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Volume I

Remedial Investigation and Feasibility Study Work Plan

MARTIN MARIETTA REDUCTION FACILITY
The Dalles, Oregon

Prepared for

MARTIN MARIETTA CORPORATION
Bethesda, Maryland

GERAGHTY & MILLER, INC.
GROUND-WATER CONSULTANTS

LANDMARK OFFICE CENTER
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GERAGHTY
& MILLER, INC.
Ground-Water Consultants

December 10, 1985

Ms. Norma Lewis
United States Environmental
Protection Agency Region 10
1200 Sixth Avenue
Seattle, Washington 98101

Dear Ms. Lewis:

We are pleased to transmit seven (7) copies of the RI/FS Work Plan and supporting documents for the Martin Marietta Reduction Facility at The Dalles, Oregon. These documents were prepared in accordance with the consent order entered into between Martin Marietta Corporation and the EPA Region 10 on September 12, 1985 (No. 1085-04-02-106).

I realize that the holidays are probably going to delay to some extent your review of these documents, and I would appreciate it if you would let me know of your expected date for commenting on the Work Plan. We will be glad to answer any questions you may have during your review, and we are prepared, as needed, to present the plan or to attend a review session at your convenience.

Sincerely,

GERAGHTY & MILLER, INC.

Jerry E. Kubal
Project Coordinator

Enclosures
cc: Mr. Jose R. Bou
Mr. John C. Peterson

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GERAGHTY & MILLER, INC.

WORK PLAN
REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
MARTIN MARIETTA REDUCTION FACILITY
THE DALLES, OREGON

Prepared for

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G&M Project No. T0487P01

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GERAGHTY & MILLER, INC.

TABLE OF CONTENTS

FIGURES

TABLES

ACRONYMS

ACL	Alternate concentration level
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980. Also known as "Superfund"
CRP	Community Relations Plan
CWA	Clean Water Act
CWEC	Century West Engineering Corporation
DEQ	State of Oregon, Department of Environmental Quality
DGWR	Dalles Ground-Water Reservoir
EPA	Environmental Protection Agency
FS	Feasibility Study
H&S	Health and Safety Plan
MMRF	Martin Marietta Reduction Facility
NCP	National Contingency Plan
NIOSH	National Institute for Occupational Safety and Health
NPDES	National Pollutant Discharge Elimination System
POTW	Publicly-owned Treatment Works
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
SDWA	Safe Drinking Water Act
TSCA	Toxic Substance Control Act
USDW	Underground Source of Drinking Water

SECTION 1.0

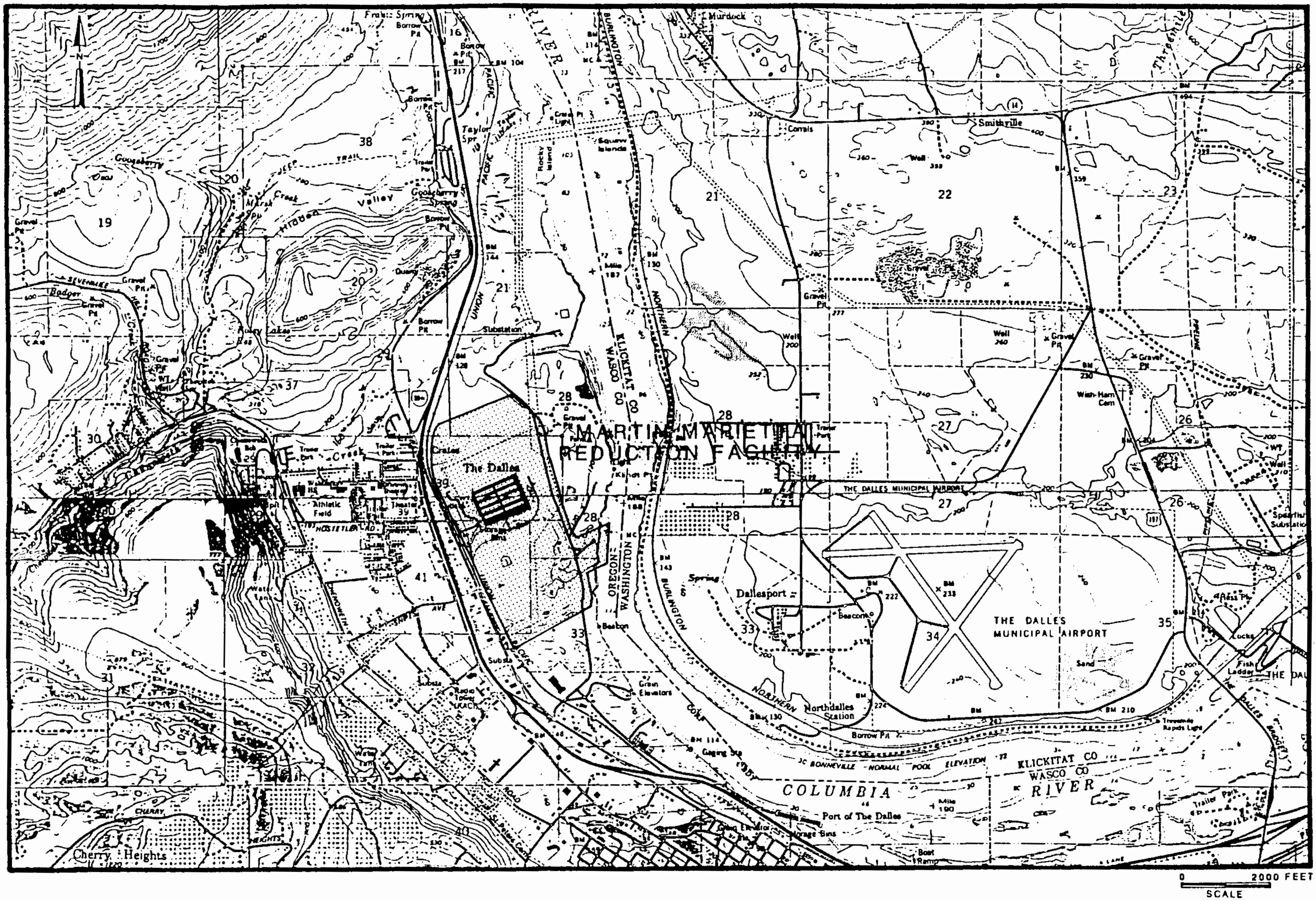

Figure 1.0-1. Topographic Vicinity Map, Martin Marietta Reduction Facility, The Dalles, Oregon.

1.0 WORK PLAN SUMMARY

This Work Plan has been prepared by Geraghty & Miller, Inc. (G&M) for a Remedial Investigation (RI) and Feasibility Study (FS) of the Martin Marietta Reduction Facility (MMRF) in Wasco County, The Dalles, Oregon (Figure 1.0-1).

The purpose of the Work Plan is to provide:

- o A detailed scope of work and technical approach to successfully complete the work assignment.
- o A detailed work breakdown and schedule to complete the work assignment.

The Work Plan contains the following sections:

- o Work Plan Summary;
- o Initial Site Evaluation;
- o Preliminary Assessment of Remedial Alternatives;
- o Remedial Investigation Scope of Work; and
- o Feasibility Study Scope of Work.

Also included in the Work Plan as technical appendices are the following items:

- o Quality Assurance Project Plan (including Chain of Custody);
- o Health and Safety Plan; and
- o Data Management Plan.

1.1 STUDY DESIGN

The overall design of the RI/FS recognizes the National Contingency Plan (NCP) requirements to determine the extent (level) of remedial action necessary while providing a cost-effective study which will produce timely results. Existing site-specific data and an understanding of the goals and objectives of the Superfund Program form the basis of the study presented in this Work Plan.

