.1599 g $Pb(NO_3)_2$ in a minimum amount of (1+1) HNO_3. Add 10.0 mL of conc. HNO_3 and dilute to 1,000 mL with deionized, distilled water.

7.3.14 Magnesium solution, stock, 1 mL = 100 ug Mg: Dissolve 0.16: g MgO in a minimum amount of (1+1) HNO_3. Add 10.0 mL conc. HNO_3 and dilute to 1,000 mL with deionized, distilled water.

7.3.15 Manganese solution, stock, 1 mL = 100 ug Mn: Dissolve 0.10(g of manganese metal in the acid mixture, 10 mL conc. HCl and 1 mL conc. HNO_3, and dilute to 1,000 mL with deionized, distilled water.

7.3.16 Molybdenum solution, stock, 1 mL = 100 ug Mo: Dissolve 0.2043 g $(NH_4)_2MoO_4$ in deionized, distilled water and dilute to 1,000 mL.

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7.3.17 Nickel solution, stock, 1 mL = 100 ug Ni: Dissolve 0.1000 g of nickel metal in 10 mL hot conc. HNO_3, cool and dilute to 1,000 mL with deionized, distilled water.

7.3.18 Potassium solution, stock, 1 mL = 100 ug K: Dissolve 0.1907 g KCl, dried at 110°C, in deionized, distilled water. Dilut to 1,000 mL.

7.3.19 Selenium solution, stock, 1 mL = 100 ug Se: Do not dry. Dissolve 0.1727 g H_2SeO_3 (actual assay 94.6%) in deionized, distilled water and dilute to 1,000 mL.

7.3.20 Silica solution, stock, 1 mL = 100 ug SiO_2: Do not dry. Dissolve 0.4730 g $Na_2SiO_3 \cdot 9H_2O$ in deionized, distilled water Add 10.0 mL conc. HNO_3 and dilute to 1,000 mL with deionized distilled water.

7.3.21 Silver solution, stock, 1 mL = 100 ug Ag: Dissolve 0.1575 g $AgNO_3$ in 100 mL of deionized, distilled water and 10 mL conc HNO_3. Dilute to 1,000 mL with deionized, distilled water.

7.3.22 Sodium solution, stock, 1 mL = 100 ug Na: Dissolve 0.2[illegible] g NaCl in deionized, distilled water. Add 10.0 mL conc. HNO_3 and dilute to 1,000 mL with deionized, distilled water.

7.3.23 Thallium solution, stock, 1 mL = 100 ug Tl: Dissolve 0.1303 g $TlNO_3$ in deionized, distilled water. Add 10.0 mL conc. HNO_3 and dilute to 1,000 mL with deionized, distilled water.

7.3.24 Vanadium solution, stock, 1 mL = 100 ug V: Dissolve 0.2297 NH_4VO_3 in a minimum amount of conc. HNO_3. Heat to increase rate of dissolution. Add 10.0 mL conc. HNO_3 and dilute to 1,000 mL with deionized, distilled water.

7.3.25 Zinc solution, stock, 1 mL = 100 ug Zn: Dissolve 0.1245 g ZnO in a minimum amount of dilute HNO_3. Add 10.0 mL conc. HNO_3 and dilute to 1,000 mL with deionized, distilled water.

7.4 Mixed calibration standard solutions — Prepare mixed calibration standard solutions by combining appropriate volumes of the stock solutions in volumetric flasks. (See 7.4.1 thru 7.4.5.) Add 2 mL of (1+1) HNO_3 and 10 mL of (1+1) HCl and dilute to 100 mL with deionized, distilled water. (See Notes 1 and 6.) Prior to preparing the mixed standards, each stock solution should be analyzed separately to determine possible spectral interference or the presence of impurities. Care should be taken when preparing t[illegible] mixed standards that the elements are compatible and stable. Transfer the mixed standard solutions to a FEP fluorocarbon or unused polyethylene bottle for storage. Fresh mixed standards should be prepared as needed with the realization that concentratio

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can change on aging. Calibration standards must be initially verified using a quality control sample and monitored weekly for stability (see 7.6.3). Although not specifically required, some typical calibration standard combinations follow when using those specific wavelengths listed in Table 1.

7.4.1 Mixed standard solution I — Manganese, beryllium, cadmiu lead, and zinc.

7.4.2 Mixed standard solution II — Barium, copper, iron, vanad and cobalt.

7.4.3 Mixed standard solution III — Molybdenum, silica, arsenic, and selenium.

7.4.4 Mixed standard solution IV — Calcium, sodium, potassium, aluminum, chromium and nickel.

7.4.5 Mixed standard solution V — Antimony, boron, magnesium, silver, and thallium.

NOTE 1: If the addition of silver to the recommende acid combination results in an initial precipitation add 15 mL of deionized distilled water and warm the flask until the solution clears. Cool and dilute to 100 mL with deionized, distilled water. For this acid combination the silver concentration should be limited to 2 mg/L. Silver under these conditions is stable in a tap water matrix for 30 days. Higher concentrations of silver require additional HCl.

7.5 Two types of blanks are required for the analysis. The calibrati blank (3.13) is used in establishing the analytical curve while t reagent blank (preparation blank, 3.12) is used to correct for possible contamination resulting from varying amounts of the acid used in the sample processing.

7.5.1 The calibration blank is prepared by diluting 2 mL of (1+ HNO_3 and 10 mL of (1+1) HCl to 100 mL with deionized, distilled water. (See Note 6.) Prepare a sufficient quantity to be used to flush the system between standards and samples.

7.5.2 The reagent blank (or preparation blank - See Exhibit E) must contain all the reagents and in the same volumes as used in the processing of the samples. The reagent blank must be carried through the complete procedure and contai the same acid concentration in the final solution as the sample solution used for analysis.

ORIGINAL (Red)

7.6 In addition the calibration standards, an instrument check standard (3.6), an interference check sample (3.7) and a quality control sample (3.8) are also required for the analyses.

7.6.1 The instrument check standard for continuing calibration verification is prepared by the analyst by combining compatible elements at a concentration equivalent to the midpoint of their respective calibration curves. (See 10.1.3.)

7.6.2 The interference check sample is prepared by the analyst, or obtained from EPA if available (Exhibit E).

7.6.3 The quality control sample for the initial calibration verification should be prepared in the same acid matrix as the calibration standards and in accordance with the instructions provided by the supplier. EPA will either supply a quality control sample or information where one of equal quality can be procured. (See 10.1.1.)

8. Procedure

8.1 Set up instrument with proper operating parameters established in Section 6.2. The instrument must be allowed to become thermally stable before beginning. This usually requires at least 30 min. of operation prior to calibration.

8.2 Initiate appropriate operating configuration of computer.

8.3 Profile and calibrate instrument according to instrument manufacturer's recommended procedures, using mixed calibration standard solutions such as those described in Section 7.4. Flush the system with the calibration blank (7.5.1) between each standard. (See NOTE 7.) (Use the average intensity of multiple exposures for both standardization and sample analysis to reduce random error.)

NOTE 7: For boron concentrations greater than 500 ug/L extended flush times of 1 to 2 minutes may be required.

8.4 Begin the sample run flushing the system with the calibration blank solution (7.5.1) between each sample. (See NOTE 7.) Analyze the instrument check standard (7.6.1) and the calibration blank (7.5.1) each 10 samples.

9. Calculation

9.1 Reagent blanks (preparation blanks) should be treated as specified in Exhibit E.

9.2 If dilutions were performed, the appropriate factor must be applied to sample values.

9.3 Data must be reported in ug/L.

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ORIGINAL (Red)

10. Quality Control (Instrumental)

10.1 Check the instrument standardization by analyzing appropriate quality control check standards as follows:

10.1.1 A quality control sample (7.6.3) must be used daily for the initial calibration verification (See Exhibit E). A fresh dilution of this sample shall be analyzed every week thereafter to monitor their stability. If the results are not within ±10% of the true value listed for the control sample, prepare a new calibration standard and recalibrate the instrument. If this does not correct the problem, prepare a new stock standard and a new calibration standard and repeat the calibration.

10.1.2 Analyze the calibration blank (7.5.1) at a frequency of 10%. The result should be within ± contract required detection levels (Exhibit C). If the result is not within the control level, terminate the analysis, correct the problem and recalibrate the instrument (See Exhibit E).

10.1.3 For continuing calibration verification, analyze an appropriate instrument check standard (7.6.1) containing the elements of interest at a frequency of 10%. This check standard is used to determine instrument drift. If agreement is not within ±10% of the expected values, the analysis is out of control. The analysis must be terminated, the problem corrected, the instrument recalibrated, and the preceding 10 samples reanalyzed (See Exhibit E).

10.1.4 To verify interelement and background correction factors analyze the ICP interference check sample (7.6.2) at the beginning, and end of the sample run or a minimum of twice per 8 hour work shift whichever is more frequent. The check sample must be analyzed initially at least 5 times repetitively to establish a mean value and standard deviation. Results must fall within the established control limits. If not, terminate the analysis, correct the problem, recalibrate the instrument, and reanalyze the samples (See Exhibit E).

11. Bibliography

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ORIGINAL (Red)

TABLE 1 - RECOMMENDED WAVELENGTHS(2) AND ESTIMATED INSTRUMENTAL DETECTION LIMITS

Element	Wavelength, nm(1)	Estimated Detection Limit, ug/L(2)
Aluminum	308.215	45
Antimony	206.833	32
Arsenic	193.696	53
Barium	455.403	2
Beryllium	313.042	0.3
Boron	249.773	5
Cadmium	226.502	4
Calcium	317.933	10
Chromium	267.716	7
Cobalt	228.616	7
Copper	324.754	6
Iron	259.940	7
Lead	220.353	42
Magnesium	279.079	30
Manganese	257.610	2
Molybdenum	202.030	8
Nickel	231.604	15
Potassium	766.491	see(3)
Selenium	196.026	75
Silica (SiO_2)	288.158	58
Silver	328.068	7
Sodium	588.995	29
Thallium	190.864	40
Vanadium	292.402	8
Zinc	213.856	2.

(1) The wavelengths listed are recommended because of their sensitivity and overall acceptance. Other wavelength may be substituted if they can provide the needed sensitivity and are treated with the same corrective techniques for spectral interference. (See 5.1.1). The use of alternate wavelengths must be reported (in nm) with the sample data.

(2) The estimated instrumental detection limits as shown are taken from "Inductively Coupled Plasma-Atomic Emission Spectroscopy-Prominent Lines EPA-600/4-79-017. They are given as a guide for an instrumental limit. The actual method detection limits are sample dependent and may vary as the sample matrix varies.

(3) Highly dependent on operating conditions and plasma position.

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TABLE 2. EXAMPLE OF ANALYTE CONCENTRATION EQUIVALENTS (mg/L) ARISING FROM INTERFERENTS AT THE 100 mg/L LEVEL

Analyte	Wavelength, nm	Interferent									
		Al	Ca	Cr	Cu	Fe	Mg	Mn	Ni	Ti	V
Aluminum	308.215	—	—	—	—	—	—	0.21	—	—	1.4
Antimony	206.833	0.47	—	2.9	—	0.08	—	—	—	.25	0.45
Arsenic	193.696	1.3	—	0.44	—	—	—	—	—	—	1.1
Barium	455.403	—	—	—	—	—	—	—	—	—	—
Beryllium	313.042	—	—	—	—	—	—	—	—	0.04	0.05
Boron	249.773	0.04	—	—	—	0.32	—	—	—	—	—
Cadmium	226.502	—	—	—	—	0.03	—	—	0.02	—	—
Calcium	317.933	—	—	0.08	—	0.01	0.01	0.04	—	0.03	0.03
Chromium	267.716	—	—	—	—	0.003	—	0.04	—	—	0.04
Cobalt	228.616	—	—	0.03	—	0.005	—	—	0.03	0.15	—
Copper	324.754	—	—	—	—	0.003	—	—	—	0.05	0.02
Iron	259.940	—	—	—	—	—	—	0.12	—	—	—
Lead	220.353	0.17	—	—	—	—	—	—	—	—	—
Magnesium	279.079	—	0.02	0.11	—	0.13	—	0.25	—	0.07	0.12
Manganese	257.610	0.005	—	0.01	—	0.002	0.002	—	—	—	—
Molybdenum	202.030	0.05	—	—	—	0.03	—	—	—	—	—
Nickel	231.604	—	—	—	—	—	—	—	—	—	—
Selenium	196.026	0.23	—	—	—	0.09	—	—	—	—	—
Silicon	288.158	—	—	0.07	—	—	—	—	—	—	0.01
Sodium	588.995	—	—	—	—	—	—	—	—	0.08	—
Thallium	190.864	0.30	—	—	—	—	—	—	—	—	—
V[illegible]dium	292.402	—	—	0.05	[illegible]	0.005	—	—	—	0.02	—
Zinc	213.856	—	—	—	[illegible]14	—	—	—	0.29	—	—

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ORIGINAL (Red)

ORIGINAL (Red)

TABLE 3. INTERFERENT AND ANALYTE ELEMENTAL CONCENTRATIONS USED FOR INTERFERENCE MEASUREMENTS IN TABLE 2 (EXHIBIT D)

Analytes	(mg/L)	Interferents	(mg/L)
Al	10	Al	1000
As	10	Ca	1000
B	10	Cr	200
Ba	1	Cu	200
Be	1	Fe	1000
Ca	1	Mg	1000
Cd	10	Mn	200
Co	1	Ni	200
Cr	1	Ti	200
Cu	1	V	200
Fe	1		
Mg	1		
Mn	1		
Mo	10		
Na	10		
Ni	10		
Pb	10		
Sb	10		
Se	10		
Si	1		
Tl	10		
V	1		
Zn	10		

AR300477

EXHIBIT XV

Revision No. 1
Initiated Date: 3/87

QUALITY ASSURANCE OPERATIONS MANUAL
STANDARD OPERATING PROCEDURE
QA-102

ORIGINAL (Red)

Title: Sample Log-in

Purpose:

In order to provide accountability of our results and to prevent sample loss or mix-up, a unique identification number is assigned to each sample.

Scope:

This SOP will cover the procedure used to log-in samples received for analysis.

Procedures:

1. All samples received by laboratory personnel shall be delivered to the Sample Administration Group immediately upon arrival at the laboratory.

2. All client correspondence relating to samples shall also be transferred to the Sample Administration Group. This includes purchase orders, quotes, letters and completed entry request forms.

3. Personnel of the Sample Administration Group shall log the samples into the computer as soon as practical after receipt. The computer will assign a unique identification number to each sample. Samples shall be logged in within 24 hours after receipt with the following exceptions:

   a. Samples received during a holiday or between 6 pm on Friday and 6 pm on Sunday. These samples shall be logged-in on the next normal work day.

   b. Samples submitted by clients without any indication of the tests to be performed or with unclear or incomplete information. Every effort shall be made to contact the client on the same day as sample receipt.