As directed by the Consent Order entered into between Martin Marietta and the EPA Region 10 (No. 1085-04-02-106), the present study will determine fully the nature and extent of the threat to public health, or to the public welfare, or to the environment caused by the release or threatened release of hazardous substances, pollutants or contaminants from the MMRF (Remedial Investigation); and, will evaluate alternatives for the appropriate extent of remedial action to prevent or mitigate the migration, the release or threatened release of hazardous substances, pollutants, or contaminants from the MMRF (Feasibility Study). The study shall accomplish these objectives by identifying and examining all areas where spent potliner waste has been deposited and by evaluating the soil, ground water, surface water, and air emissions at all areas on and adjacent to the MMRF site.

As directed by the Consent Order, the RI/FS Work Plan was to address the work effort herein described in two phases. Phase I would evaluate the area included within the monitoring activities being carried out by Martin Marietta as of April 1985, while Phase II would evaluate all areas on and adjacent to the site not addressed in Phase I. During a project planning meeting held with the EPA and DEQ following signing of the Consent Order, it was agreed that the phased separation of the study was unnecessary and that combining the two phases would result in a more cost effective and less time consuming investigation. Therefore, the RI/FS Work Plan presented herein includes all areas described in Phases I and II of the Consent Order.

1.2 OBJECTIVES OF THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (RI/FS)

The following objectives have been defined for the Remedial Investigation:

- o To determine the nature and the lateral and vertical extent of contaminant sources above and beneath the site surface;
- o To characterize, as necessary, the wastes in the various potential contaminant sources identified at the site;
- o To determine the presence or absence of contaminants in sediments, soils, and surface waters on and adjacent to the site;
- o To determine the presence or absence of contaminants in the various ground-water systems underlying the site;

- o To determine the types and nature of the geologic strata separating the water-bearing zones beneath the site; and
- o To assess the hydrogeologic properties of water-bearing zones beneath the site.

The following objectives have been defined for the Feasibility Study:

- o To identify preliminary remedial technologies appropriate for the site;
- o To recommend a cost-effective remedial alternative which effectively mitigates and minimizes damages to, and provides adequate protection of public health, welfare, or the environment; and
- o To prepare a conceptual design for the selected remedial action, unless the no-action alternative is selected.

1.3 SCOPE OF WORK

The RI and FS scope of work are described in Sections 4.0 and 5.0, respectively. This Work Plan establishes the scope of the MMRF site RI necessary to accomplish the objectives listed in the subsections above. The information obtained as a result of the RI will be the basis for the determination, evaluation, and recommendation of a cost-effective remedial alternative during the site FS. The final task of the Work Plan is the development of the conceptual design of the selected remedial action, unless the selected action is the no-action alternative.

The proposed RI/FS for the MMRF site has been divided into the following two project phases:

REMEDIAL INVESTIGATION

Initial Activities

Task 1.0 Project Initiation
Task 2.0 Initial Site Visit
Task 3.0 Existing Data Review
Task 4.0 Site Mapping

Site Investigation

Task 5.0 Waste Characterization
Task 6.0 Hydrogeologic Investigation
Task 7.0 Soils and Sediment Investigation
Task 8.0 Surface Water Investigation
Task 9.0 Air Investigation
Task 10.0 Interim Site Investigation Report

Reporting Requirements

Task 11.0 Monthly Reporting
Task 12.0 RI Report

FEASIBILITY STUDY

Statement of Objectives

Problem Characterization/General Response Actions

Task 1.0 Problem Characterization
Task 2.0 Identify General Response Actions

Preliminary Identification of Remedial Technologies

Task 3.0 Technology Identification
Task 4.0 Screening of Technologies

Development of Alternatives

Task 5.0 Development of Alternatives

Initial Screening of Alternatives

Task 6.0 Initial Alternative Screening

Detailed Evaluation of Remaining Alternatives

Task 7.0 Detailed Alternative Evaluation

Conceptual Design of the Recommended Alternative

Task 8.0 Conceptual Design

Reporting Requirements

Task 9.0 Monthly Reporting
Task 10.0 FS Report

1.4 SCHEDULE

The anticipated schedule for completion of the RI/FS for the MMRF site is presented in Figure 1.4-1. The implementation of this Work Plan is a dynamic process with activities performed during the RI and FS being interdependent. The RI emphasizes data collection and site characterization, whereas the FS emphasizes data analysis and decision making. Additional tasks not previously recognized at the conception of this Work Plan, or extensions of existing tasks, may be required. Therefore, the schedule will be revised to reflect any additions to, or deletions from, the tasks during implementation of this Work Plan.

FIGURE 1.4-1

PROPOSED RI/FS SCHEDULE
MARTIN MARIETTA ALUMINUM
THE DALLES, OREGON

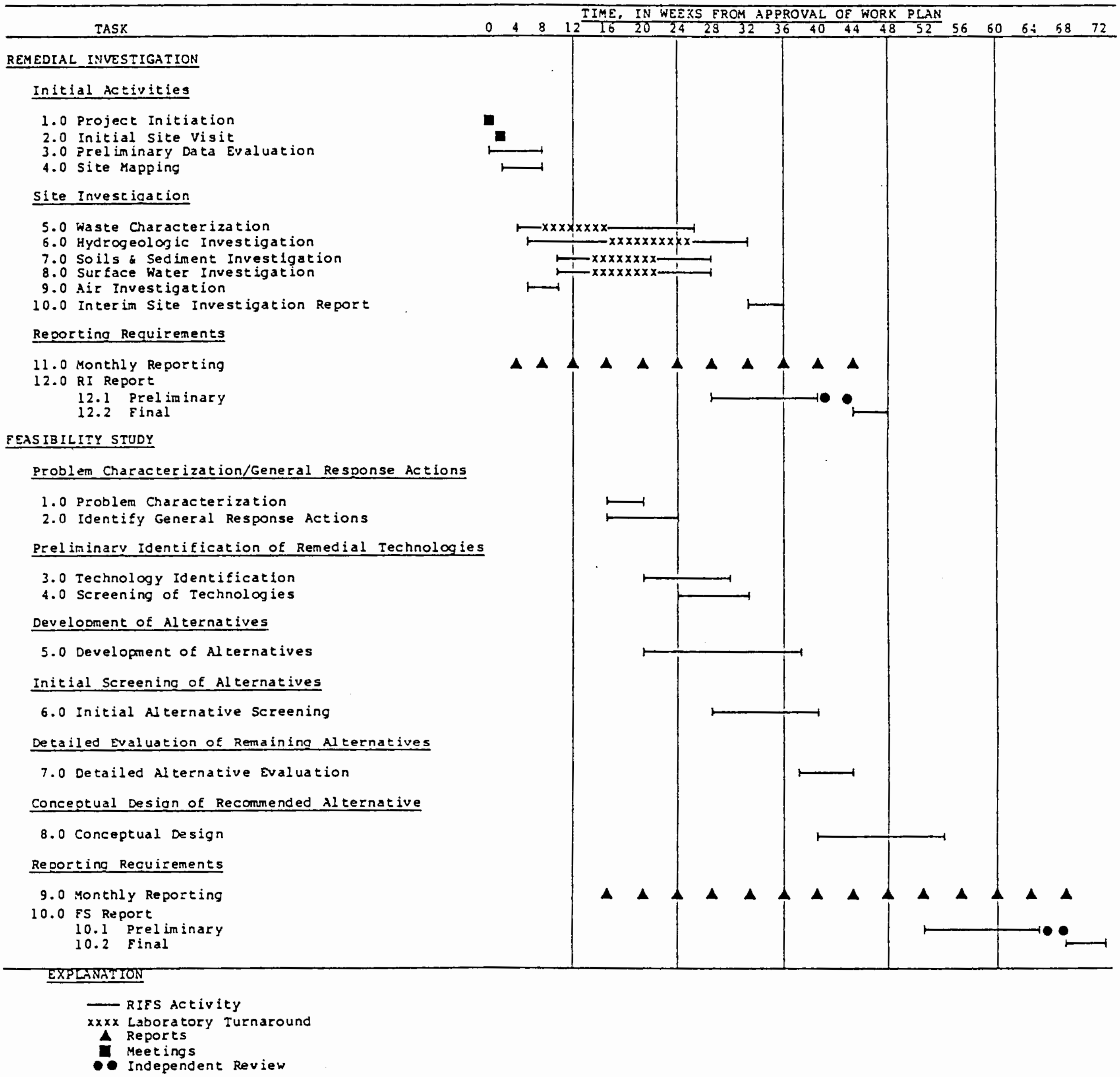

Figure 1.4-1. Project Schedule.