   If same day entry is not possible, any special storage requirements (e.g., refrigeration) should be observed.

4. Upon assignment of a sample number, the computer will generate a label which shall be attached to the sample container. The information on the label will include the LLI sample number, the client name, the storage location and a list of analyses requested by analytical method number.

5. Samples requiring the addition of preservatives will be delivered to the appropriate group leader or his designate immediately after log-in. A list of preservatives required for routine analyses may be found in the Fee Schedule.

6. After samples are logged-in (or preserved, if required) they shall be stored in the computer-assigned location. If the computer-assigned location is inappropriate for the samples, the location code may be changed by manually overriding the computer.

QA102
SOPs #1

Approved By: M. Louise Hess 8/28/87

QUALITY ASSURANCE OPERATIONS MANUAL
STANDARD OPERATING PROCEDURE
QA-103

ORIGINAL (Red)

Title: Sample Storage and Disposal

Purpose:

Sample integrity can be compromised by improper storage conditions. The objective of these procedures is to prevent samples from deteriorating prior to analysis. The computerized sample management system (CSMS) is used to assign storage locations and to monitor the orderly storage of samples in locations from which they are easily retrieved for analysis or discard at the appropriate date.

Scope:

This SOP will outline procedures used in storing samples, retrieving and returning samples for analysis, and discarding samples when their holding time expires.

Procedures:

1. Personnel of the Sample Administration Group will designate the approximate size and type (e.g., refrigerator, freezer or room temperature) of sample storage required for each group of samples as they are logged onto the CSMS. The computer will assign the storage location and record the length of time the sample must be retained after the analysis report has been issued. Samples will be stored in the assigned location. If the location is not suitable (e.g., insufficient space), the storage location may be changed using the manual override on the computer. If refrigerated space has been requested and all the computerized refrigerator locations are occupied, the sample will be assigned a WLK000 location. Storage of samples with this designation will be assigned locations in overflow refrigerators and will be tracked using a manual system until computerized locations are available.

2. Analysts requiring the use of a sample may determine its location by referring to the daily sample status sheet. There are varying degrees of security on sample storage locations. The procedures for removal of samples from these locations are as follows:

   a. Free access locations are those which are neither locked nor attended by a sample custodian. These areas are usually located within an individual group's laboratory and samples may be removed from and returned to these locations without

ORIGINAL (Red)

documentation. However, if the sample must be taken out of the laboratory, documentation may be requested. Care shall be exercised in returning the sample to its appropriate location.

b. Controlled access areas are attended by a sample custodian and are usually large areas used by more than one group. Samples stored in controlled access areas can be removed only after requisitioning the sample via the CSMS. The sample custodian will retrieve the requisitioned samples from the storage locations. At this time, laboratory personnel sign the sample requisition form and assume custody of the samples. After use, the samples are returned to the sample storage center, signed in by the sample custodian and returned to the designated storage location. Only Sample Administration personnel shall be admitted to controlled access areas. The only exception to this rule will be during hours when no sample custodians are on duty (11 p.m. - 6 a.m. weeknights and during weekends). During these hours, samples must be requisitioned as above, but analysts must retrieve the samples themselves, by obtaining a key to the controlled access area from the security desk. Samples must be signed out as above. After use, samples must be signed in and placed on the return cart inside WK4. Sample custodians will return these samples to their location when they come on duty.

c. Forensic storage areas are locked and admission to these areas is only permitted to sample custodians. Most of the samples stored in these areas require strict chain-of-custody documentation as outlined in SOP QA-104, and should be requisitioned as described in (b) above. Samples may not be removed or returned to these areas without signing chain-of-custody forms.

3. To prevent unnecessary deterioration of the samples, the aliquots needed for analysis shall be removed and the sample returned to storage with a minimum of delay.

4. Each day the Sample Administration Group will generate a discard list of the samples whose holding time has expired. These samples will be removed from storage by a member of the Sample Administration Group or a

ORIGINAL (Red)

member of the department responsible for the given storage location. Hazardous samples shall either be returned to clients, decontaminated, or disposed of at the direction of supervisory personnel.

5. The temperature of each refrigerator or freezer used for storing samples or reagents requiring temperature control should be checked during each normal working day by an assigned member of the group responsible for the samples stored within and recorded on a log posted on the outside of the unit. Refrigerator temperatures should be maintained at 5°C ± 3°C and freezer temperatures should be maintained at -15°C ± 5°C. If the temperature recorded does not fall within these ranges, the Maintenance Department should be contacted. Any repairs should be recorded and filed with the temperature log.

QA103
SOPs #1

Approved By: M. Louise Hess 8/28/87

EXHIBIT XVI

SAMPLE AND DATA ROUTING AT LANCASTER LABORATORIES, INC.

Action	Personnel Involved
Sample Received at LLI	Sample Administration
Sample is entered onto sample management system (lab ID number assigned, analyses scheduled, chain-of-custody started, storage location assigned	Sample Administration
Sample stored in assigned location (refrigerator, freezer, etc.)	Sample Administration
Removed from storage for analysis; necessary aliquot taken and sample returned to storage	Technical Personnel
Analysis performed according to selected analytical method; raw data recorded in notebook and transferred to computer by chemist or technician*	Technical Personnel
Computer performs calculations as programmed according to methods	Data Processing
Chemist or supervisor verifies raw data	Technical Personnel
Computer generates final report which is sent to client along with any copies of raw data requested. Final reports are reviewed by supervisors prior to mailing	Data Processing Middle Management Corporate Management

*Analyses requiring the chemist's interpretation may involve manual data reduction prior to entry onto the computer.

Exhibit XVII

PERFORMANCE EVALUATION REPORT

WATER SUPPLY STUDY NUMBER WS022

DATE: 7/2

ORIGINAL (Red)

LABORATORY PA009

ANALYTES	SAMPLE NUMBER	REPORTED VALUE	TRUE VALUE*	ACCEPTANCE LIMITS	PERFORMANCE EVALUATIONS
TRACE METALS IN MICROGRAMS PER LITER:					
ARSENIC	1	6.30	5.33	3.49- 7.57	ACCEPTABLE
	2	27.8	28.4	22.7- 33.3	ACCEPTABLE
BARIUM	1	510.	567	485.- 632.	ACCEPTABLE
	2	84.0	86.7	66.2- 105.	ACCEPTABLE
CADMIUM	1	38.4	** 42.0	32.5- 45.8	ACCEPTABLE
	2	3.20	3.36	2.60- 4.11	ACCEPTABLE
CHROMIUM	1	37.9	39.4	33.7- 45.3	ACCEPTABLE
	2	110.	118	103.- 133.	ACCEPTABLE
COPPER	1	1180.	1320	1220.-1400.	NOT ACCEPTABLE
	2	23.0	22.0	18.5- 25.8	ACCEPTABLE
LEAD	1	6.00	5.28	3.31- 7.63	ACCEPTAB
	2	65.0	66.0	54.9- 75.9	ACCEPTAB
MERCURY	1	1.00	1.00	.656- 1.32	ACCEPTABLE
	2	7.00	7.50	5.57- 9.07	ACCEPTABLE
SELENIUM	1	26.0	26.6	20.4- 32.1	ACCEPTABLE
	2	72.0	76.0	58.3- 91.1	ACCEPTABLE
SILVER	1	70.0	73.3	65.2- 83.0	ACCEPTABLE
	2	5.00	5.38	3.98- 7.16	ACCEPTABLE
NITRATE/NITRITE/FLUORIDE IN MILLIGRAMS PER LITER:					
NITRATE AS N	1	1.27	1.50	1.27- 1.76	ACCEPTABLE
	2	5.70	6.02	4.98- 7.37	ACCEPTABLE
NITRITE AS N	1	0.11	0.104	.0857- .122	ACCEPTABLE
	2	1.02	1.00	.871- 1.13	ACCEPTABLE

* BASED UPON THEORETICAL CALCULATIONS, OR A REFERENCE VALUE WHEN NECESSAR

** SIGNIFICANT GENERAL METHOD BIAS IS ANTICIPATED FOR THIS RESULT.

PERFORMANCE EVALUATION REPORT

DATE: 7/22/

WATER SUPPLY STUDY NUMBER WS022

LABORATORY PA009

ANALYTES	SAMPLE NUMBER	REPORTED VALUE		TRUE VALUE*	ACCEPTANCE LIMITS	PERFORMANCE EVALUATIONS
NITRATE/NITRITE/FLUORIDE IN MILLIGRAMS PER LITER:						
FLUORIDE	1	0.705		0.701	.631- .771	ACCEPTABLE
	2	1.50		1.46	1.31- 1.61	ACCEPTABLE
INSECTICIDES IN MICROGRAMS PER LITER:						
ALACHLOR	1	8.93		10.1	6.69- 12.7	ACCEPTABLE
	2	1.13		1.13	.624- 1.55	ACCEPTABLE
ATRAZINE	1	36.3		44.6	6.18- 75.5	ACCEPTABLE
	2	7.85	**	7.81	D.L.- 12.4	ACCEPTABLE
ENDRIN	1	6.24		6.71	4.32- 8.53	ACCEPTABLE
	2	0.434		0.479	.333- .617	ACCEPTABLE
HEPTACHLOR	1	2.27		1.91	.897- 2.65	ACCEPTABLE
	2	0.344		0.334	.141- .452	ACCEPTABLE
HEPTACHLOR EPOXIDE	1	1.44		1.55	1.01- 2.02	ACCEPTABLE
	2	0.211		0.233	.150- .292	ACCEPTABLE
LINDANE	1	3.24		3.47	2.04- 4.74	ACCEPTABLE
	2	0.104		0.116	.0629- .159	ACCEPTABLE
METHOXYCHLOR	1	59.4		65.4	42.7- 84.4	ACCEPTABLE
	2	2.41		2.62	1.67- 3.54	ACCEPTABLE
TOXAPHENE	3	8.55		8.94	5.04- 11.5	ACCEPTABLE
	4	2.58		2.58	1.26- 3.49	ACCEPTABLE
CHLORDANE	5	1.73	**	1.65	.851- 2.09	ACCEPTABLE
	6	6.75	**	6.60	4.15- 7.90	ACCEPTABLE

* BASED UPON THEORETICAL CALCULATIONS, OR A REFERENCE VALUE WHEN NECESSA

** SIGNIFICANT GENERAL METHOD BIAS IS ANTICIPATED FOR THIS RESULT.

D.L. STANDS FOR DETECTION LIMIT

PERFORMANCE EVALUATION REPORT

DATE: 7/2

WATER SUPPLY STUDY NUMBER WS022

LABORATORY PA009

ANALYTES	SAMPLE NUMBER	REPORTED VALUE	TRUE VALUE*	ACCEPTANCE LIMITS	PERFORMANCE EVALUATIONS
CARBAMATES IN MICROGRAMS PER LITER:					
ALDICARB	1	10.6	11.2	5.69- 16.8	ACCEPTABLE
	2	37.0	37.2	26.0- 46.5	ACCEPTABLE
ALDICARB SULFONE	1	7.30	8.22	4.73- 11.1	ACCEPTABLE
	2	21.8	24.0	16.6- 31.3	ACCEPTABLE
CARBOFURAN	1	7.50	7.18	4.14- 9.83	ACCEPTABLE
	2	30.4	30.7	19.5- 38.6	ACCEPTABLE
HERBICIDES IN MICROGRAMS PER LITER:					
2,4-D	1	71.4	** 89.6	34.6- 121.	ACCEPTABLE
	2	2.17	2.87	.498- 4.87	ACCEPTABLE
2,4,5-TP (SILVEX)	1	23.8	** 25.0	8.47- 33.6	ACCEPTABL
	2	1.05	** 1.20	.409- 1.59	ACCEPTAB
PENTACHLOROPHENOL	1	4.43	** 7.68	1.06- 10.9	ACCEPTABLE
	2	0.189	0.349	.0732- .537	ACCEPTABLE
POLYCHLORINATED BIPHENYLS IN MICROGRAMS PER LITER:					
PCB-AROCLOR 1016/1242	1	1.27	0.981	.544- 1.36	ACCEPTABLE
PCB-AROCLOR 1254	2	2.34	2.66	1.35- 3.45	ACCEPTABLE
TRIHALOMETHANES IN MICROGRAMS PER LITER:					
BROMODICHLOROMETHANE	1	15.8	16.7	13.4- 20.0	ACCEPTABLE
	2	54.3	55.7	44.6- 66.8	ACCEPTABLE

* BASED UPON THEORETICAL CALCULATIONS, OR A REFERENCE VALUE WHEN NECESSAR

** SIGNIFICANT GENERAL METHOD BIAS IS ANTICIPATED FOR THIS RESULT.

PERFORMANCE EVALUATION REPORT

DATE: 7/22/

WATER SUPPLY STUDY NUMBER WS022

LABORATORY PA009

ANALYTES	SAMPLE NUMBER	REPORTED VALUE	TRUE VALUE*	ACCEPTANCE LIMITS	PERFORMANCE EVALUATIONS
TRIHALOMETHANES IN MICROGRAMS PER LITER:					
BROMOFORM	1	50.3	54.9	43.9- 65.9	ACCEPTABLE
	2	21.5	23.2	18.6- 27.8	ACCEPTABLE
CHLORODIBROMOMETHANE	1	63.1	67.6	54.1- 81.1	ACCEPTABLE
	2	13.7	14.2	11.4- 17.0	ACCEPTABLE
CHLOROFORM	1	37.9	42.4	33.9- 50.9	ACCEPTABLE
	2	19.5	21.2	17.0- 25.4	ACCEPTABLE
TOTAL TRIHALOMETHANE	1	167.1	181.6	145.- 218.	ACCEPTABLE
	2	109.0	114.3	91.4- 137.	ACCEPTABLE
VOLATILE ORGANIC COMPOUNDS IN MICROGRAMS PER LITER:					
BENZENE	1	6.47	6.32	3.79- 8.85	ACCEPTABLE
CARBON TETRACHLORIDE	1	4.33	3.65	2.19- 5.11	ACCEPTABLE
	2	7.86	8.36	5.02- 11.7	ACCEPTABLE
1,4-DICHLOROBENZENE	1	9.11	8.72	5.23- 12.2	ACCEPTABLE
	2	10.4	11.1	8.88- 13.3	ACCEPTABLE
1,2-DICHLOROETHANE	1	3.58	2.56	1.54- 3.58	ACCEPTABLE
1,1-DICHLOROETHYLENE	1	4.45	4.35	2.61- 6.09	ACCEPTABLE
	2	12.6	13.5	10.8- 16.2	ACCEPTABLE
1,1,1-TRICHLOROETHANE	1	7.15	6.41	3.85- 8.97	ACCEPTABLE
TRICHLOROETHYLENE	1	2.94	2.57	1.54- 3.60	ACCEPTABLE
	2	10.8	11.0	8.80- 13.2	ACCEPTABLE