SECTION 2.0

2.0 INITIAL SITE EVALUATION

The initial site evaluation of the Martin Marietta Reduction Facility (MMRF) has been divided into four (4) areas consisting of:

- o Site description;
- o Problem definition;
- o Contaminant migration pathways; and
- o Initial remedial measures.

Site description includes discussion of site history, physical setting, geology and hydrogeology. Sections on waste generation, preliminary assessment of site contamination, and contaminant toxicity are included in problem definition. Contaminant migration discusses identifiable pathways and potential receptors. Initial remedial measures discusses activities to be implemented during the RI/FS.

2.1 SITE DESCRIPTION

2.1.1 Site History

Aluminum reduction operations at the site began in 1958 under the name of Harvey Aluminum. In 1968, Martin Marietta Corporation acquired an interest in the aluminum reduction facility, herein referred to as the Martin Marietta Reduction Facility (MMRF). The MMRF continued operation through December 1984 when the facility shut down.

The MMRF plant site consists of 300 aluminum reduction cells housed in five (5) production buildings. When at full production, MMRF produced approximately 90,000 tons of reduced aluminum annually. Aluminum was produced at the facility using the Hall-Heroult reduction process.

The MMRF Site consists of approximately 300 to 350 acres with 110 acres for the actual industrial process. Figure 2.1-1 shows the site and the approximate boundaries of the study area. The MMRF is located in The Dalles, Oregon, due in part to the abundance of electricity produced from The Dalles Dam located approximately five (5) miles upstream on the Columbia River.

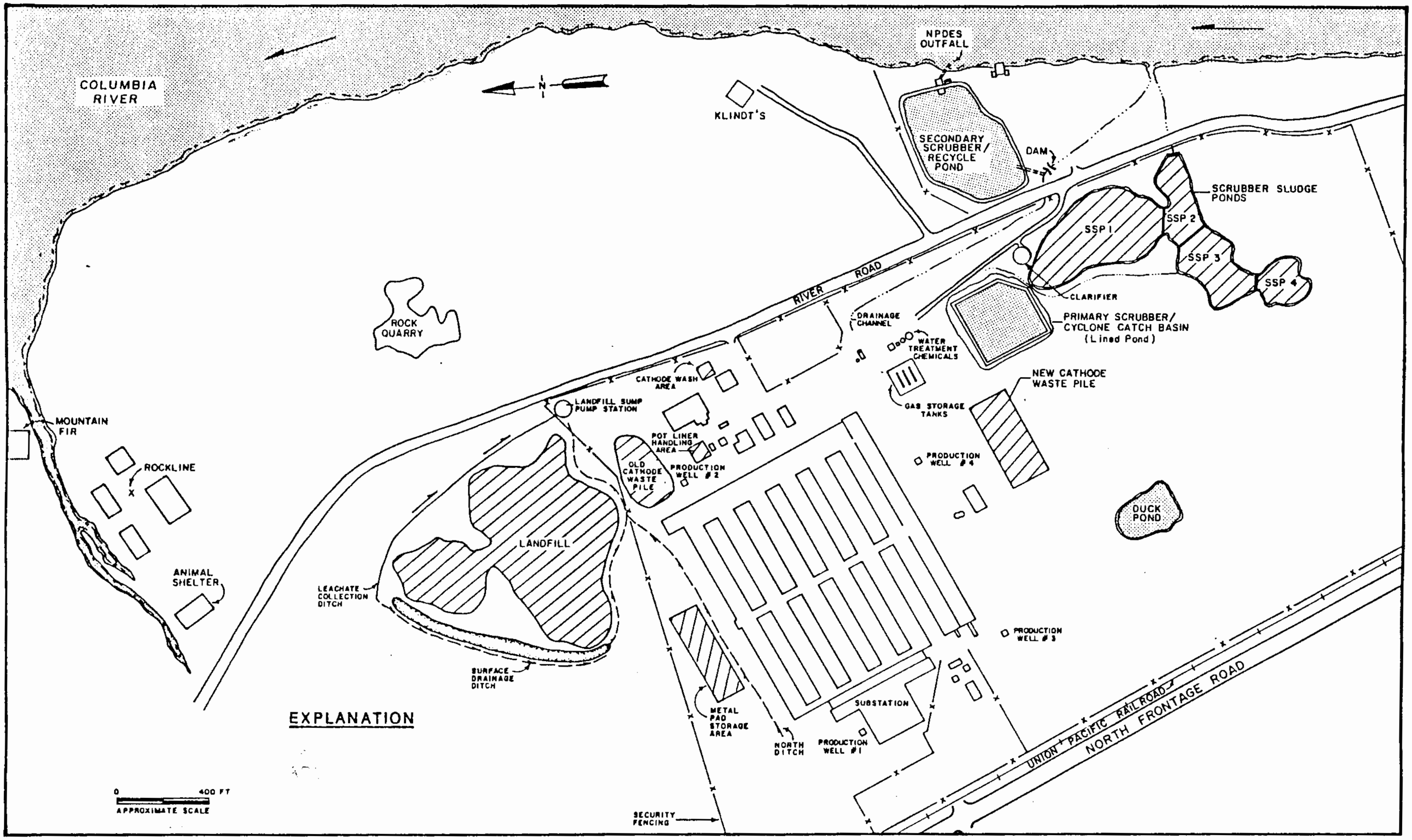

Figure 2.1-1. Approximate Study Area Boundaries.

2.1.2 Physical Setting

The MMRF is located approximately 2000 feet west of the Columbia River. The Columbia River is impounded behind the Bonneville Dam and has a normal pool elevation of 72 ft msl. Land surface elevations at the facility range from approximately 150 ft msl in the southwestern part to 130 ft msl in the northeastern part.

The site is located between Mill and Chenoweth Creeks, tributaries to the Columbia River. Mill Creek lies to the south of the site and has a length of over 20 miles. Mill Creek is a perennial stream which drains the Desuetes-Umtilla Plateau. The stream reportedly receives a component of baseflow from the ground-water system (Newcomb, 1969).

Chenoweth Creek lies to the north of the MMRF and is intermittent in all but its lowest reaches. Chenoweth Creek has a length of approximately 10 miles. The natural surface water drainage at the site is to Chenoweth Creek or directly to the Columbia River. The natural drainage system at the MMRF has been modified and stormwater runoff in the vicinity of the plant building is routed through a drainage channel to the recycle pond.

The Dalles has a semi-arid climate, transitional between the humid Cascade Range to the west and the arid regions to the east. Grady (1983) prepared an isohyetal map for the area which is reproduced as Figure 2.1-2. The average rainfall at The Dalles is approximately 14 inches per year, most of which (approximately 10 inches) occurs during the four-month period from November to February.

2.1.3 Geology

The geology and water resources of The Dalles, Oregon, has been the subject of several published investigations. Piper (1932) prepared an evaluation of the geology and ground-water resources of The Dalles region. Stanley (1959) defined the "Dalles Ground-Water Reservoir" (DGWR) and proclaimed The Dalles within a "critical ground-water area." Foxworthy and Bryant (1967) evaluated the potential to artifically recharge the DGWR. Newcomb (1969) defined the potential structural influence upon the ground-water flow system in the Columbia River Basalt Group. Grady (1983) described the ground-water resources of the Hood Basin, Oregon, including the The Dalles area.

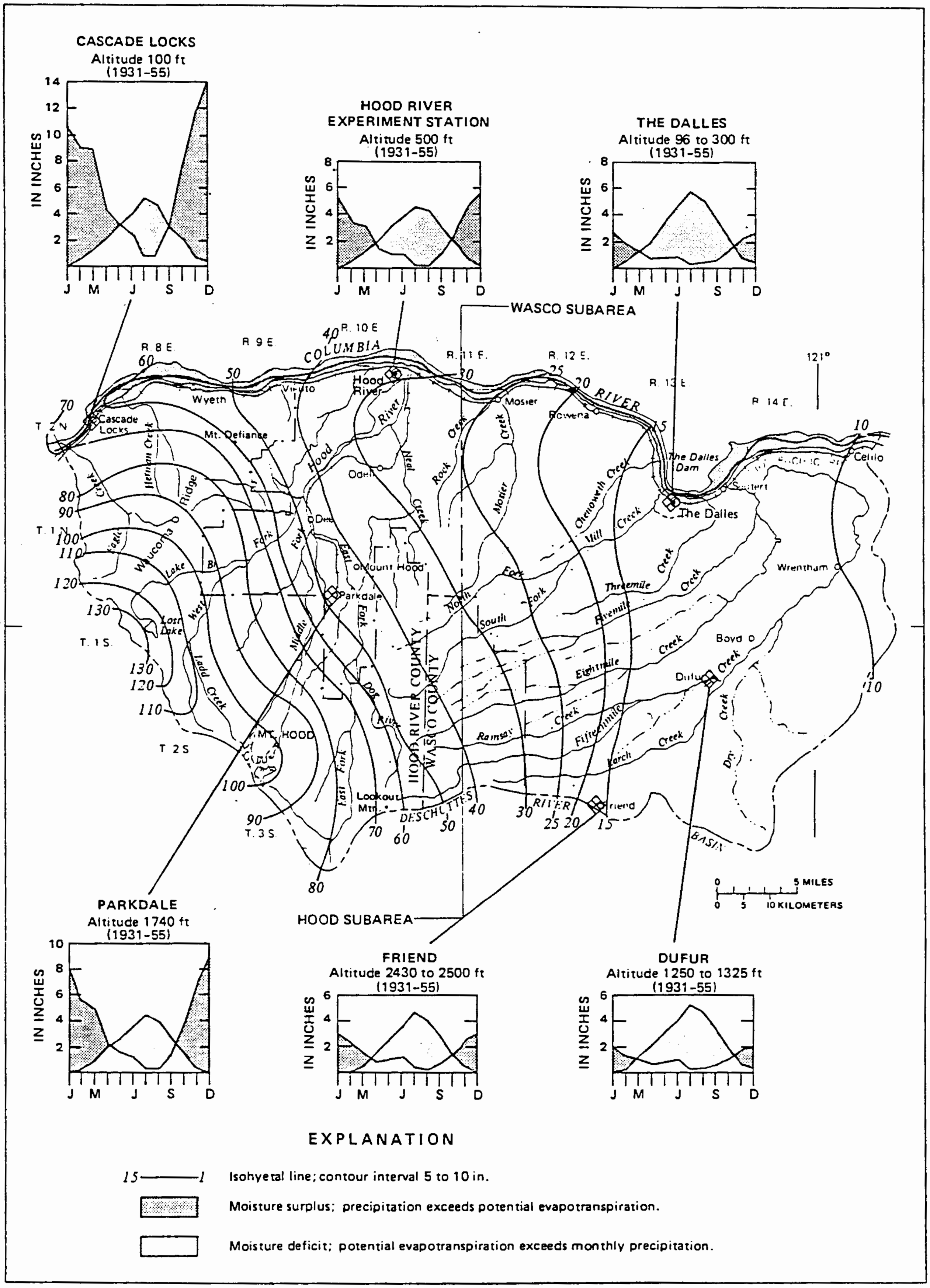

Figure 2.1-1. Isohyetal Map

The MMRF is located on the 150 ft terrace of the Holocene Columbia River (Piper, 1932). The terrace formed at the contact between the semi-consolidated, fragmental volcanogenic and sedimentary rocks of the Dalles Group and the more resistant rocks of the underlying Columbia River Basalt Group.

The Columbia River Basalt Group consists of multiple basalt flows separated by volcanoclastic, colluvial, and alluvial deposits, referred to as interflow zones. Generally, the individual basalt units are non-porphyritic and microgranular and are comprised of labradorite, augite, and magnetite with brownglass and tiny microlites (Newman, 1969). The thickness and character of the interflow zone materials are a function of the time period and geologic environment between flows.

The Columbia River Basalt Group is over 2,000 ft in thickness in the vicinity of the MMRF. The basalts are Miocene and Pliocene in age and apparently originated from volcanic vents located to the southeast of the study area. The flows range in thickness from 35 to over 100 ft, averaging about 80 ft (Piper, 1932).

The study area was deformed during Pliocene age, apparently by compressional tectonic forces. Several folds, both anticlinal and synclinal, are evident in the area. The Dalles syncline is the major fold within the general vicinity of the MMRF. Previous investigations have located the axis of the syncline in different locations. Newcomb (1969) identifies the axis of the Dalles syncline immediately west of and parallel to Mill Creek. Newcomb correlates The Dalles syncline with the broad syncline of the Umatilla Valley. Bela (1982) identifies the Dalles-Umatilla syncline to the west of the study area. The axis of an unnamed syncline, which may correlate to the Dalles syncline of Newcomb, is shown by Bela to pass immediately south of the MMRF.

Other major folds in the area include the Mosier syncline and the Ortley section of the Columbia Hills anticline to the north, the Tygh Ridge anticline to the south, and the Gordon Ridge anticline and the Grass Valley syncline to the east. The axis of the folds generally are oriented from west-southwest to east-northeast.

Several faults have been identified near the MMRF. The Chenoweth Fault (Newcomb, 1969) is present approximately 2 miles north of the site and trends approximately N70°E. Piper (1932) identifies the fault as a normal fault with the southern block downthrown along the segment west of the Columbia River. According to Piper, the displacement changes near the Columbia River and from there westward the northern block is downthrown. Bela (1982) divides the fault into a western high angle normal fault and an eastern thrust fault having a northward dipping axial plane. Bela also identifies several minor faults near the MMRF which trend approximately N60^{o}W.

Fracturing of the rock units in the area has occured during genesis of the rocks and due to tectonic stress. Columnar joints developed within the individual basalt flows during cooling. Piper (1932) reports that the resultant prisms have a transverse dimension of from 3 to 10 ft.

2.1.4 Hydrogeology

2.1.4.1 Regional Hydrogeology

The major regional aquifers represent horizons within the Columbia River Basalt Group capable of yielding significant quantities of water to a well. The total thickness of the water-bearing zones is a small percentage of the total thickness of the basalt group, estimated by Newcomb (1969) as between 2% and 5%. The intervening material consists of low permeability basalts and interflow zone materials.

For the purpose of water supply, the basalts between the water bearing zones have been assumed to be impermeable. The basalts generally have been fractured due to cooling and during formation of post genetic structures. The fracture density varies within the different flows and with relation to the proximity of structural features. The basalts do have a low permeability, especially as compared to that of the water-bearing zones. However, with regard to contaminant transport, the fracture permeability within the basalts may be significant locally.

The interflow zone material may be permeable or relatively impermeable dependent upon its nature. The three water supply aquifers identified at the site are most likely within permeable portions of interflow zones. Examples of low permeability interflow zone materials include tuffs, clays, and shales. These ductile deposits are less likely to fracture due to stress and are not fractured during genesis as are the basalts. These low permeability interflow zone materials may be effective confining units in the region.

2.1.4.2 Site Hydrogeology

Three aquifers have been identified below the MMRF including the Dalles Ground-Water Reservoir present at approximately 300 ft bls (feet below land surface). The DGWR is a source of municipal, industrial, and agricultural water supply and has been declared "a critical ground-water area" by the Oregon State Engineer (Stanley, 1959).