* BASED UPON THEORETICAL CALCULATIONS, OR A REFERENCE VALUE WHEN NECESSA

PERFORMANCE EVALUATION REPORT

DATE: 7/2

WATER SUPPLY STUDY NUMBER WS022

ORIGINAL (Red)

LABORATORY PA009

ANALYTES	SAMPLE NUMBER	REPORTED VALUE	TRUE VALUE*	ACCEPTANCE LIMITS	PERFORMANCE EVALUATIONS
VOLATILE ORGANIC COMPOUNDS IN MICROGRAMS PER LITER:					
VINYL CHLORIDE	1	1.90	3.04	1.82- 4.26	ACCEPTABLE
CHLOROBENZENE	2	9.73	7.50	4.50- 10.5	ACCEPTABLE
1,2DIBROMO3CHLOROPROPANE	2	0.286	0.235	.141- .329	ACCEPTABLE
DIBROMOMETHANE	2	5.76	5.12	3.07- 7.17	ACCEPTABLE
1,2 DICHLOROBENZENE	2	13.5	12.1	9.68- 14.5	ACCEPTABLE
T 1,2 DICHLOROETHYLENE	2	5.66	5.45	3.27- 7.63	ACCEPTABLE
DICHLOROMETHANE	2	2.51	2.60	1.56- 3.64	ACCEPTABLE
1,2 DICHLOROPROPANE	2	3.38	3.41	2.05- 4.77	ACCEPTABLE
ETHYLENE DIBROMIDE (EDB)	2	0.182	0.150	.0900- .210	ACCEPTABLE
TETRACHLOROETHYLENE	2	4.27	4.52	2.71- 6.33	ACCEPTABLE
MISCELLANEOUS ANALYTES:					
RESIDUAL FREE CHLORINE	1	0.38	0.521	.281- .773	ACCEPTABLE
(MILLIGRAMS PER LITER)	2	1.36	1.42	1.01- 1.79	ACCEPTABLE

* BASED UPON THEORETICAL CALCULATIONS, OR A REFERENCE VALUE WHEN NECESSAR

PERFORMANCE EVALUATION REPORT

DATE: 7/22/

WATER SUPPLY STUDY NUMBER WS022

LABORATORY PA009

ANALYTES	SAMPLE NUMBER	REPORTED VALUE		TRUE VALUE*	ACCEPTANCE LIMITS	PERFORMANCE EVALUATIONS
MISCELLANEOUS ANALYTES:						
TURBIDITY	1	3.90		3.75	3.21- 4.29	ACCEPTABLE
(NTU'S)	2	0.48	**	0.350	.250- .612	ACCEPTABLE
TOTAL FILTERABLE RESIDUE (MILLIGRAMS PER LITER)	1	300.	**	301	192.- 485.	ACCEPTABLE
CALCIUM (MG. CACO3/L)	1	144.		148	136.- 159.	ACCEPTABLE
PH-UNITS	1	8.95		9.10	8.77- 9.34	ACCEPTABLE
ALKALINITY (MG. CACO3/L)	1	44.8	**	42.0	38.4- 48.0	ACCEPTABLE
CORROSIVITY (LANGELIER IND. AT 20C)	1	0.82		0.92	.498- 1.24	ACCEPTABLE
SODIUM (MILLIGRAMS PER LITER)	1	19.1		19.3	17.7- 21.8	ACCEPTABLE

* BASED UPON THEORETICAL CALCULATIONS, OR A REFERENCE VALUE WHEN NECESSAI

** SIGNIFICANT GENERAL METHOD BIAS IS ANTICIPATED FOR THIS RESULT.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

ORIGINAL (Red)

NOV 9 1987

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

MEMORANDUM

SUBJECT: Pre-award Performance Evaluation Scores for IFB's WA87-K236, 237 and 238

FROM: Joan F. Fisk, CLP National Organics Program Manager
Analytical Operations Branch
Hazardous Site Evaluation Division

TO: All Participating Organics Laboratories

Enclosed is your final score sheet for the pre-award PE sample on the above cited solicitations. Also included, for your information, are the windows for acceptable quantitation.

The passing score is 740 points.

If you wish to be de-briefed by EMSL-LV on the results of your analyses, please contact Larry Butler at 702-798-2114.

Thank you for your participation.

cc: James Petty, EMSL-LV
Larry Butler, EMSL-LV
Carla Dempsey, AOB

Rec'd 11/18/87

PREAWARD PERFORMANCE EVALUATION SAMPLE DATA SCORING

ORIGINAL (Red)

Laboratory Lancaster Laboratories (LANCAS) #H2

IFB Full Organics - PA287 Date 9/28/87

SUMMARY:

I.	Identification	150 points for water	150 points for soil		
a.	Total number of I pts. deducted	1.1	70.1		
				Water	Soil
b.	pts. awarded for I			148.9	79.9
II.	Quantification	150 points for water	150 points for soil		
a.	Total number of II pts deducted	83.3	0		
b.	pts. awarded for II			66.7	150
	Total points awarded for I and II, water and soil			446	out of 600 pts.
III.	Quality Control	300 pts.			
a.	Total number of III pts. deducted	50			
b.	pts. awarded for III			250	out of 300 pts
IV.	Reporting/Deliverables	100 pts.			
a.	Total number of IV pts. deducted	12.5			
b.	pts. awarded for IV			88	out of 100 pts
V.	Score				
a.	Total number of I, II, III, and IV pts. awarded			784	out of 1000 pts.
b.	Total pts. awarded			784	out of 1000 pts
VI.	Number of days late			0	

ORIGINAL (Red)

IMPORTANT: Points deducted will not exceed the maximum possible number of points.

I. Identification (150 points for water sample; 150 points for soil samples).

	Water	Soil
A. Target Compound List (TCL) identification (Water Sample = 100 pts. max.; Soil Sample = 100 pts. max.).		
Number of compounds not identified (0/2) X 100 pts. (Number of compounds in study (36/34)/10 = (0/58.8) pts. ded.	0	58.8
B. TCL false positives (Water Sample = 30 pts. max.; Soil Sample = 30 pts. max.)		
Number of TCL false positives (0/2) X 3 points = (0/6) points deducted	0	6
C. Tentatively Identified Compounds (TIC) identification (Water Sample = 10 pts. max.; Soil Sample = 10 pts. max.)		
Number of compounds not identified (2/4) X 10 pts. Number of compounds in study (18/12) = (1.1/3.3) pts. ded.	1.1	3.3
D. TIC false positives (Water Sample = 10 pts. max.; Soil Sample = 10 pts. max.)		
Number of TIC false positives (0/2) X 1 point = (0/2) points deducted	0	2
Total number of I pts. deducted	1.1	70.1

II. Quantification of the TCL (150 points for water sample; 150 points for soil sample)

A. TCL quantification include VOA, Semi-VOA, and Pesticides (Water Sample = 150 pts. max.; Soil Sample = 150 pts. max.)		
Number of compounds not within criteria (4/0) x 150 pts Number of compounds in study (36/34)/5 = (83.3/0) pts. ded.	83.3	0
Total number of II pts deducted	83.3	0

ORIGINAL (Red)

III. Quality Control (300 points)

A. Instrument Quality Control (150 points)

Number of pts deducted

1. Tuning (50 points)

a. DFTPP (25 pts. max.)

1. For any DFTPP performance tune analyzed separately or as part of the calibration standard with any critical ions abundance ratios outside criteria deduct 25 points. (Critical key ions are: 68, 70, 197, 198, 199, 441, 442, 443, and 365). 0

2. For any DFTPP performance tune analyzed separately or as part of the calibration standard with any non-critical ions abundance ratios outside criteria deduct 2 points. for each to a maximum of 25 pts. (Non-critical key ions are: 51, 127, and 275.) 0

3. Failure to perform a DFTPP tune at the required 12-hour frequency, deduct 25 points. 0

b. BFB (25 pts. max.)

1. For any BFB performance tune analyzed separately or added to reagent water with any critical ions abundance ratios outside criteria deduct 25 points. (Critical key ions are: 95, 96, 174, 175 176, 177.) 0

2. For any BFB performance tune analyzed separately or added to reagent water with any non-critical ions abundance ratios outside criteria deduct 2 points for each to a maximum of 25 points. (Non-critical key ions are: 50, 75, 173.) 0

3. Failure to perform a BFB tune at the 12-hour frequency, deduct 25 pts. 0

Sub Total (maximum 50 points deducted) 0

2. Initial Calibration (50 points)

a. For initial calibration data for VOA or Semi-VOA with System Performance Check Compound (SPCC) average relative response factor (RRF) less than 0.300 for VOA fraction (less than 0.250 for Bromoform) or less than 0.050 for Semi-VOA fraction, (15 pts. max.)

compounds not within criteria, both fractions (0)
Total number of compounds, include both fractions (14)
X 15 pts = (0) pts. ded. 0

ORIGINAL
(Red)

III.A.2. (continued)

Number of
pts deducted

b. For initial calibration data for VOA or Semi-VOA with Calibration Check Compound (CCC) percent relative standard deviation greater than 30%, (20 pts. max.)

compounds not within criteria, both fractions (0)
Total number of compounds, include both fractions (25)
X 20 pts. = (0) pts. ded. .. 0

c. 72-hour Calibration Requirements for GC/EC (15 pts. max.)

1. If the retention time of 4,4'-DDT is not ≥ 12 minutes on packed GC columns

Number of items not within criteria (0) x 15 pts.
Total number of items required (8)
= (0) pts ded. 0

2. If the linearity of Aldrin, Endrin, or Dibutylchlorendate in Evaluation Mixtures A, B, and C exceeds a 10% relative standard deviation (% RSD).

Number of items not within criteria (0) x 15 pts.
Total number of items required (6)
= (0) pts ded. .. 0

3. If the percent breakdown for Endrin,4,4'-DDT or the combined peaks % breakdown exceeds 20% in Evaluation Mix B.

Number of items not within criteria (0) x 15 pts.
Total number of items required (2)
= (0) pts ded. 0

4. If the retention time shift for Dibutylchlorendate exceeds a 2% difference for packed GC columns (0.3% difference for capillary column) between the initial standard (Evaluation Mix A) and Evaluation Mixtures B and C, individual standards Mixtures A and B.

Number of items not within criteria (0) x 15 pts.
Total number of items required (8)
= (0) pts ded. 0

ORIGINAL (Red)

III.A.2.c. (continued)

	Number of Pts. Deducted
5. If the pesticide standards are not analyzed in the proper sequence, deduct 15 points.	0
Sub Total (maximum 50 points deducted)	0

3. Continuing Calibration (50 points)

a. For continuing calibration data for VOA or Semi-VOA with System Performance Check Compound (SPCC) average relative response factor (RRF) less than 0.300 for VOA fraction (less than 0.250 for Bromoform) or less than 0.050 for Semi-VOA fraction, (15 pts. max.)

compounds not within criteria, both fractions (0)
Total number of compounds, include both fractions (14)
X 15 pts. = (0) pts. ded. — 0

b. For continuing calibration data for VOA or Semi-VOA with Calibration Check Compound (CCC) percent relative standard deviation greater than 25%, (20 pts. max.)

compounds not within criteria, both fractions (0)
Total number of compounds, include both fractions (25)
X 20 pts. = (0) pts. ded. — 0

c. 72-hour Calibration Requirements for GC/EC (15 pts. max.)

1. If the retention time of 4,4'-DDT is not $\geq$ 12 minutes on packed GC columns

Number of items not within criteria (0)
Total number of items required (2)
X 15 pts. = (0) pts. deducted. — 0

ORIGINAL (Red)

III.A.3.c. (continued)

	Number of Pts. Deducted
2. If the percent breakdown for Endrin, 4,4'-DDT or the combined peaks % breakdown exceeds 20% in Evaluation Mix B.	
Number of items not within criteria (0) X 15 pts. / Total number of items required (0) = (0) pts. ded.	0
d. Failure to perform continuing calibration will result in the deduction of all the continuing calibration points, which equals 50 points.	50
Sub Total (maximum 50 points deducted)	50
Sub Total (A) (maximum 150 points deducted)	50

B. Failure to perform initial calibration will result in the deduction of 300 points.

Sub Total (B) (maximum 300 points) 0

C. Sample/Method Quality Control (150 points)

1. Surrogate Spike recovery (60 points) NOTE: Do not include Method Blanks.

a. VOA (30 pts. max.)

Number of surrogate compounds not within criteria (0) / Total number of VOA surrogate compounds (12). X 30 pts. = (0) pts. deducted — 0

b. Semi-VOA (30 pts. max.)

Number of surrogate compounds not within criteria (0) / Total number of Semi-VOA surrogate compounds (24). X 30 pts = (0) pts. deducted. — 0

c. Points will not be evaluated for Pesticide/PCBs surrogate compound. — NR

2. Method Blank Analyses (75 points)

a. VOA surrogate recovery (15 pts. max.)

Number of surrogate compounds not within criteria (0) / Total number of VOA surrogate compounds (6) X 15 pts. = (0) pts. deducted. — 0

ORIGINAL (Red)

III.C.2. (continued)

	Number of Pts. Deducted
b. VOA method blank contamination (15 pts. max.).	
If one or more TCL compounds are detected in the method blank above the contract required quantitation limit (5X the CRQL for methylene chloride, acetone, toluene, and 2-butanone) deduct the maximum points, 15.	0
c. Semi-VOA surrogate recovery (15 pts. max.)	
Number of surrogate compounds not within criteria (0) Total number of Semi-VOA surrogate compounds (12) X 15 pts. = (0) pts. deducted	0
d. Semi-VOA method blank contamination (15 pts. max.) If one or more TCL compounds are detected in the method blank above the contract quantitation limit (5 X the CRQL for phthalate esters) deduct the maximum points, 15.	0
e. Pesticide/PCBs method blank contamination (15 pts. max.)	
If one or more TCL compounds are detected in the method blank above the contract required quantitation limit deduct the maximum points, 15.	0
f. Failure to perform the method blank analysis for any of the fractions will result in the deduction of 75 points.	0
3. Matrix Spike/Matrix Spike Duplicate (15 points)	
a. Utilization of the wrong spiking concentration in one or more of the fractions will result in the deduction of 15 points.	NR
b. Failure to perform matrix spike or matrix spike duplicate analysis will result in the deduction of 15 points.	NR
4. Positive pesticide/PCB confirmation chromatogram submitted for all reported pesticide TCLs. (Deduct 25 points for each pesticide TCL not confirmed). (Maximum 100 points deducted)	0

Sub Total (C) (maximum 150 points deducted) 0

Total number of III points deducted (maximum 300 points) 50

ORIGINAL (Red)

Number of Pts. Deducted

IV. Reporting and Deliverables (100 points)

A. BFB and DFTPP (12.5 points max for BFB and 12.5 points max for DFTPP)

1. Mass listing and bar graph output submitted for each instrument and for every 12-hour period samples were analyzed. Deduct 12.5 points for any BFB violation and 12.5 pts for any DFTPP violation. 0

B. RICs, Chromatograms, quantitation reports, and system print-outs (25 pts. max.)

1. Deduct 25 points maximum if any of the required deliverables are not submitted in accordance with the statement of work. 0
(RICs or Chromatogram-Maximum 12.5 points) (Quant. Report or System printout - Maximum 12.5 points).