The site-specific ground-water occurrence and quality has been the subject of investigations performed by Century West Engineering Corporation (CWEC) of Bend, Oregon. The investigations were performed in order to comply with state and federal waste management regulations. As part of these investigations, a total of twenty-two monitor wells have been installed at the site under the supervision of CWEC.

Originally, CWEC identified five hydrologic units at the site: a perched zone, an "A" aquifer, a "B" aquifer, a "C" aquifer, and the Dalles Ground-Water Reservoir. Based on additional information from the on-going monitor well installation program, CWEC subsequently modified their interpretation to include only four units; the "B" aquifer and the "C" aquifer were combined due to similar hydrostatic heads and were subsequently called "the lower" or "B" aquifer.

The existing monitor wells are located at 11 well clusters (Figure 2.1-3). At clusters with multiple wells, separate casings were installed in a single borehole. The screened intervals are separated by bentonite slurry seals.

The existing monitor wells were installed in phases. Clusters 1, 2, and 3 were installed in August 1983 and provided initial information upon the site hydrogeology (Century West, 1983b). Clusters 4, 5, 6, and 7 were installed during April and May 1984 based on recommendations from DEQ (Century West, 1984). Clusters 8 and 9 were installed in October 1984; well 10A was installed in February 1985, and well 11D was installed in March 1985. The installation report for clusters 8, 9, 10, and 11 is not presently available.

The wells screen four hydrogeologic units as defined by CWEC. CWEC is preparing additional information on the construction of well clusters 8, 9, 10, and 11.

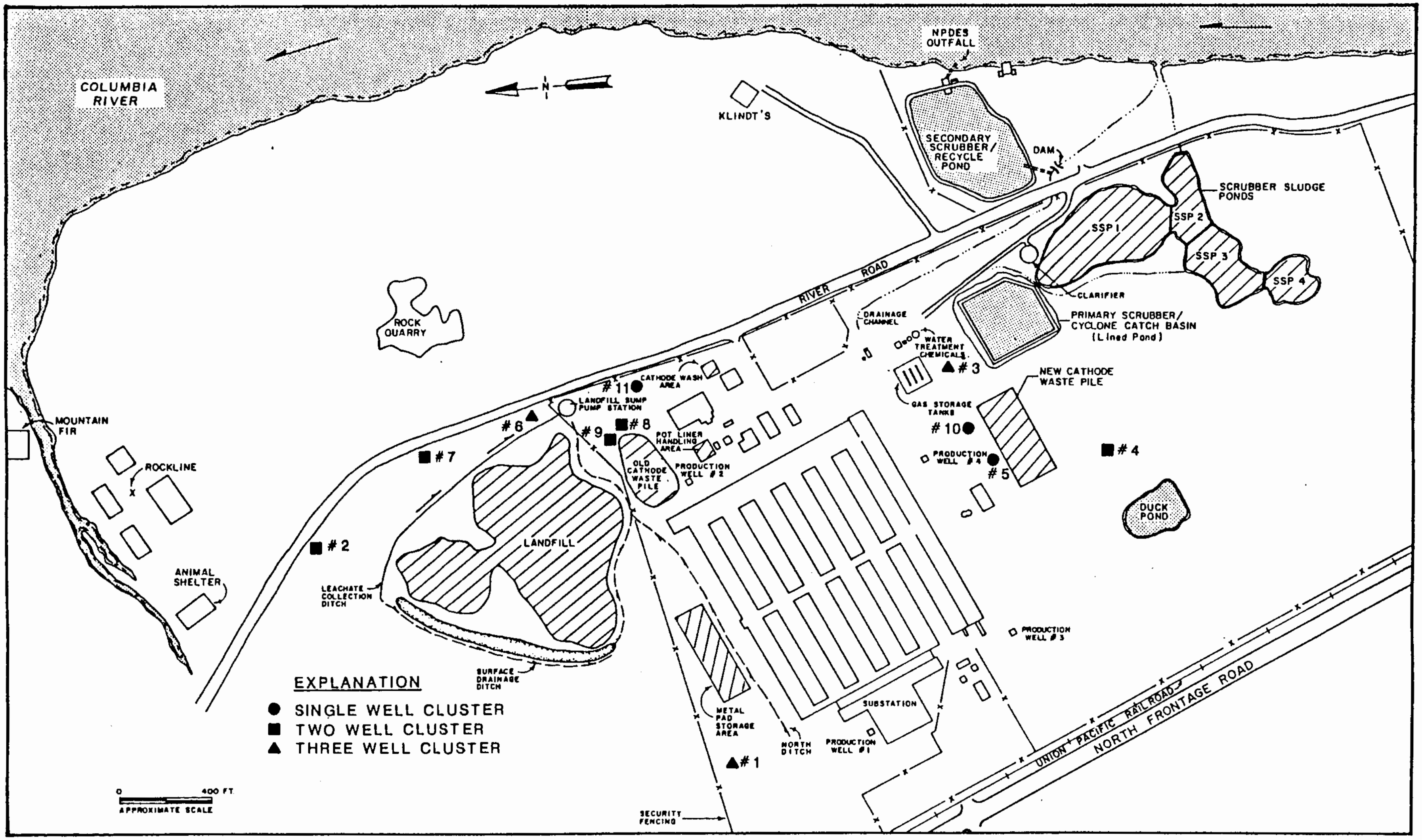

Figure 2.1-3. Location Map of Existing Wells.

Ground-water samples have been periodically collected from the existing wells to be analyzed for certain chemical parameters. Selected wells are sampled quarterly for indicator parameters, water-quality parameters, and drinking-water parameters. All wells are currently sampled bimonthly, previously monthly, for waste-specific parameters.

The chemical analyses reportedly show that waste constituents, including cyanide and fluoride, have entered the ground water at the site. The main body of affected ground water has been identified by CWEC within the "A" and "B" aquifers in the vicinity of the landfill and the old cathode waste pile.

During the course of the CWEC investigation, elevated levels of cyanide were detected within Martin Marietta's production well #2. CWEC identified the source of the cyanides as an improper annular seal and the well was abandoned by perforating the casing and presure grouting from total depth to land surface.

2.1.4.3 Nomenclature

Five major hydrogeologic units have been identified at the site. The hydrogeologic units are:

The water-table (fractured basalt) zone;

The "A" aquifer;

The "B" aquifer;

The lower confining unit, and;

The Dalles Ground-Water Reservoir (DGWR).

These units have been defined based upon the data generated by Century West (1984).

The results of the site investigation (Section 4.0) may provide additional information to refine this preliminary interpretation.

The Water-Table Zone

The water table at the site ranges in depth from approximately 40 ft to 100 ft bls. The water table apparently includes the "perched zone" identified by Century West (1984). In the vicinity of well 4S, the water table is present within a zone of moderate permeability, reportedly capable of yielding 1 gpm. The hydraulic gradient of the water table slopes to the northeast at an estimated .02 ft/ft. At the site of well 10A, the depth to the water table has increased and is present below the relatively permeable zone screened by well 4S. The water table at this location (well 10A) is apparently within the fractured, fairly low permeability basalt overlying the "A" aquifer. Further to the northeast and hydraulically downgradient, near clusters 8 and 9, the elevation of the water table drops sharply and appears to be within the "A" aquifer. The apparent cause of the sharp decline in the elevation of the water table in this area may be increased fracturing of the basalts resulting in enhanced vertical flow. The water-table zone is in apparent hydrogeologic communication with the underlying "A" aquifer. The distinction between zones is based upon permeability contrasts.

The "A" Aquifer

The "A" aquifer is the first unit below the site capable of supplying significant ground-water yields to wells, estimated at approximately 10 gpm. The "A" aquifer is present approximately 100 ft bls at an elevation of 30 to 50 ft msl. The aquifer reportedly averages about 10 ft in thickness.

The general ground-water flow direction within the "A" aquifer is from southwest to northeast. In the vicinity of the old cathode waste pile, a potentiometric low is evident. This low may be derived from increased fracture permeability in this area, thereby providing a preferential flow direction within the aquifer.

The nature and hydrogeologic characteristics of the materials separating the "A" and "B" aquifers have not been defined. However, there appears to be a 40 to 50 ft head difference between the "A" aquifer and the underlying "B" aquifer. The potentiometric head decreases with depth indicating a downward flow gradient. In the vicinity of the old cathode waste pile and the above referenced fracture zone, the head difference between these zones decreases to about 4 ft indicating enhanced vertical permeability in this area.

The "B" Aquifer

The "B" aquifer is reportedly present from about 150 to 180 ft bls (-20 to -50 ft msl). The "B" aquifer reportedly produces from 300 to 500 gpm. The static water level within the "B" aquifer is generally between 37 and 38 ft msl. The existing data base is not sufficient to determine the hydraulic gradient and direction of ground-water movement within the "B" aquifer. However, it is apparent that the gradient within the "B" zone is relatively flat, possibly reflecting the apparent high transmissivity of this unit.

The Lower Confining Unit

The lower confining unit underlies the "B" aquifer at the MMRF, separating the "B" aquifer from the underlying DGWR. Locally, the lower confining unit is comprised of 25 to 30 ft of low permeability interflow zone sediments, reportedly consisting of blue or green clay.

The Dalles Ground-Water Reservoir

The DGWR is a high capacity aquifer used as a municipal, industrial, and agricultural water supply. Numerous production wells tap the DGWR. The city of The Dalles water supply is supplemented by production wells within the DGWR. The Chenoweth Irrigation System and various orchards also utilize the aquifer as a water supply. Three production wells at the MMRF produce from the DGWR; a fourth well was abandoned due to the presence of cyanides, reportedly derived from an improper annular seal. This well (#2) was abandoned by perforating the casing and pressure grouting from total depth to land surface.

Piper (1932) identified the water-bearing potential of the aquifer, called by him "the lower water-bearing zone of the Yamika Basalt." Subsequent development caused a general decline in potentiometric head within area wells. As a result of these rapid water-level declines, the State Engineer defined the aquifer as "The Dalles Ground-Water Reservoir" placing it within a "critical ground-water area" (Stanley, 1959).

The DGWR covers an area of about 30 square miles and ranges from 10 to 25 ft in thickness (Newcomb, 1969). The aquifer is highly productive with reported specific capacities of up to 500 gal/min/ft of drawdown. The transmissivity of the aquifer is high and has been calculated at between 320,000 and 1,000,000 gal/day/ft (Foxworthy and Bryant, 1967).

The ground-water flow direction within the DGWR is poorly defined. Apparently, the original ground-water flow direction was from southwest to northeast, from areas of higher elevation toward the Columbia River. Ground-water withdrawals have since lowered the potentiometric head within the DGWR and the ground-water flow direction within the aquifer has been modified by these withdrawals.

2.2 PROBLEM DEFINITION

2.2.1 Waste Generation

Waste generation associated with the aluminum reduction process consisted of materials generated from the reduction cells, air emissions, water treatment and other activities which supported the manufacturing process. The following text discusses the aluminum reduction process and the operational units for waste management.

Hall-Heroult Reduction Process

The Hall-Heroult reduction process electrolytically reduces alumina in a molten bath of cryolite as illustrated in Figure 2.2-1. The following text is a brief description of this process.

The anode is made up of steel supports, aluminum bus bars, steel electrical contact studs with aluminum risers and the constant forming carbon anode normally referred to as the Vertical Stud Soderberg anode. The anode is sacrificed during the reduction process and consists of briquettes produced from a variable mixture of petroleum pitch and coke. The briquettes are formulated in a separate process plant and vary in pitch content from 20 to 35 percent. The reason for various pitch content depends on the need of the anode and to prevent cracking or softening.

The space between the anode and cathode is where the alumina reduction occurs. Alumina is added to form the crust above the cryolite and periodically added to the cryolite to be reduced to aluminum. This process occurs at between 950 to 1,000 degrees celsius. Aluminum settles to the bottom, being attracted to the cathode. Improper temperature can cause the cryolite bath and aluminum to invert and short circuit the process. Molten aluminum is siphoned out of all the cells approximately every other day and collectively transferred to the casthouse. In the casthouse, the aluminum

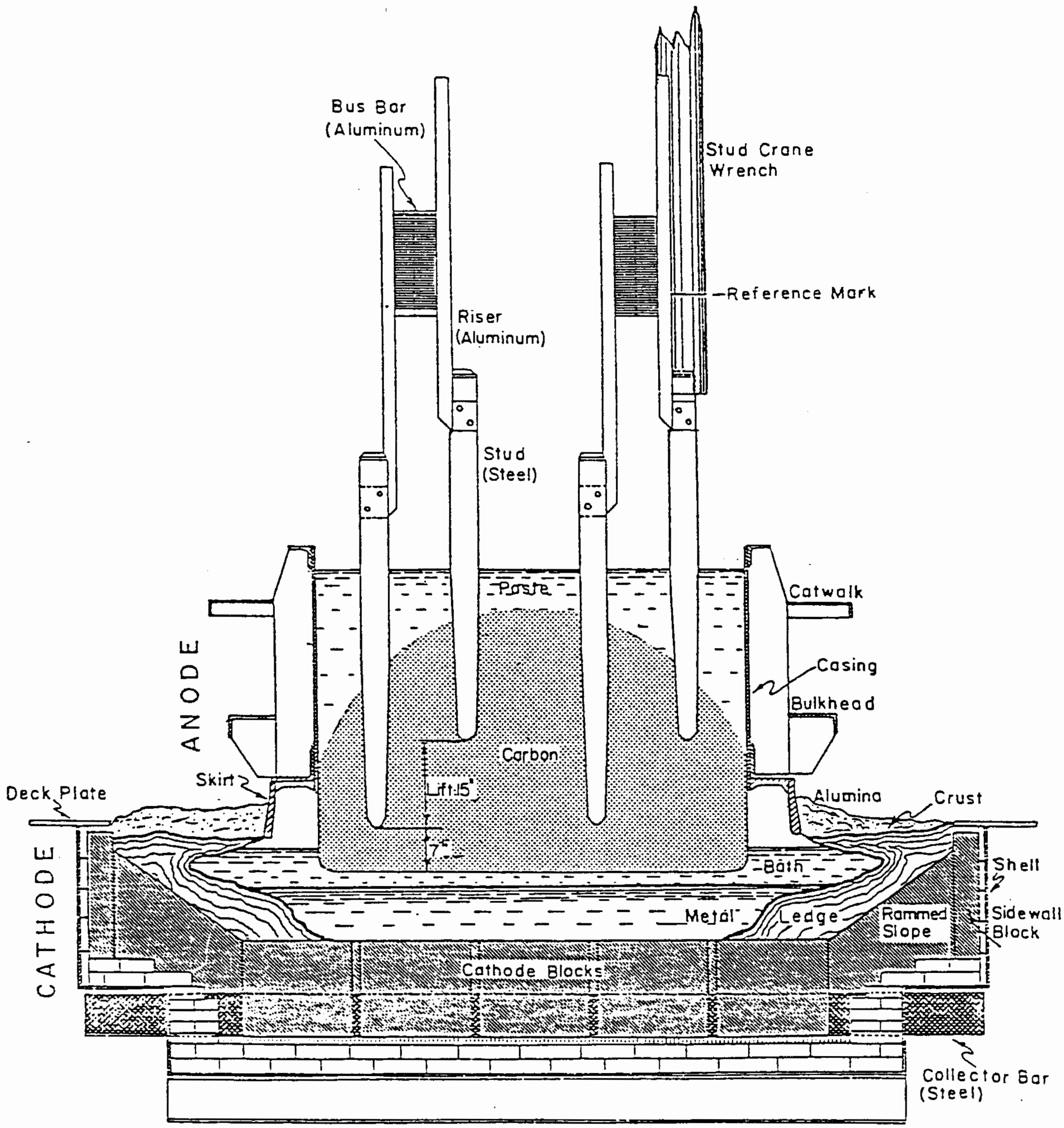

Figure 2.2-1. Alumina Reduction Process

is cast into various shapes and sizes as required by other manufacturers.