C. Mass spectra (25 pts. max.)

1. Deduct maximum 25 points if any of the required deliverables are not submitted in accordance with the Statement of Work. 12.5
(12.5 points-VOA, 12.5 point-Semi-VOA.)

D. Contractual Forms I-X (25 pts. max.)

1. Deduct 25 points if any of the required deliverables are not submitted in accordance with the Statement of Work. 0

Total number of IV points deducted (maximum 100 points) 12.5

IFB WA 87 K236/K237/K238
PA287
FINAL 9/24/87
AQUEOUS SAMPLE (ug/L)

COMPOUND	95 % CI B1 b LOWER	UPPER	A1.
VOA			
CHLOROETHANE	56.9	112	
1,1-DICHLOROETHANE	35.6	57.6	
BENZENE	47.2	72.1	
ETHYLBENZENE	45.9	70.9	
TOTAL XYLENES	55.3	83.9	
BASE/NEUTRAL/ACID			
PHENOL	22.9	153	
4-METHYL PHENOL	63.8	193	
n-NITROSO-DI-N-PROPYLAMINE	39.5	126	
HEXACHLOROBUTADIENE	19.8	123	
4-CHLORO-3-METHYL PHENOL	95.4	316	
ACENAPHTHYLENE	56	139	
4-NITROPHENOL*	21.9	179	
DIBENZOFURAN	55.7	129	
FLUORENE	40.3	97.2	
PESTICIDES			
ALDRIN	0.122	0.351	
HEPTACHLOR EPOXIDE	0.185	0.444	
4,4'-DDD	0.202	0.468	
ENDOSULFAN SULFATE	0.117	0.569	
TOTAL OUT (TCL ACTION LIMIT)			
TOTAL OUT (TCL IDENTIFICATION)			
NON-TCL *			
VOA			
ETHYLCYCLOHEXANE	1		
1-CHLOROPENTANE	2		
HEPTALDEHYDE	3		
BASE/NEUTRAL/ACID			
BIPHENYL	4		
o-DIBROMOBENZENE	5		
CYCLODECANONE	6		
BUTYL PHENYL ETHER	7		
4-ETHYLNITROBENZENE	8		
p-TOLUNITRILE	9		
TOTAL OUT (NON-TCL IDENTIFICATION)			

IFB WA 87 K236/K237/K238
PA287
FINAL 9/24/87
SOIL SAMPLE (ug/Kg)

COMPOUND	95 % CI B b LOWER	UPPER	A:
VOA			
1,2-DICHLOROETHANE	1080	2500	
DIBROMOCHLOROMETHANE	1180	2970	
TOLUENE	2160	4100	
CHLOROBENZENE	1830	3360	
BASE/NEUTRAL/ACID			
1,4-DICHLOROBENZENE	713	2280	
NITROBENZENE	585	2020	
ISOPHORONE	893	3030	
2,4-DICHLOROPHENOL	1010	3920	
1,2,4-TRICHLOROBENZENE	785	2650	
2-METHYLNAPHTHALENE	705	2870	
PENTACHLOROPHENOL*	1060	3660	
PYRENE	1030	2740	
BIS(2-ETHYLHEXYL)PHTHALATE	803	2560	
PESTICIDES			
DELTA-BHC	32.5	106	
ENDRIN	91.6	237	
4,4'DDT	66.5	287	
GAMMA-CHLORDANE	120	317	
TOTAL OUT (TCL ACTION LIMIT)			
TOTAL OUT (TCL IDENTIFICATION)			
NON-TCL *			
VOA			
FLUOROBENZENE	10		
CYCLOHEXYLCHLORIDE	11		
BASE/NEUTRAL/ACID			
P-BROMOPHENOL	12		
4 SEC-BUTYLPHENOL	13		
3-BROMOTOLUENE	14		
m-IODOTOLUENE	15		
TOTAL OUT (NON-TCL IDENTIFICATION)			

ORIGINAL (Red)

Revision No. 1
Initiated Date: 3/87

QUALITY ASSURANCE OPERATIONS MANUAL
STANDARD OPERATING PROCEDURE
QA-104

ORIGINAL (Red)

Title: Chain-of-Custody Documentation

Purpose:

In order to demonstrate reliability of data which may be used as evidence in a legal case or required by a regulatory agency, an accurate written record tracing the possession of the sample from its receipt at the laboratory to the time of its disposal must be maintained.

Scope:

Procedures for initiating and maintaining chain-of-custody documentation are described in this document.

Definition:

A sample is in custody if it is in any one of the following states:

1. In actual physical possession.
2. In view after being in physical possession.
3. In physical possession and locked up so that no one can tamper with it.
4. In a secured area, restricted to authorized personnel.

Procedures:

1. Chain-of-custody documentation shall be kept upon request of the client or for any samples which are known to be involved in a legal dispute.
2. If requested by the client, the chain-of-custody documentation will begin with the preparation of bottles. A form (see Attachment 1) will be initiated by the person packing the sample bottles for shipment to the client. If the delivery of bottles is via our Transportation Department, the driver shall sign the form when relinquishing the bottles. Drivers must also sign chain-of-custody forms when picking up samples which require such documentation.
3. When samples arrive at the laboratory, a member of the Sample Administration Group will receive them and sign the chain-of-custody form, if one is provided with samples. If the sample was picked up by our Transportation Department, the driver must sign to indicate relinquishing the sample.

ORIGINAL (Red)

4. Samples will be logged into the computer as described in QA-102. Sample Administration personnel shall indicate locked storage, enter a lab note to inform analysts of the need for chain-of-custody documentation, and enter the analysis number for "forensic storage".

5. Sample Administration personnel shall initiate an "Internal Chain-of-Custody" form (Attachment 2) for each type of container in the sample, and relinquish the samples to a sample custodian or designated key holder, who will store the sample in the assigned locked location. At this point, external chain-of-custody forms will be filed with the Accounts Receivable Department to be returned with the invoice, and the internal forms will accompany the samples.

6. Sample handling should be kept to a minimum. Analysts requiring use of a sample should contact a sample custodian or key holder who will remove it from storage and sign the form to indicate relinquishment. The analyst will sign the "received by" column and note the reason for change of custody.

7. Analysts in possession of samples shall remove the aliquot required for analysis and return the sample to storage as described in #8 below with a minimum of delay. During the time of possession, samples must remain in the analyst's view or be locked-up. All changes of custody (e.g., because of shift change) shall be documented on the form. If additional containers of the sample are created (e.g., an extract container from preparation for organic analysis), an additional form marked with the container type shall be created to accompany the new container.

8. After analysis, samples shall be relinquished to a key holder or sample custodian who will return the samples to locked storage. The forms which remain with the samples shall be signed again to indicate storage.

9. After completion of analysis, these forms are given to the Data Package Group for inclusion in extended reports.

QA104
SOPs #1

Approved By: M. Louise Hess 8/28/87

Lancaster Laboratories INCORPORATED

Chain Of Custody Record

2425 New Holland Pike, Lancaster, Pa 17601 • (717) 656-2301

ORIGINAL (Red)

Project No. / I.D. _____ Sheet No. _____

Sampler(s) _____ Bottles Supplied By _____

Date Sampled _____ Bottle Batch No. _____

Sample I.D.	Sample Description	Sample Type	Sampling Method	Time	No. Of Containers	Analysis Requested	Remarks

Relinquished By (Signature)	Received By (Signature)	Date/Time	Reason For Transfer

AR300502

Copies White - Sampler, Yellow - Lab Pink - Client

ATTACHMENT 1

Lancaster Laboratories
INCORPORATED
2425 New Holland Pike, Lancaster, PA 17601 • 717/656-2301

Locked Storage Internal Chain-of-Custod

ORIGINAL (Red)

ent/Project: _____ Preservative: _____

LLI Number(s): _____ Analyses:

Storage Location: _____

ORIGINAL SAMPLE

Sample Number(s)	Relinquished by	Received by	Time	Date	Reason for Change of Custod

s form has been designed to accompany the sample from the moment it is
ginally entered into the computer until the last test is performed.

ATTACHMENT 2

EXHIBIT XIX

ORIGINAL (Red)

GLASSWARE CLEANING PROCEDURES

Inorganics:

All glassware is rinsed five times with deionized water and soaked four hours in 10% nitric acid. The glassware is then rinsed five times with deionized water. In addition, beakers are heated for thirty minutes with 10% nitric plus 10% hydrochloric acid.

GC/MS Extractables or Pesticides by GC:

Glassware is rinsed with acetone or tap water as appropriate, then soaked in Chemsolv four hours. Upon removal, it is rinsed three times with tap water and three times with deionized water, then baked at 200C four hours.

EXHIBIT XX

Revision No. 1
Initiated Date: 6/87

QUALITY ASSURANCE OPERATIONS MANUAL
STANDARD OPERATING PROCEDURE
QA-118

ORIGINAL (Red)

Title: Quality Assurance Audits

Purpose:

Occasional audits of each technical group's operations are made to ensure that laboratory personnel are adhering to the procedures set forth in our Quality Assurance Standard Operating Procedures and in the group's methods manual.

Scope:

This SOP will describe the frequency and types of audits carried out by the Quality Assurance Department.

Procedures:

1. The Quality Assurance Department shall conduct periodic audits of analyses or phases of analyses which are representative of the work routinely performed in each group.

2. Any project which is subject to FDA or EPA Good Laboratory Practices (GLPs) must be audited once every three months for the duration of the project. This same frequency is suggested for audits of general laboratory work performed by each group.

3. Whenever possible, inspections of GLP projects should include direct observation of analysts as they perform the various phases of the study. The purpose of this type of audit is to ensure that no deviations from the written methods occur. Inspections of non-GLP areas should also ensure that the written methods are followed, and may include review of notebooks, reagent preparation data, calibrations, standardizations, maintenance of equipment, quality control records, computer programming, and personnel training records. Direct observation may be used, although traceability audits (auditing by ensuring that an accurate paper trail exists) are also useful.

4. At the completion of each audit, a review of any significant problems uncovered during the audit will be held with the Group Leader of the audited department.

ORIGINAL (Red)

5. The findings of each audit will be reported in writing to management by the auditor.

QA118
SOPs #1

Approved By: M. Louise Hess Date: 8/28/87

ORIGINAL (Red)

A LIST OF SAMPLE CONTAINERS, PRESERVATIVES AND HOLDING TIMES FOR AQUEOUS SAMPLES

	Vol Req. (ml)	Container Plastic, Glass	Preservation	Holding Time
Volatiles	3 x 40 ml vials	G	Cool, 4C*	14 days
Pesticides	2 x 1000	G	Cool, 4C*	14 days
Acid/Base Neutrals	2 x 1000	G	Cool, 4C*	7 days
Metals	500	P, G	HNO_3 to pH <2	6 months
Cyanide	1000	P, G	Cool 4C NaOH to pH >12	14 days
Phenol	1000	G	Cool 4C H_2SO_4 to pH <2	28 days
Mercury	500	P,G	HNO_3 to pH <2	28 days

**Thiosulfate needed for chlorinated samples. (HCL to pH <2 for aromatic compounds.)*

NOTE: **Solid Samples** for any or all of the above analyses require a 500 ml glass container with a Teflon-lined cap. For volatiles analysis, the container should be filled completely, with no headspace. **All sample containers, preservatives and mailers will be supplied at no additional charge upon request.**

EXHIBIT XXII

Revision No. 1
Initiated Date: 6/87

ORIGINAL (Red)

QUALITY ASSURANCE OPERATIONS MANUAL
STANDARD OPERATING PROCEDURE
QA-116

Title: Investigation and Corrective Action of Unacceptable Quality Control Data

Purpose:

Quality Control (QC) samples should be analyzed with each test performed in the laboratory in order to ensure the quality of the analytical data. One of the most effective means of preventing trouble is to respond immediately to indications of suspicious data or equipment malfunctions. Application of corrective actions at this point can reduce or prevent the collection of poor quality data. When results for QC data fall outside of established acceptance criteria, the cause of this irregularity must be investigated, corrected and documented, as soon as possible. The documentation will be used to prevent a recurrence of the problem and to inform management of the situation.

Scope:

This SOP will outline the procedures to be followed when quality control data for an analysis falls outside of previously established acceptance limits. The methods for determining and documenting the cause and corrective action taken are described. Also specified in this SOP are guidelines for determining when out-of-spec QC results should prevent data from being reported to clients until the deficiency is corrected.

Procedure:

1. All QC data <u>must</u> be entered onto the computerized QC system promptly after its generation.

2. Each group shall establish a QC notebook or file for retaining information involving QC data. The material to be kept in this notebook includes documentation of investigation of QC outliers and any QC data which can not be logged onto the computerized system (e.g., results of blind samples submitted by clients). The group leader is responsible for maintaining this notebook. However, a QC coordinator may be appointed and the maintenance of the QC notebook may be delegated to this coordinator. All entries in the notebook should be initialed and dated.

3. Daily "out-of-spec" data will be reported via the computerized QC system. The statistical limits established by the computer based on our internal data may result in acceptance limits that are narrower than

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limits set by recognized standard-setting organizations (e.g., EPA, NIOSH, ASTM, etc.). In such cases, the limits set by the standard-setting organization will take precedence over internally generated limits, and the Group Leaders are responsible for ensuring that the allowable limits are part of the analytical method. Any data outside the established 95% confidence interval, or other acceptance criteria (e.g., EPA limits for reference materials), will be reviewed by the QA Director. Where appropriate, the QA Director will place outliers in one of three categories:

A. Marginal Outlier
B. Outlier
C. Extreme Outlier

4. The daily sheets will then be distributed to Group Leaders or their designates.

The following are definitions of the types of outliers and the actions to be taken when they occur. In all cases, the outliers should be investigated as soon as possible after notification is received.

a. Marginal Outlier: The acceptance criteria for QC data is usually based on a 95% confidence interval. Statistically, this means that one in every twenty pieces of acceptable data will fall outside of the "acceptable" range. Data that are outside the 95% confidence interval but within the 99% confidence interval will be considered a marginal outlier. Types of quality control samples, such as recoveries and duplicates, which may be adversely effected by matrix interferences, may also be designated as "marginal outliers". When the daily out-of-spec report contains data which has been designated as a marginal outlier, the Group Leader or QC Coordinator should check all supporting data (calculations, calibrations, other QC data, etc.) and note any irregularities found on the report. The findings of these checks and any corrective action should be documented within two weeks on the "out-of-spec" report and filed in the departmental QC notebook. Although it is not necessary to report findings on a marginal outlier to the QC Director, spot checks of the QC notebooks will be made during quarterly audits to ensure that all outliers are being followed up.

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b. Outlier: Data outside the 99% confidence interval will be considered to be a more serious problem, as will observable trends in the data, such as a shift in the mean or a significant increase in standard deviation. In these cases, the QA Director will issue a formal request for investigation and corrective action (see attached form). The Group Leader, or their designate, will investigate the unacceptable data and complete the report as soon as possible. All reports <u>must</u> be returned to the QA Director within two weeks. A photocopy of the report should be placed in the Group's QC notebook. In cases where the suspect data involves a low recovery on a spiked sample, or poor precision on duplicates, factors such as a non-homogeneous sample, or severe matrix effects should be considered. It may be necessary to note these problems on the client report or to repeat the sample if no such interferences can be identified.

c. Extreme Outlier: Occasionally, QC data will indicate that the analytical system has gone so far out-of-control, that no results should be reported to clients until the problem has been investigated and corrective action taken. An example of this severe type of outlier would be when more than one reference or control falls outside the 99% confidence interval, since statistically the chances of this occurring when the system is actually in control are very small. The QA Director will mark the attached form to indicate that no data may be reported to clients until it can be demonstrated that the problem has been resolved. Approval to resume reporting data to clients must be given by the QA Director, or the President. The completed form must be submitted to the QA Director before approval will be given. A copy of the form should be filed in the Group's QC notebook.

5. In the absence of the QA Director, daily out-of-spec sheets will be given directly to Group Leaders who should assess the degree of investigation required. In the case of extreme outliers, Group Leaders should consult with their Division Director for instruction in the absence of the QA Director.

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6. The QA Director will circulate all completed Investigation & Corrective Action forms to the appropriate managers, and then retain it in the QA files.

QA116
SOPs #1

Approved By: M. Lariese Hess Date: 8/28/87

No. _____

INVESTIGATION AND CORRECTIVE ACTION FOR QC OUTLIERS

Part I (to be filled out by QA Director)

1. Date
2. LLI sample number(s) involved
3. Nature of QC outlier

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4. _____Check if investigation must be complete before reporting further data to clients

Signed_____
Quality Assurance Director

Part II

1. Steps taken to investigate outlier:

2. Explanation of probable cause of outlier:

3. Steps taken to prevent future occurrence:

4. Name of analyst who performed work:

5. Signed_____ Date_____

E.

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Appendix E
Health and Safety Plan

The ERM Group

HEALTH AND SAFETY PLAN
FOR THE RI/FS
AT THE
TEXTRON LYCOMING
WILLIAMSPORT PLANT
WILLIAMSPORT, PENNSYLVANIA

ORIGINAL (Red)

1 May 1989

Kyle Rosato (JBB)

Kyle Rosato
Project Industrial Hygienist

Richard Wroblewski

Richard Wroblewski, P.G.
ERM Project Manager

Joseph B. Baker

C.I.H. Review

Prepared For:

Textron Lycoming
Williamsport Plant
Williamsport, Pennsylvania

Prepared By:

Environmental Resources Management, Inc.
855 Springdale Drive
Exton, Pennsylvania 19341

File No. 723.01.05.01

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FOREWORD

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Environmental Resources Management, Inc. (ERM), has developed the following Health and Safety Plan for the Textron Lycoming Remedial Investigation/Feasibility Study (RI/FS) activities. The intent of this plan is to recommend appropriate health and safety procedures to be followed by site personnel during the field investigation phase of this project. ERM will provide consulting assistance to Textron Lycoming, for implementing the protocols associated with the Williamsport Plant.

Key regulations that apply to the proposed activities during the Textron Lycoming Site RI/FS are listed below. All field activities and operations associated with the RI/FS will be in accordance with these regulations.

Government Regulations	Subject
29 CFR 1910.120	Hazardous Waste Site Operations
29 CFR 1910.20	Recordkeeping/Recording
29 CFR 1904	Recordkeeping/Recording
29 CFR 1910.1000	OSHA Permissible Exposure Limit
29 CFR 1926	Construction Activities
29 CFR 1910.134	Respiratory Protection

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INTRODUCTION

This Health and Safety Plan has been developed by Environmental Resources Management, Inc. (ERM), for the Textron Lycoming facility in west Williamsport, Lycoming County, Pennsylvania. This plan will provide recommended health and safety procedures for those ERM employees who may be present during the site investigation activities.

The procedures set forth in this Plan are designed to reduce the risk of exposure to chemical substances and physical hazards which may be present in the soil, water, and air associated with the activities at the Textron Lycoming facility. The procedures set forth herein are developed in accordance with the provisions of 29 CFR 1910.120 (Interim Final Occupational Safety and Health Administration (OSHA) Rule) and in accordance with ERM experience in similar field investigations. ERM shall be responsible solely for compliance with the provisions of the present Health and Safety Plan by ERM employees and ERM subcontractors unless otherwise specified and agreed to in writing by ERM, Inc.

The recommended health and safety guidelines set forth within this document may be modified as further information is made available through sample analysis and on-site characterization. The activities to be performed during the RI/FS are listed and discussed in Section 1.3 of this Health and Safety Plan. This plan has been developed on the basis of the information obtained from previous reports and historical data.

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SECTION 1

PROJECT PERSONNEL RESPONSIBILITIES

The following responsibilities and authorities have been or will be assigned to designated personnel for the Textron Lycoming RI/FS activities in Williamsport, Pennsylvania.

ERM, Inc. Project Director

Charles Bandoian, P.G., is the Project Director for the Textron Site Field Investigation RI/FS. The Project Director is responsible for oversight and coordination of the various elements of the FI. Working with Project Managers responsible for the individual elements. The Project Director provides overall review and access to ERM.

ERM, Inc. Project Manager and Designated Representative

Richard Wroblewski, P.G., is the Project Manager for the RI/FS. He will act in a supervisory capacity over all ERM employees and activities with respect to ERM's contracted obligations to Textron Lycoming during the Lycoming site RI/FS. Mr. Wroblewski is responsible for assuring that ERM Health and Safety responsibilities on the site are carried out.

Site Safety Officer

The Site Safety Officer appointed by ERM will be responsible solely for ERM employees and ERM subcontractors, unless otherwise specified in an appropriate written agreement between ERM, Inc. and Textron. The Site Safety Officer may assume:

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- responsibility for the field implementation, evaluation, and any necessary field modifications of this Health and Safety Plan.

- responsibility for maintaining adequate supplies of all personal protective equipment as well as calibration and maintenance of all monitoring instruments.

- authority to suspend site operation at the site due to any ineffectiveness of or non-conformance to this Health and Safety Plan.

- Site Safety Officer(s) will be designated by the ERM Health and Safety Coordinator. Site Safety Officer(s) will be qualified members of the ERM Health and Safety Group. On-site personnel may be designated as Assistant or Associate Site Safety Officer(s) dependent upon site conditions and personnel qualifications.

SECTION 2

PROJECT INFORMATION

2.1 Background

The following provides a summary of the information found in the Textron Lycoming, Williamsport Plant RI/FS. This summary is intended to provide the information necessary to understand the scope of this Health and Safety Plan. A more detailed project background description can be found in the Textron Lycoming RI/FS.

In 1984 the Williamsport Municipal Water Authority (WMWA) detected the presence of volatile organic compounds in the ground water at their backup water supply well field. The Pennsylvania Department of Environmental Resources (PADER) was advised of this situation by WMWA.

In November 1984 Textron Lycoming advised Chester Engineers to initiate a ground water investigation at the completion of the PADER study. Ground water samples taken during December 1984 by PADER within and upgradient to the WMWA emergency well field revealed similar contaminants in ground water from an abandoned production well on the Textron property. In February 1985 Chester Engineers installed ten on site ground water monitoring wells. In April and May 1985, seventeen on-site and off-site ground water monitoring wells and one recovery well were drilled and a report was submitted to PADER in June 1985.

Drilling of 21 additional on-site and off-site ground water monitoring wells along with a second recovery well took place between June 1985 and June 1986.

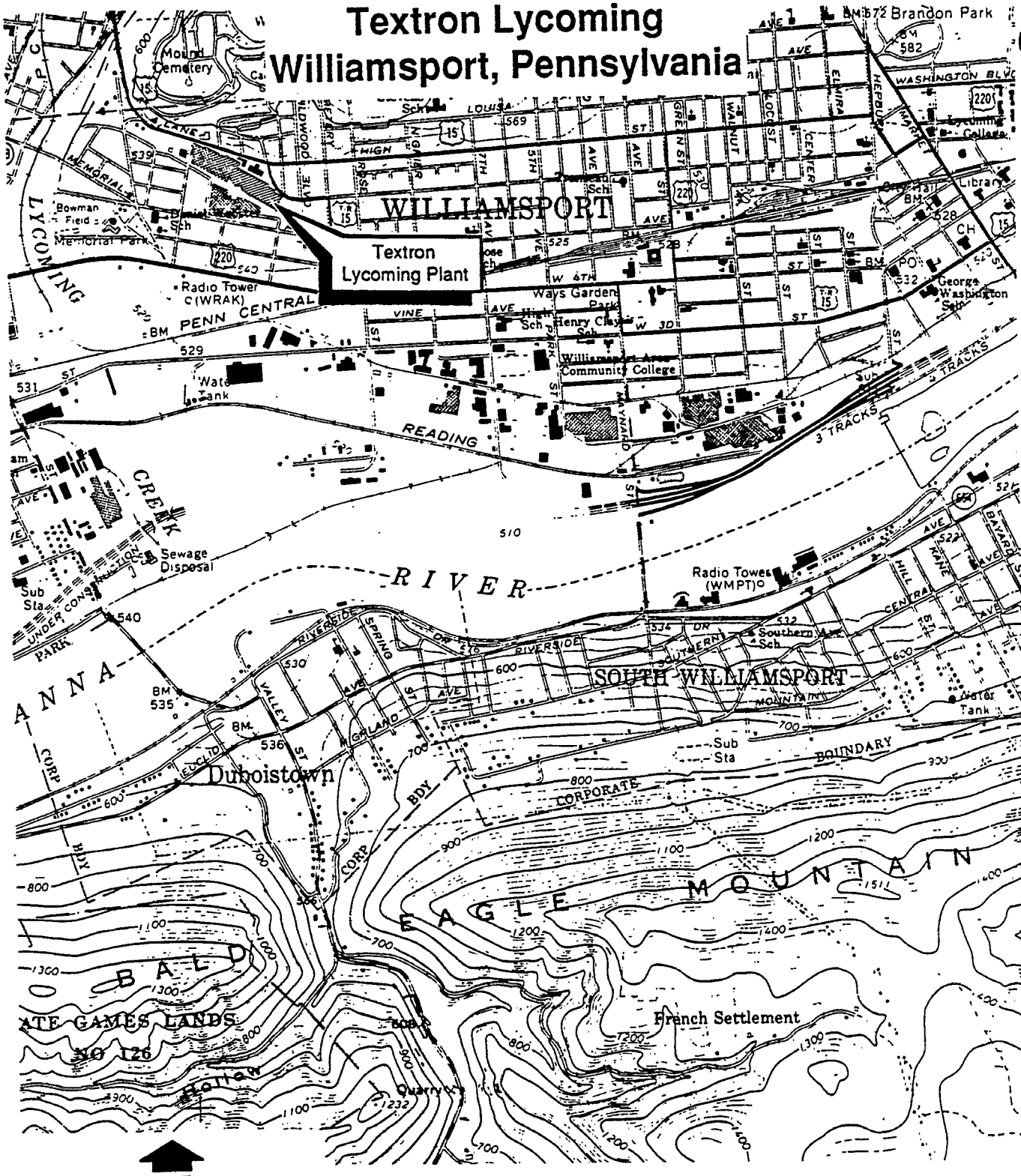
In September and October 1986 three Firehouse Recovery Wells were installed. The Water Authority Recovery well was installed in January 1987. Textron was listed as the third entry in Group 7 on the sixth update of the National Priorities List by the EPA on 22 January 1987. On December 1987 Textron Lycoming was advised that it will be required to conduct a Remedial Investigation/Feasibility Study. On 27 June 1988 Consent Agreement and order was signed between Textron Lycoming and EPA, Region III.

2.2 Location

The Textron Lycoming facility is located in the western portion of Williamsport in Lycoming County, Pennsylvania (Figure 2-1). The facility is located on approximately 28 acres bordered by a residential neighborhood that also contains some light industry.

The first buildings on the property were constructed around the turn of the century. The facility operations centered on the manufacturing of aircraft engines. The plant also produced automobile engines, sewing machines, sand paper and silk. Presently, activities consists of manufacturing, electroplating, parts manufacturing, engine cleaning, pre-manufacturing, and assembly of aircraft engines (The Chester Engineers, 1988). Figure 2-2 shows the plans property.