The cathode is made up of several members consisting of a steel shell, refractory bricks, transfer bar, carbon blocks, and carbon paste. Through the carbon blocks, a steel collector bar is placed to complete the electrical circuit. As the cathode ages, the seams between the carbon blocks erode and eventually molten aluminum contacts the collector bar. This event is identified by analyzing the molten aluminum for iron concentrations. Eventually, the iron concentration will be high enough to influence the aluminum properties and the reduction process must be stopped and the cathode replaced. The average cathode life is approximately five (5) years, which means on the average 60 cathodes were replaced annually at MMRF.

Management Areas

At the MMRF site, there are nine (9) areas that were used to specifically manage or store waste generated as part of the alumina reduction process. These areas include:

- Landfill;
- Old cathode waste pile;
- New cathode waste pile;
- Potliner handling area;
- Cathode wash area;
- Metal pad storage area;
- Primary scrubber/cyclone catch basin (Lined pond);
- Scrubber sludge ponds; and
- Secondary scrubber/recycle pond (Recycle pond);

The waste management areas are shown in Figure 2.2-2.

The landfill was started in 1958 initially receiving construction debris. Later it received spent refractory brick, asbestos, non-salvagable aluminum slag and skimmings, waste cathode material, metal drums, off-spec briquettes consisting of coke and pitch for the anode and old air emission control equipment and sludges. In the early 1970's,

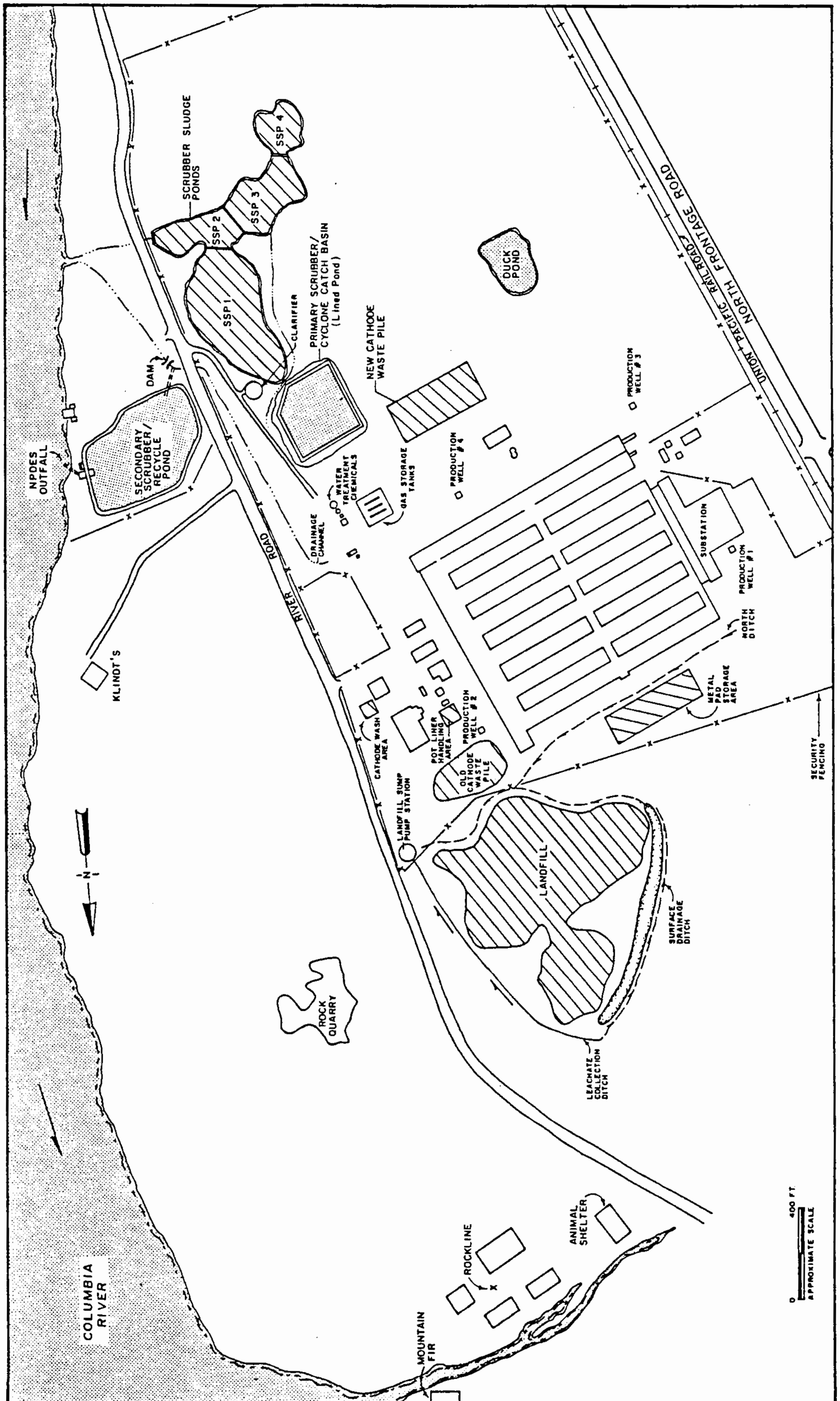

Figure 2.2-2. Location of Potential Contamination Sources.

the process of sending spent cathodes off-site discontinued and the landfill received a small quantity of spent cathode and bath materials, with the majority being stored in the old cathode waste pile area. The landfill consists of approximately 178,000 cubic yards of the above listed materials.

In an effort to control leachate from the landfill, a sump pump station was installed in the early 1980's, and leachate and surface water were collected and pumped to the discharge channel. In conjunction with the sump pump installation, ditches were excavated around the landfill to prevent runon and runoff, directing the flow to the sump pump station. The north ditch, which parallels the reduction process building, also contributes flows to the sump pump station.

From 1958 to 1972, spent waste cathode material was shipped off-site to Reynolds Aluminum in Longview, Washington. The old cathode waste pile was started after MMRF discontinued shipping spent cathodes off-site. Prior to being used as a cathode waste pile, the area was used for cathode washing prior to disassembly and relocation to the potliner handling area for off-site disposal. The spent potliner and associated materials were removed from the steel potliner shells. Metal pads and refractory brick were removed during the process and stored in the metal pad area or landfill, respectively. The spent potliner was stored in the old cathode waste pile. The storage of spent potliners in the old cathode waste pile was discontinued after the construction of the new cathode waste pile. The old cathode waste pile was moved to the new cathode waste pile in late 1984. The old cathode waste pile area was not lined and existed on top of fill material used to construct and level the MMRF site. In use for approximately 12 years (1972 to 1984), the old cathode waste pile covered an area of approximately two (2) acres.

The new cathode waste pile consists of approximately 80,000 tons of cathode waste from the old cathode waste pile. It is an engineered structure consisting of a reinforced concrete slab and retaining wall underlain by a single flexible membrane liner and leachate collection system. Since its construction and utilization in 1984, the concrete slab has developed stress cracks and contaminated leachate is currently being collected and treated. The pile is expected to be covered by late 1985 with a PVC flexible liner which will eliminate exposure of the waste cathode material to further precipitation and the volume of leachate should gradually decrease.

The potliner handling area was used extensively until approximately 1972 when MMRF discontinued shipping waste cathode material off-site. During this time, the steel potliner shells were disassembled in the area. Metal pads were removed and stored in their designated area and refractory bricks were separated and deposited in the landfill. The carbon blocks associated with the cathode were ground into approximately quarter-inch pieces for off-site disposal/recycling at Reynolds Aluminum in Longview, Washington. The method of transport was railroad hopper cars.