Figure 2-1
Site Location Map
Textron Lycoming
Williamsport, Pennsylvania



Source: USGS 7.5 Min. Topographic Quadrangle; Williamsport, PA

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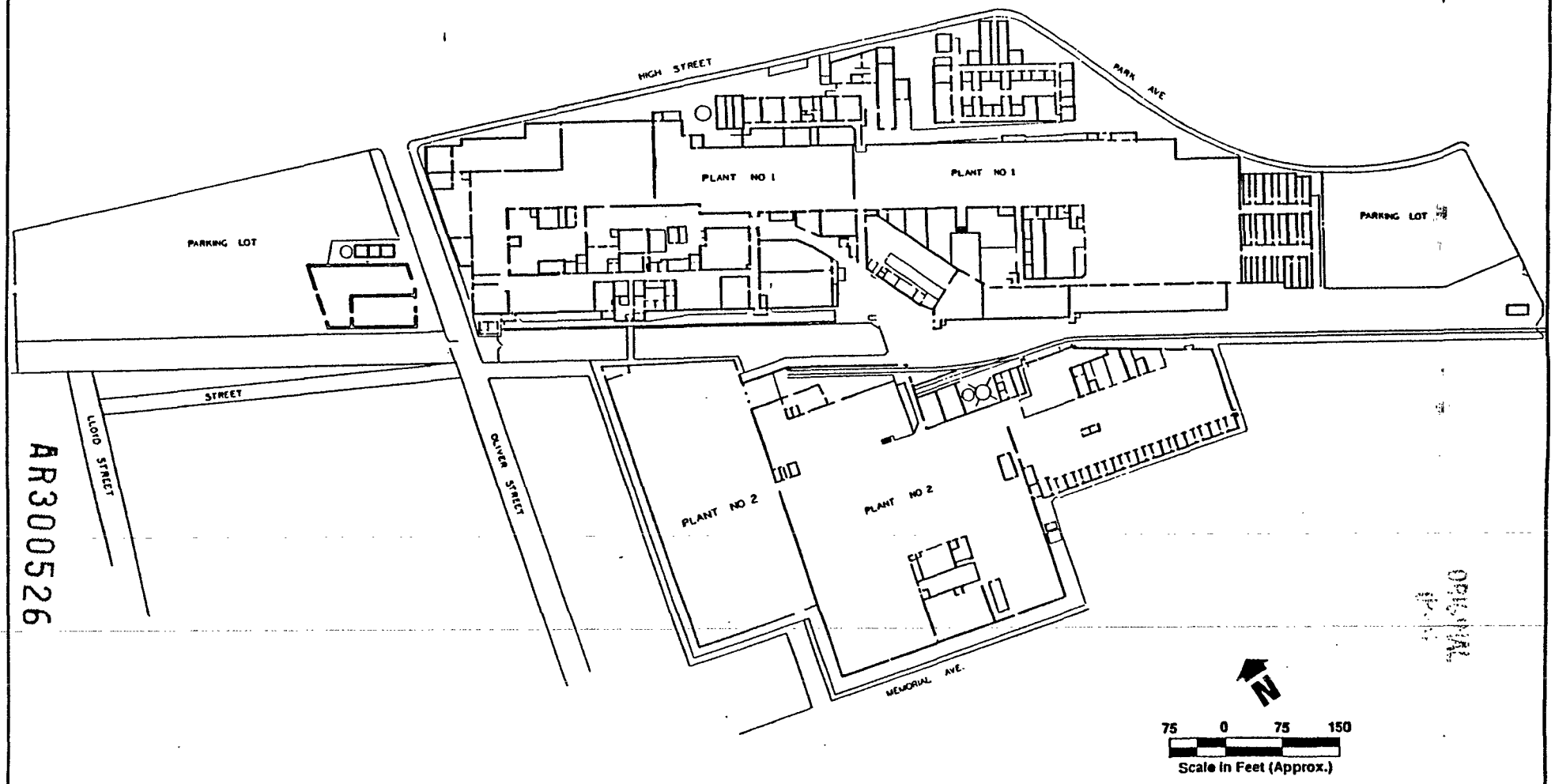
Figure 2-2
Site Map
Textron Lycoming
Williamsport, Pennsylvania



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WO#	Drawn by / Date:	Checked by / Date:	Notes:	The ERM Group
72303	MEW 1/18/89	B. DIESI 1/18/89		
	Revised by / Date:	Checked by / Date:		

SECTION 3

SUMMARY OF FIELD INVESTIGATION TASKS
TEXTRON LYCOMING RI/FS

TASKS	DESCRIPTION
Soil borings and sampling (up to 20 locations)	split spoon samples taken ahead of the drill bit
Surficial water and sediment sampling	samples will be taken upstream and downstream from the Oliver Street and Cemetary Run storm sewer outfall, and from Lycoming Creek
	obtain surface water elevations and establish reference point
Biota Inventory	verify USFWS identified wetlands and determine approximate wetland boundaries
	take sediment sample from each benthic macroinverte-brate station established in Lycoming Creek
Bedrock well installation and coring	Subcontractor will

(at 5 locations)	install the wells using a variety of drilling methods ERM on-site geologist will supervise well installation All drilling equipment will be decontaminated with a high-pressure water cleaner prior to the initiation of the drilling between boring locations, and prior to leaving the facility
Quarterly Ground water sampling (up to 33 locations)	quarterly RI ground water sampling by PADER instruction at 33 monitor wells
RI/FS Ground water sampling (up to 16 locations)	TCL sampling for RI/FS activities; sampling will be done on the 5 proposed bedrock wells, 5 existing bedrock wells, and the 6 wells located in the shallow aquifer
Slug tests	define hydraulic properties of the bedrock aquifer

Air Sampling (if a Phase II is requested)	Ambient air sampling for volatile organic compounds at one location upwind and four locations downwind of the site

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SECTION 4

HEALTH AND SAFETY HAZARDS

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Table 4-1 lists chemical compounds which may be present during RI/FS activities. The compounds listed have been chosen to produce a framework for the development of this Health and Safety Plan. Historically, trichloroethylene (TCE) and 1,2-trans-dichloroethylene and chromium have been considered the primary contaminants of concern. They will continue to serve as indicator compounds used in the development of the action levels found in Section 5.

Although certain compounds have been chosen as indicators, other contaminants are present on site. Table 4-2 lists additional compounds not included in Table 4-1 that have been detected on site based on historical analytical data.

Table 4-3 lists potential health and safety hazards that may be encountered due to the tasks to be performed. This list has been compiled based on scheduled activities and potential site conditions.

TABLE 4-1

POTENTIAL SITE COMPOUNDS AND ASSOCIATED EXPOSURE INFORMATION

Compound	CAS	TLV/PEL	Characteristics	Route of Exposure	Symptoms of Overexposure	Target Compounds
Chromium	7440-47-3	0.05 mg/m3	Appearance and odor may vary depending upon specific compounds	Inhalation Ingestion Contact	Respiratory irritation, skin and nasal septum ulceration	Respiratory system, skin
1,2-Trans-dichlorethylene	540-59-0	200 ppm	Colorless liquid with an ether-like, slightly aerid odor	Inhalation Ingestion Contact	Irritation to eyes, respiratory system, CNS depression	Respiratory system, eyes CNS
Trichloroethylene	79-01-6	50 ppm	Colorless liquid with a sweet odor like chloroform	Inhalation Ingestion Contact	Vertigo, tremors, nausea, vomitting, eye irritation, alteration in hearbeat	Respiratory system, heart, kidneys, CNS, skin
Vinyl Chloride	75-34-4	1 ppm	Colorless gas	Inhalation	Weakness, abdominal pain, GI bleeding, human carcinogen	Liver

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TABLE 4-2

TEXTRON LYCOMING ON-SITE CONSTITUENTS

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CONSTITUENTS	TLV
Acetone	750 ppm - 1,780 mg/m3
Benzene	1 ppm
Carbon Tetrachloride	5 ppm - 30 mg/m3
Chlorobenzene	75 ppm - 350 mg/m3
Chloroform	10 ppm - 50 mg/m3
1,1-Dichloroethane	200 ppm - 810 mg/m3
1,2-Dichloroethane	10 ppm - 50 mg/m3
1,1-Dichloroethylene	5 ppm - 20 mg/m3
1,2-Dichloroethylene	200 ppm - 790 mg/m3
Ethylbenzene	100 ppm - 435 mg/m3
Methylene Chloride	50 ppm - 175 mg/m3
Tetrachloroethylene	50 ppm - 335 mg/m3
1,1,1-Trichloroethylene	50 ppm - 270 mg/m3
Toluene	100 ppm - 375 mg/m3

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TABLE 4-3

HEALTH AND SAFETY HAZARDS

Hazard*	Description	Location	Procedure Used to Monitor/Reduce Hazard
Heavy Equipment	Drill Rigs, Machinery	Throughout Site	Personnel maintain eye contact with operators; hard hats, safety shoes, and eye protection worn (as appropriate) during equipment operation.
Overhead/Underground Utilities	Electrical, Sewer, Gas, Water	Throughout Site	Locate existing utilities prior to site operations. Design installation of additional utilities so that they do not interfere with site operations.
Refuse and Materials	Construction refuse and construction materials	Throughout Site	Maintain clean work areas; dispose of refuse immediately; do not block access routes with materials.
Heat Producing/ Electrical Equipment	Generators/Drill Rigs	Throughout Site	Operate equipment away from vegetation and other materials that may ignite. Maintain fire-fighting equipment in the vicinity of operating equipment.
Heat Stress/ Cold Exposure	Personnel working under extreme temperature are subject to adverse temperature-related effects	Throughout Site	Employ buddy system. Each worker is responsible for visually monitoring his/her partner for signs of heat stress/cold exposure. Site safety personnel will also monitor worker's conditions and establish work/rest regimens and recommend appropriate diet.
Chemical Exposure	Personnel can be exposed to various compounds associated with the site	Throughout Site	Follow guidelines in Safety Plan. Be familiar with signs and symptoms of exposure and first aid procedures. Report suspected over-exposure to supervisor immediately.

* Based on equipment or situations that can cause a hazard.

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SECTION 5

ACTION LEVELS

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Action levels have been established for activity cessation, site evaluation, emergency response, and the upgrade or downgrade in the level of personal protective equipment. Level D personal protective equipment as described in this plan will be permitted for those site operations that do not pose a potential threat of exposure to toxic or hazardous substances. Level C personal protective equipment, as described in the Plan, has been established as a minimum requirement during activities that involve any type of surface disturbance or exposure to subsurface media, i.e., drilling, soil sampling, surface and ground water sampling. Table 5-1 lists the action levels, airborne concentrations and the respective personal protection.

The following action levels are based on the Threshold Limit Values (TLV) for Trichloroethylene (TCE) and chromium as recommended by the American Conference of Governmental Industrial Hygienists (ACHGIH). These action levels, Table 5-1 (A), will be implemented provided that vinyl chloride gas is not present. Colorimetric indicator tubes will be used to determine the presence of vinyl chloride. Action levels specified in Table 5-2 (B) will be followed where vinyl chloride is detected. The ACGIH has established a 50 ppm TLV for TCE as an eight-hour time-weighted average. TCE is a primary contaminant of concern and has been detected in various media both on and off of site.

The ACGIH has established a 0.05 mg/m^3 TLV for water soluble Chromium (VI) as an eight-hour time-weighted average. Hexavalent chromium has been found to be a human carcinogen. Total Chromium has been detected only on the west side of the plant area. The

TABLE 5-1

ACTION LEVELS

Organic Vapor* Concentrations (ppm)	and/or	Dust/Particulate Concentrations (mg/m3)	Level of Personal Protection*
A. Vinyl chloride not present in breathing space			
Background to 25 ppm		Background to 0.05 mg/m^3	Level D (with outer boots and gloves for sampling), Tyvek and respiratory protection readily available
25 ppm to 250 ppm		0.05 mg/m^3 to 0.5 mg/m^3	Level C (with half-face respirator and organic vapor/dust cartridges)
250 ppm to 900 ppm		0.5 mg/m^3 to 2.5 mg/m^3	Level C (with full-face respirator and organic vapor/dust cartridges)
>900 ppm		>2.5 mg/m^3	Level B (with SCBA)
B. Vinyl Chloride present in breathing zone			
1 ppm			Level C (with full-face respirator and organic vapor/dust cartridges)
>1 ppm			Level B (with SCBA)

* Levels of personal protection may be modified based on site conditions. Modifications to levels of PPE will be made by the Site Safety Officer unless otherwise specified in this Plan (see Section 6)

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action levels based on dust and particulate concentration will be used during activities occuring in that area.

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SECTION 6

ANTICIPATED PERSONAL PROTECTIVE EQUIPMENT LEVELS FOR SITE ACTIVITIES

The levels of protection assigned for personnel performing each activity (below) represent the best estimate of anticipated exposure potential and protective equipment needed for that exposure. THE SITE SAFETY OFFICER WILL REVISE THOSE LEVELS OF PROTECTION BASED ON AIR MONITORING RESULTS AND ON-SITE ASSESSMENT OF ACTUAL EXPOSURES. See Attachment A for detailed description and discussion of personal protective equipment.

PHYSICAL SITE ACTIVITY	LOCATION	PERSONAL* PROTECTION REQUIRED
Installation of monitoring wells	Various areas	Modified Level C (with air purifying [a.p.] respirators readily available)
Performing ground Water Sampling	Monitoring wells	Modified Level C (with a.p. respirators readily available)
Soil boring and	Various areas	Modified Level C (with a.p. respirators readily available)
Surficial soil Sampling	Various areas	Modified Level C (with a.p. respirators readily available)

PHYSICAL SITE ACTIVITY	LOCATION	PERSONAL* PROTECTION REQUIRED
Surface water Sampling	Various locations	Level D with coveralls, outer boots, inner and outer gloves.

*Protective eyewear is required at all times when working at the plant. Hard hats and safety glasses are to be worn around drill rigs and other heavy machinery both on and off the plant property.

SECTION 7

MEDICAL MONITORING

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The following components must be included in the medical monitoring program required for on-site personnel, unless otherwise noted:

A. Medical History and Physical, including:

- Medical questionnaire
- Completion of medical history with occupational risk factor analysis
- Examination by physician
- Evaluation of test results
- Brief report sent to employer covering specific requested areas as well as pertinent positive findings; report sent to family physician and employee by request

B. Pulmonary Function Testing (FEV_1, FVC)

C. EKG (12-lead)

D. Lab tests, including:

- Urinalysis
- Blood "Chemzyme" Analysis (Chem 18)
- Coronary Risk Screen
- Complete Blood Count with differential

E. Audiometric testing - supervised by board-certified staff otolaryngologist

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F. Visual Acuity and Tonometry - supervised by board-certified staff ophthalmologist

Attachment B provides general information on medical monitoring. Subcontractor personnel will document their compliance with medical program requirements by completing the "Subcontractor Occupational Safety and Health Certification" form, Exhibit 7-1.

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EXHIBIT 7-1

SUBCONTRACTOR OCCUPATIONAL SAFETY AND HEALTH CERTIFICATION

PROJECT: _____

SUBCONTRACTOR: _____

1. Contractor certifies that the following personnel to be employed during the _____ have met the following requirements of the OSHA Hazardous Waste Operations Standard (29 CFR 1910.120) and other applicable OSHA standards, as required by ERM.

Subcontractor Personnel	Training	Respirator Certification	Medical Exam

2. Subcontractor certifies that it has received a copy of the Site Safety and Health Plan and will ensure that its employees are informed and will comply with its requirements.

3. Subcontractor further certifies that it has read and understands and will comply with all provisions of its contractual agreement

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SECTION 8

PERSONNEL TRAINING

At a minimum, all applicable employees must meet the training requirements specified in 29 CFR 1910.120 by having been trained in the areas listed below. ERM contractors and subcontractors must acknowledge their compliance to the training requirements by completing the form shown in Exhibit 7-1.

1. Safety and Health Officer and Site Management Responsibilities - personnel must understand Safety Officer and Site Management responsibilities and authority.

2. Site-Specific Health and Safety Hazards - personnel must be informed of specific hazards related to site and site operations.

3. Personal Protection Equipment (PPE) - personnel must be trained in proper use of personal protective equipment.

4. Safe Work Practices/Engineering Controls - personnel must be informed of appropriate work practices and engineering controls that will reduce the risk of exposure to site hazards.

5. Safety Equipment Use - personnel must understand the use of monitoring instruments and other safety equipment.

6. Medical Surveillance Program - personnel must be informed of requirements for medical surveillance of hazardous waste site employees.

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7. Site Controls Methods - personnel must understand site methods used to reduce exposure to on-site and off-site personnel.

8. Decontamination Procedures - personnel must be trained in proper emergency response operations and procedures.

10. Confined Space Entry/Special Hazards - personnel involved in specific hazardous activities, such as confined space entry and drum handling, must receive training in appropriate techniques to employ during such operations.

Subcontractor personnel will document their compliance with training and medical program requirements by completing the "Subcontractor Occupational Safety and Health Certification form, Exhibit 7-1.

A more detailed discussion of training requirements is included in Attachment C.

SECTION 9

SITE MONITORING

Field activities associated with the RI/FS may create potentially hazardous conditions, such as the release of hazardous substances into the breathing space. These substances may be in the form of vapors, dusts, or mists that can enter the body through ingestion, inhalation, absorption and direct contact. Monitoring of these substances will be performed to ensure appropriate personal protective measures are employed during site activities.

Explosive environments may be encountered during the course of any field investigation, particularly where any confined space conditions are encountered that allow for accumulation of gases or vapors. It is important to monitor for explosive environments prior to entry into confined spaces and/or when "hot work" is performed in any area where a build-up of flammable or explosive vapors can occur ("hot work" is defined as any operation that may provide a source of ignition). Monitoring for explosivity will be conducted periodically as necessary during subsurface activities (well installation, etc.) and prior to initiation of any "hot work" operations. Such monitoring will be conducted continuously whenever confined space conditions exist or as determined by information generated during site activities.

The following describes the monitoring parameters to be evaluated during the RI/FS. Recommended instruments to be used are also provided in the discussion. All instruments to be used during site activities will meet the established requirements set forth by OSHA, MSHA, NIOSH, and state agencies were applicable. Action levels based on monitoring results are discussed in the following section.

Organic Vapor Concentrations - will be monitored periodically in the breathing space with an organic vapor meter. Organic vapor concentrations will be used as action level criteria for upgrading or downgrading protective equipment and in implementing additional precautions or procedures. A backup organic vapor meter will be present throughout site activities in the event of an instrument malfunction. Colorimetric indicator tubes will be used initially and periodically to determine if vinyl chloride is present in the workers breathing zone.

Explosivity - will be monitored periodically during site activity. Measurements obtained from this instrument will be used as action level criteria for institution of additional precautions and protective equipment selection. An instrument capable of indicating the percentage of the lower explosive limit for substances present at the site will be utilized. Again, a backup or secondary meter will be available during site activities.

Dust and Particulate Concentrations - A real time air-borne particulate monitoring instrument will be used to monitor for dust and particulates within the breathing space in those areas where chromium has been detected in the soils.

All site monitoring will be conducted by or under the supervision of the Site Safety Officer. All readings obtained will be recorded in a dedicated site notebook by the Site Operation Manager and Site Safety Officer. The Site Safety Officer will maintain all monitoring instruments throughout the site investigation to ensure their reliability and proper operation.

SECTION 10

DECONTAMINATION

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10.1 General

Personnel involved with the Textron Lycoming investigative activities may be exposed to compounds in a number of ways, despite the most stringent protective procedures. Field personnel may come in contact with vapors, mists, or particulates in the air, or other media while performing field duties.

In general, decontamination involves scrubbing with a detergent/water solution followed by clean water rinses. All disposable items shall be disposed of in a dry container. Certain parts of contaminated respirators, such as harness assembles and leather or cloth components, are difficult to decontaminate. If grossly contaminated, they may have to be discarded. Rubber components can be soaked in detergent and water and scrubbed with a brush. In addition to being decontaminated, all respirators, non-disposable protective clothing, and other personal articles must be sanitized before they can be used again if they become soiled from exhalation, body oils, and perspiration. The manufacturer's instructions should be followed in sanitizing the respirator masks.

10.2 Minimum Decontamination Procedure

All work areas (i.e. drilling locations, soil sampling locations, etc.) will be setup such that a decontamination zone is established for personnel working in that area. Personnel leaving the work area will be required to follow the decontamination

ORIGINAL (Red)

procedures applicable to the level of personal protective equipment employed.

Personnel leaving the point of operations should wash outer gloves and boots whenever possible. At a minimum, the outer boots shall be removed first and stored in an appropriate area or properly disposed. Outer boots must be properly washed where gross contamination is evident. Personnel shall then remove the Tyvek coveralls so that inner clothing does not come in contact with any contaminated surfaces. After Tyvek removal, personnel shall remove the respirator, where applicable. Respirators shall be disinfected between use with towelettes or other sanitizing methods. A wash station, at a minimum, will be present so that field personnel can thoroughly wash hands and face after leaving the point of operations.

SECTION 11

ACCESS AND CONTROL

ORIGINAL (Red)

11.1 Access

Work site locations associated with Textron Lycoming RI/FS include areas both on and off the facility grounds. Access to those work areas within the plant property boundaries will be controlled by standard plant procedures. All personnel entering/leaving the facility will be required to pass through the security station at the west gate. Personnel will be required to sign-in and out with the plant guard.

Access inside all specific worksite locations (i.e. drilling locations, soil/ground water sampling location, etc.) during the RI/FS activities will be limited to trained, authorized personnel. This will include ERM employees, equipment operators, and designated client, state and/or federal agency representatives. Access into established exclusion zones or work areas will be limited to those authorized personnel wearing appropriate personal protective equipment. The exclusion zones will be cordoned off with flagging tape or other suitable indicators designating the exclusion zone boundary. The zones will also be monitored by the Site Safety Officer to ensure personnel do not enter without proper personal protection.

11.2 Control

The following procedures must be followed to ensure suitable control and limitation of access so that persons who may be

unaware of the conditions are not potentially exposed to internal hazards.

All excavations left open and unattended by field personnel will be appropriately barricaded and visibly posted with "Keep Out Danger" signs, warning flags, or other suitable signs. Well caps will be secured by suitable locking devices to prevent unauthorized access. All heavy machinery and equipment will be stored in a secured area upon completion of daily activities. Lastly, all potentially contaminated media, such as cuttings and soils, will be secured in an area to prevent tampering.

SECTION 12

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EMERGENCY RESPONSE

12.1 Notification of Site Emergencies

Medical personnel at Williamsport Hospital will be informed of the potential hazards and activities related to the RI/FS prior to project initiation so that emergency situations can be handled efficiently.

In the event of an emergency, field personnel will signal distress with three blasts from an appropriate horn (vehicle horn, air horn, etc.). All appropriate authorities will then be immediately notified of the nature and extent of the emergency.

Table 12-1 contains Emergency Response Telephone Numbers. This table will be maintained at all work stations by the Site Safety Officer, and will always be accessible to field personnel in case of an emergency.

12.2 Responsibilities

The Site Safety Officer will be responsible for responding to all emergencies. The Site Safety Officer will:

1. Notify appropriate individuals, authorities and/or health care facilities of the activities and hazards of the investigation.

2. Ensure that the following safety equipment is available at the site: eyewash station, first aid supplies, and fire extinguishers;

3. Have working knowledge of all safety equipment available at the site; and

4. Ensure that a map which details the most direct route to the nearest hospital is prominently posted with the emergency telephone numbers.

12.3 Accidents and Injuries

In the event of a safety or health emergency, appropriate emergency measures will immediately be taken to assist those who have been injured or exposed and to protect others from hazards. The Site Safety Officer will be immediately notified and will respond according to the seriousness of the injury. Personnel trained in First-Aid will be present during site activities to provide appropriate treatment of injuries or illnesses incurred during operations. The ERM Project Manager will be immediately informed of any serious injuries.

12.4 Communications

Telephones are available throughout the facility and can be used by personnel involved in on-site activity. Important plant phone numbers are listed on Table 12-1.

Two-way radios will be available for use during field activities to facilitate communications. Hand signals will be utilized where radios are impractical or unsafe. If possible, mobile phones will be present during the field activities for emergency response and

office communications. All ERM field vehicles used for the RI/FS are equipped with mobile phones. Public telephones will be located prior to the start-up of activities as back up to the mobile phones or as the primary off-site communication network.

12.4 Site to Hospital Directions

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The hospital nearest to the Textron Lycoming facility is Williamsport Hospital, located at 777 Rural Avenue. To get to the hospital, exit the Textron facility by making a right hand turn on to Oliver Street. Make a right at the light onto High Street. Follow High Street (approximately 1.5 miles) and make a left. Follow Walnut Street for one block. The emergency room is located on the left.

TABLE 12-1

EMERGENCY RESPONSE TELEPHONE NUMBERS

Agency	Address	Telephone No.
Environmental Resources Management, Inc.	855 Sprindale Drive Exton, PA 19341	(215) 524-3500
Williamsport Hospital	777 Rural Avenue Williamsport, PA	(717) 321-1000
Williamsport Fire Dept.		911 or (717) 327-7537
Williamsport Police Dept.		911 or (717) 323-8541
Lee Tressger Plant Environmental Engineer		(717) 327-7343
Anthony DiSalvo Plant Engineer		(717) 327-7923

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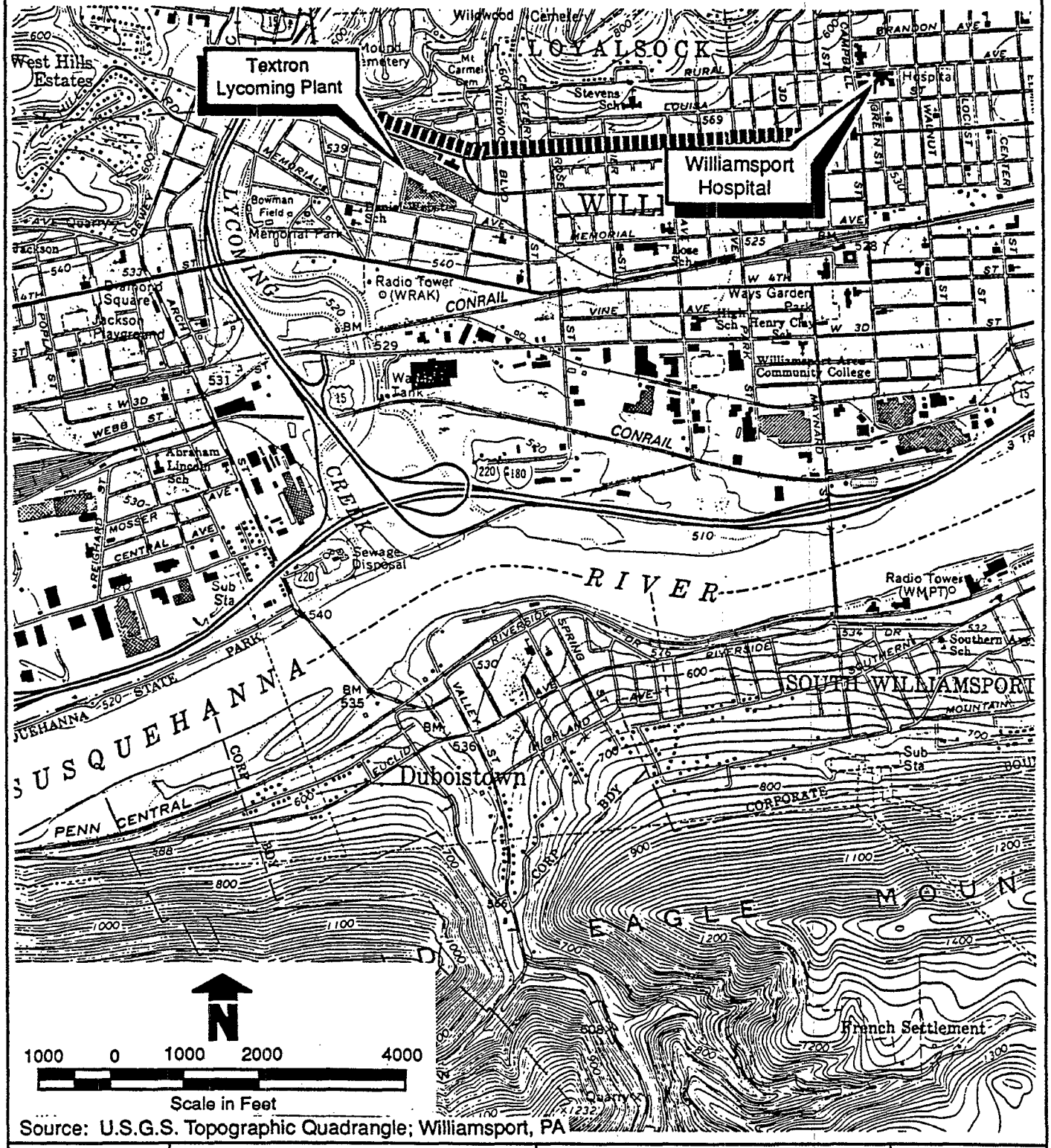
Figure 12-1
Hospital Route Map
Textron Lycoming
Williamsport, Pennsylvania



Source: U.S.G.S. Topographic Quadrangle; Williamsport, PA

WO#	Drawn by / Date:	Checked by / Date:	The ERM Group
72303	MEW 1/17/89	B DEST 1/17/89	
	Revised by / Date: MSS 4/27/89	Checked by / Date: L. Horne 4/27/89	

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SECTION 13

INCIDENT REPORTING PROCEDURE

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Adherence to this site-specific Health and Safety Plan and any additional facility safety rules and regulations will significantly reduce the likelihood of personnel being exposed to toxic substances above permissible exposure limits. However, in the event an incident does occur, it is imperative that specific reporting procedures be followed so that appropriate corrective action can be taken by the ERM Health and Safety (H&S) Manager and the ERM Project Manager. Upon notification of an incident, the ERM H&S Manager will contact the appropriate technical personnel for recommended medical diagnosis and, if necessary, treatment. The ERM Project Manager and the ERM H&S Manager will investigate facility/site conditions to determine: (1) whether and at what levels the incident actually occurred, (2) the cause of the incident, and (3) the means to prevent the incident from recurring.

An incident reporting form (Exhibit 13-1) has been developed so that consistent and appropriate information is obtained regarding employee exposures. The form will be completed by the ERM H&S Manager and the exposed individual. The form will be filed with the employee's medical and safety records to serve as documentation of the incident and the actions taken.

EXHIBIT 13-1

ENVIRONMENTAL RESOURCES MANAGEMENT
855 SPRINGDALE DRIVE
EXTON, PENNSYLVANIA 19341
215-524-3500

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ERM - INCIDENT REPORT FORM

CLIENT NAME:
DATE:

LOCATION OF INCIDENT:

EMPLOYEE:

TYPE OF INCIDENT:

EMPLOYEE JOB TITLE:

SPECIFIC JOB AT TIME OF INCIDENT:

LEVEL OF PROTECTION WORN AT TIME OF EXPOSURE:

SUMMARY OF WHAT OCCURRED:

ACTIONS TAKEN TO CORRECT SITUATION (Engineering, P.P.E., etc.):

EMPLOYEE SIGNATURE:

SITE SAFETY OFFICER:

ERM H&S COORDINATOR:

TIME & DATE OF REPORT:

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SECTION 14

SPECIAL PRECAUTIONS AND PROCEDURES

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The Textron Lycoming RI/FS poses potential exposure risks to both chemical and physical hazards. The chemical risks have been explained in detail in the previous sections. The potential for chemical exposure to hazardous substances is significantly reduced through the use of personal protective clothing, engineering controls, and implementation of safe work practices.

Other potential hazards that are associated with the field activities include working around heavy equipment, heat stress, and cold exposure. Precautionary measures have been established to reduce these risks to a minimum during field activities.

14.1 Heat Stress or Cold Exposure

The timing of this project may be such that heat stress or cold exposure may pose a threat to the health and safety of site personnel. Work/rest regimens will be employed as necessary so that personnel do not suffer adverse effects from heat stress or cold exposure. Special clothing and an appropriate diet and fluid intake will be recommended to all field personnel to further reduce these temperature-related hazards. The work/rest regimens will be developed following the guidelines in the ACGIH, Threshold Limit Values and Biological Exposure Indices for 1987-1988.

14.2 Heavy Machinery/Equipment

All ERM employees must remain aware of those site activities that involve the use of heavy equipment and machinery. Respiratory

protection and protective eyewear may be worn frequently during field activities. Protective eyewear is required at all times when working at the plant. This protective equipment significantly reduces peripheral vision of the wearer. Therefore, it is essential that all employees at the site exercise extreme caution during operation of equipment and machinery to avoid physical injury to themselves or others.

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14.3 Additional Safety Practices

The following are important safety precautions which will be enforced during this investigation:

1. Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated as contaminated.

2. Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking, or any other activity.

3. Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.

4. No excessive facial hair which interferes with the effectiveness of a respirator will be permitted on personnel required to wear respiratory protection equipment. The respirator must seal against the face so that the wearer receives air only through the air purifying cartridges attached to the respirator. Fit testing shall be performed prior to respirator use to ensure a proper seal is obtained by the wearer.

ORIGINAL (Red)

5. Contact with potentially contaminated surfaces should be avoided whenever possible. One should not walk through puddles, mud, or other discolored surfaces; kneel on ground; lean, sit or place equipment on drums, containers, vehicles, or the ground.

6. Medicine and alcohol can potentiate the effect from exposure to certain compounds. Prescribed drugs and alcoholic beverages should not be consumed by personnel involved in field activities.

7. Personnel and equipment in the work areas should be minimized, consistent with effective site operations.

8. Work areas for various operational activities should be established.

9. Procedures for leaving the work area must be planned and implemented prior to going to the site. Work areas and decontamination procedures must be established on the basis of prevailing site conditions.

10. Respirators will be issued for the exclusive use of one worker and will be cleaned and disinfected after each use by the worker.

11. Safety gloves and boots shall be taped to the disposable, chemical-protective suits as necessary.

12. All unsafe equipment left unattended will be identified by a "DANGER, DO NOT OPERATE" tag.

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13. Noise mufflers or ear plugs may be required for all site personnel working around heavy equipment. This requirement will be at the discretion of the Site Safety Officer. Disposable, form-fitting plus are preferred.

14. Cartridges for air-purifying respirators in use will be changed daily at a minimum.

15. Self-contained breathing apparatus (SCBA) and air-purifying respirators will be inspected daily by the Site Safety Officer.

16. All activities in the exclusion zone will be conducted using the "Buddy System". The Buddy is another worker fully dressed in the appropriate PPE, who can perform the following activities:

- Provide his/her partner with assistance;
- Observe his/her partner for signs of chemical or heat exposure;
- Periodically check the integrity of his/her partner's PPE; and
- Notify others if emergency help is needed.

ATTACHMENT A

PERSONAL PROTECTIVE EQUIPMENT

ORIGINAL (Red)

A.1 Protective Equipment

All personnel must be provided with appropriate personal safety equipment and protective clothing. Each individual will be properly trained in the use of this safety equipment before the start of field activities. Safety equipment and protective clothing will be cleaned and maintained in proper condition by project personnel. The Site Safety Officer will monitor the maintenance of personnel protective equipment to ensure proper procedures are followed.

Personal protective equipment will be worn at all times, as designated by the Health and Safety Plan. Levels of protective clothing and equipment have been assigned to specific work tasks.

The personal protective equipment levels designated below are in conformance with EPA criteria for Level C, and D protection. All respiratory protective equipment used will be approved by NIOSH/MSHA.

A.2 Level C Protection

A. Full-face or half-face air purifying respirator equipped with appropriate organic vapor/dust canisters or cartridges.

B. Chemical-resistant clothing such as Tyvek®, Poly-coated Tyvek® or Saranex®'. Suits will be one piece with hoods, booties and elastic wrist bands.

C. Outer nitrile gloves and inner latex surgical gloves.

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D. Leather boots with rubber overboots.

E. Options as required:

1. Coveralls
2. Disposable outer boots
3. Escape mask
4. Hard hat
5. Face shield
6. Hearing protection
7. Safety glasses
8. Water-resistent tape

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A.3 Level D Protection

A. Coveralls or long sleeve shirts and long pants.

B. Outer nitrile gloves at a minimum for all material handling activities. Inner latex surgical gloves are recommended where practical.

C. Leather boots with rubber outerboots.

D. Level C protection readily available.

E. Options as required:

1. Disposable outer boots
2. Hard hat
3. Safety glasses
4. Hearing protection
5. Chemical-resistant gloves

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ATTACHMENT B

MEDICAL MONITORING

The Occupational Safety and Health Administration (OSHA) has established requirements for a medical surveillance program designed to monitor and reduce health risks for employees potentially exposed to hazardous materials (29 CFR 1910.120). This program has been designed to provide baseline medical data for each employee involved in hazardous waste operations including field activities, and to determine his/her ability to wear personal protective equipment, such as chemical resistant clothing and respirators. Employees who wear or may wear respiratory protection must be provided respirator as regulated by 29 CFR 1910.134. This standard requires that an individual's ability to wear respiratory protection be medically certified before he/she performs designated duties. Where medical requirements of 29 CFR 1910.120 overlap those of 29 CFR 1910.134, the most stringent of the two will be enforced.

The medical examinations must be administered on a pre-employment and annual basis and as warranted by symptoms of exposure or specialized activities. These examinations shall be provided by employers without cost or loss of pay to the employee. For the purposes of this Health and Safety Plan, all subcontractors shall assume the employer's responsibility in obtaining the necessary medical monitoring and training for their employees pursuant to this section of 29 CFR 1910.120.

The examining physician is required to make a report to the employer of any medical condition which would place such employees at increased risk of wearing a respirator or other personal protective equipment. Each employers engaged in site work shall assume the responsibility of maintaining site personnel medical

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records as regulated by 29 CFR 1910.120 where applicable. Exemption from the medical surveillance program may be allowed by the ERM Manager of Safety and Health or his designee. These exemptions will be based on his interpretation of the requirements of 1910.120 relative to each individual exemption request.

All employees contracted to work at the site designated by this Plan will be responsible to insure their employees have received the proper medical tests as regulated by 29 CFR 1910.120 and shall provide the contractor with certification of same.

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ATTACHMENT C

PERSONNEL TRAINING

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Site personnel associated with those field activities in which the potential for exposure to hazardous substances above the PEL exists will be required to participate in a health and safety training program that complies with criteria set forth by ERM and OSHA as per interim final regulation 29 CFR 1910.120. This program will instruct employees on general health and safety principles and procedures, proper operation of monitoring instruments, and use of personal protective equipment.

In addition, site employees will undergo site-specific training prior to the start-up of any given project or task. As activities change at a particular site, related training will address potential hazards and associated risks, site operating procedures, emergency response and site control methods to be employed.

Specialized training will be provided as dictated by the nature of site activities. Specialized training will be provided for activities such as confined space entry, excavations and handling of unidentified substances. Employees involved in these types of activities will be given off-site instruction regarding the potential hazards involved with safety activities and the appropriate health and safety procedures to be followed. Off-site instruction is meant to include any area where employees will not be exposed to site hazards.

Site personnel involved in the field activities will have received the appropriate basic training plus additional specific training where needed. This Health and Safety Plan must be distributed to all subcontractors prior to the start of field activities. A pre-operation meeting will be held to discuss the contents of the

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Plan. Specialty training will be provided as determined by task and responsibility. All training of personnel will be conducted under direct supervision of a trained Health and Safety Officer.

Exemptions from training may be approved by the ERM Manager of Health and Safety or his designee.

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ATTACHMENT D

DECONTAMINATION

ORIGINAL (Red)

D.1 General

Personnel involved with hazardous material handling may be exposed to compounds in a number of ways, despite the most stringent protective procedures. Personnel may come in contact with vapors, gases, mists, or particulates in the air, or may come in contact with site media while performing work tasks. Use of monitoring instruments and equipment can also result in exposure to hazardous substances.

In general, decontamination involves scrubbing with a non-phosphate soap/water solution followed by clean water rinses. All disposable items will be disposed of in a dry container. Certain parts of contaminated respirators, such as harness assemblies and leather or cloth components, are difficult to decontaminate. If grossly contaminated, they may have to be discarded. Rubber components can be soaked in soap and water and scrubbed with a brush. In addition to being decontaminated, all respirators, non-disposable protective clothing, and other personal articles must be sanitized before they can be used again unless they are dedicated to specific individuals. The manufacturer's instructions should be followed in sanitizing the respirator masks. The Site Safety Officer will be responsible for supervising the proper protective equipment.

D.2 Standard PPE Decontamination

The Site Safety Officer will monitor decontamination procedures to ensure their effectiveness. Modifications of the decontamination

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procedure may be necessary as determined by the Site Safety Officer's observations.

Level C - Personal Protection Decontamination Procedure

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Step 1 -- Segregated Equipment Drop

Deposit equipment (tools, sampling devices, notes, monitoring instruments, radios, etc.) used on the site onto plastic drop cloths.

Step 2 -- Boot Covers and Glove Wash

Outer boot covers and outer gloves should be scrubbed with a decontamination solution of detergent and water.

Step 3 -- Rinse Off Boot Covers and Gloves

Decontamination solution should be rinsed off boot covers and gloves using generous amounts of water. Repeat as many times as necessary.

Step 4 -- Tape Removal

Remove tape from around boots and gloves and place into container with plastic liner.

Step 5 -- Boot Cover Removal

Remove disposable boot covers and place into container with plastic liner.

Step 6 -- Outer Glove Removal

Remove outer gloves and deposit in container with plastic liner.

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Step 7 -- Suit/Safety Boot Wash

Completely wash splash suite, gloves, and safety boots.

Step 8 -- Suit/Safety Boot Rinse

Thoroughly rinse off all decontamination solution from protective clothing.

Step 9 -- Removal of Safety Boots

Remove safety boots and deposit in container with a plastic liner.

Step 10 -- Splash Suit Removal

With care, remove splash suit. The exterior of the splash suit should not come in contact with any inner layers of clothing.

Step 11 -- Inner Glove Wash

The inner gloves should be washed with a mild decontamination solution (detergent/water).

Step 12 -- Inner Glove Rinse

Generously rinse inner gloves with water.

Step 13 -- Face Piece Removal

Without touching face with gloves, remove face piece. Deposit face piece into a container which has a plastic liner.

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Step 14 -- Inner Glove Removal

Remove inner glove and deposit in container with plastic liner.

Step 15 -- Field Wash

Wash hands and face thoroughly. If highly toxic, skin corrosive, or skin-absorbant materials are known or suspected to be present, take a shower.

Level D - Personal Protective Decontamination

The decontamination procedure for Level D personal protection will employ applicable steps detailed in the Level C decontamination process.

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ORIGINAL (Red)

MINIMUM MEASURES FOR LEVEL C DECONTAMINATION

Station 1:	Equipment Drop	1 Deposit equipment used on site (tools, sampling, devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces probability of cross contamination. During hot weather operations, cool down stations may be set up within this area.
Station 2:	Outer Garment, Boots, and Gloves Wash and Rinse	2 Scrub outer boots, outer gloves and chemical resistant splash suit with decon solution or detergent and water. Rinse off using copious amounts of water.
Station 3:	Outer Boot and Glove Removal	3 Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4:	Canister or Mask Change	4 If worker leaves Exclusion Zone to change canister (or mask) this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 5:	Boot, Gloves and Outer Garmet Removal	5 Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers line with plastic.
Station 6:	Face Piece Removal	6 Facepiece is removed. Avoid touching face with fingers. Facepiece deposited on plastic sheet.
Station 7:	Field Wash	7 Hands and face are thoroughly washed. Shower as soon as possible.

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ORIGINAL (Red)

MAXIMUM MEASURES FOR LEVEL C DECONTAMINATION

Station 1:	Segragated Equipment Drop	1	Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Segragation at the drop reduces the probability of cross-contamination. During hot weather operations, cool down stations may be set up within this area.
Station 2:	Boot Cover and Glove Wash	2	Scrub outer boot covers and gloves with docon solution or detergent and water.
Station 3:	Boot Cover and Glove Rinse	3	Rinse off decon solution from station 2 using copious amounts of water.
Station 4:	Tape Removal	4	Remove tape around boots and gloves and deposit in container with plastic liner
Station 5:	Boot Cover Removal	5	Remove boot covers and deposit in container with plastic liner.
Station 6:	Outer Glove Removal	6	Remove outer gloves and deposit in container with plastic liner.
Station 7:	Suit and Boot Wash	7	Wash splash suit, gloves, and safety boots. Scrub with long-handle scrub brush and decon solution.
Station 8:	Suit and Boot, and Glove Rinse	8	Rinse off decon solution using water. Repeat as many times as necessary.
Station 9:	Canister or Mark Change	9	If worker leaves exclusion zone to change air tank, this is the last step in the decontaminatic procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, and joints taped. Worker returns to duty.
Station 10:	Safety Boot Removal	10	Remove safety boots and deposit in container with plastic liner.
Station 11:	Splash Suit Removal	11	With assistance of helper, remove splash suit. Deposit in container with plastic liner.
Station 12:	Inner Glove Rinse	12	Wash inner gloves with decon solution.
Station 13:	Inner Glove Wash	13	Rinse inner gloves with water.
Station 14:	Face Piece Removal	14	Remove face piece. Deposit in container with plastic liner. Avoid touching face with fingers.
Station 15:	Inner Glove Removal	15	Remove inner gloves and deposit in container

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with liner.

Station 16:	Inner Clothing Removal	16 Remove clothing soaked with perspiration and place in lined container. Do not wear inner clothing off-site since there is a possibility that small amounts of contaminants might have been transferred in removing the fully-encapsulating suit.
Station 17:	Field Wash	17 Shower if highly toxic, skin-corrosive or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available.
Station 18:	Redress	18 Put on clean clothes.

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UNSCANNED ITEM(S)

ONE OR MORE OF THE FOLLOWING ITEMS MAY BE ASSOCIATED WITH THIS DOCUMENT:

PHOTOGRAPHS
DRAWINGS
OVERSIZED MAPS
ROLLED MAPS

PLEASE CONTACT THE CERCLA RECORDS CENTER TO VIEW THE ITEM(S)