Softening of the cathode began in the early 1960's continuing until 1984 when the MMRF site discontinued production. This process consisted of quenching the spent cathodes continuously with water for several days. At least two (2) areas were used for this activity, the old waste cathode area prior to 1972 and the existing cathode wash area after 1972. Initially, the cathode wash area was not curbed and water left the area uncontrolled. Some time during its use, the cathode wash area was curbed and overland flow was directed via a surface-water ditch to the recycle pond.

During disassembly of the potliners for either off-site disposal or after softening, a slag commonly referred to as the metal pad was often produced which consisted of alumina, aluminum, and impurities not removed from the reduction cell prior to cathode replacement. Upon removing the metal pad, small amounts of spent cathode and bath which adhered to the pad were moved to the storage location until sufficient quantity justified recycling.

The lined pond was constructed in 1977 and utilized until plant shutdown in 1984. The construction of the lined pond consists of a single PVC flexible membrane liner with an approximate capacity of 4.0 million gallons, but currently contains approximately 2.6 million gallons of water and sludges. The lined pond received air emission control waste consisting of particulates from the dry cyclone scrubber and blowdown from the wet scrubber. The lined pond is an important operational management unit should be MMRF facility restart alumina reduction.

The scrubber sludge ponds were used starting in the mid-1960's. Wastes stored in ponds consists of primary air scrubber untreated and treated sludges, secondary air scrubber untreated and treated sludges, and dredging from the recycle pond. The scrubber ponds have been divided into four (4) sub-ponds consisting of the following approximate capacities:

- SSP1: 135,500 CY (cubic yards):
- SSP2: 48,400 CY
- SSP3: 90,300 CY; and
- SSP4: 15,700 CY.

SSP1 was constructed around 1972 to store solids from the clarifier resulting from treating scrubber waters. In 1981, SSP1 was closed and covered with one foot of soil and seeded with grasses. SSP2 and SSP3 were used as sedimentation basins from the mid-1960's until 1972 prior to the construction of the clarifier and SSP1. SSP2 and SSP3 use existing topographic features in the area and are separated by earthen dams. Dredging of SSP2 and approximately half of SSP3 occurred in 1977 and the dredged material was placed in SSP4. The ponds SSP2 and SSP3 were used as backup to the clarifier and SSP1 from 1972 until 1982. In 1982, the recycle and the lined pond solids were removed and deposited in SSP2 and SSP3. SSP4 only received the dredgings from SSP2 and SSP3 one time in 1977 and was capped in 1982 with 18 inches of soil. Since the construction of the scrubber sludge ponds occurred in topographic lows, during certain times of the year, water is present, which either evaporates or leaches through the sludges. Approximately 20 percent of the water from the current recycle system was treated by the clarifier from 1982 to late 1984 when MMRF shut down. Sludges from this process were disposed of in SSP2 and SSP3.

The recycle pond has been used as part of the treatment process for a number of years. Prior to MMRF implementing recycling of scrubber waters, the recycle pond was dredged in 1982 and sludges placed in SSP2 and/or SSP3. The recycle pond also receives water or treated leachate from the landfill, new cathode waste pile and surface runoff from the plant site. The recycle pond is an important operational management area should the MMRF facility restart alumina reduction.

2.2.2 Preliminary Assessment of Site Contamination

Waste storage at the MMRF has resulted in elevated levels of waste constituents, including cyanide and fluoride, within the soil and ground water at the site. Cyanide and other waste constituents have been identified within the aquifers present above the DGWR, primarily near the old cathode waste pile and the landfill.

Elevated levels of cyanide were reported in one of four production wells at the MMRF. Cyanides had been previously detected within shallower aquifers in the vicinity of the affected production well. The occurrence of cyanide within the production well was attributed to an improper annular seal and the well was subsequently abandoned. Free cyanides have not been reported above detection limits within the remaining production wells nor the DGWR monitor well (11D).

The primary source of potential contaminants at the MMRF appears to be spent potliner material. The occurrence and distribution of waste constituents at the site is related to the location of potliner storage and management areas. Analyses of leachate from the potliner material (Century West, 1985) have reported concentrations of 1,200 mg/l total cyanide and 300 mg/l free cyanide. The potliner may also contain elevated levels of fluoride. The concentrations of other waste constituents within the leachate from the spent potliner has not been well defined.

Table 2.2-1 presents the maximum and minimum concentrations of fluoride, total cyanide and free cyanide reported in water samples collected monthly from the period January 1985 through June 1985, inclusive. The analytical results show the general waste constituent generation potential of the spent potliner. The leachate collection system at the landfill (landfill sump, Leach 1, Leach 2, Leach 3, and Leach 4) reportedly contains up to 2.8 mg/l free cyanide, 162 mg/l total cyanide, and 5,400 mg/l fluoride. The samples from the leachate collection system at the new cathode waste pile (DT manhole) reportedly contain up to 13 mg/l free cyanide, 826 mg/l total cyanide and 2,400 mg/l fluoride.

The old cathode waste pile was a major source of the waste constituents found at the site prior to relocation of the potliner to the engineered storage facility (new cathode waste pile). The downgradient monitor wells at the old cathode waste pile (8A, 8B, 9A, and 9B) contain elevated levels of fluoride, total cyanide and free cyanide. For the

TABLE 2.2-1

RANGE IN CONCENTRATIONS OF SELECTED WASTE CONSTITUENTS
FROM WATER SAMPLES COLLECTED MONTHLY FROM
JANUARY THROUGH JUNE 1985 INCLUSIVE

SAMPLE ID	FLUORIDE mg/l		TOTAL CYANIDE mg/l		FREE CYANIDE mg/l	
	max	min	max	min	max	min
Well 1A	0.57	0.38	0.006	<0.001	0.002	<0.001
Well 1C	1.1	0.78	0.019	<0.001	0.001	<0.001
Well 2A	0.58	0.37	0.053	0.018	0.015	<0.001
Well 2B	0.97	0.68	0.773	0.471	0.054	0.004
Well 3A	0.65	0.43	0.008	0.002	0.002	<0.001
Well 3C	0.97	0.47	0.049	0.042	0.005	<0.001
Well 4S	0.66	0.37	0.014	0.006	0.005	<0.001
Well 4A	0.68	0.47	0.018	0.012	0.003	<0.001
Well 5A	0.32	0.21	0.022	0.017	0.004	<0.001
Well 6A	0.88	0.76	0.445	0.340	0.041	0.007
Well 6AA	0.96	0.80	0.412	0.338	0.038	0.007
Well 6B	0.43	0.32	1.266	1.14	0.089	0.021
Well 7A	0.72	0.52	1.185	0.927	0.106	0.007
Well 7B	0.45	0.31	1.059	0.890	0.010	0.045
Well 8A	2.3	0.32	1.859	1.26	0.416	0.021
Well 8B	0.55	0.35	0.551	0.456	0.031	0.006
Well 9A	9.2	3.3	5.463	2.063	0.120	0.027
Well 9B	3.6	1.9	1.553	1.093	0.063	0.004
Well 10A[1/]	1.2	0.32	0.026	0.014	0.003	<0.001
Well 11D[2/]	0.54	0.26	0.015	0.001	0.001	<0.001

TABLE 2.2-1
(continued)

SAMPLE ID	FLUORIDE mg/l		TOTAL CYANIDE mg/l		FREE CYANIDE mg/l	
	max	min	max	min	max	min
Hard Pitch Facility Sump	1070	47	244.1	77.34	1.190	0.220
DT Manhole3/	2400	210	826.2	339.4	13.00	1.411
Well OW-4	1100	750	388.2	316.4	4.632	0.494
Landfill Sump	520	6.2	157.0	1.359	2.260	0.253
Leach 14/	850	340	52.9	31.47	0.35	0.202
Leach 2	5400	200	162.6	26.29	2.831	0.153
Leach 34/	890	77.1	84.82	0.035	0.726	0.001
Leach 45/	646	25	31.80	3.8	1.8	0.075
Quarry5/	390	101	20	15.9	0.35	0.07
Rockline Well	4.1	0.54	0.633	0.133	0.024	0.002
Mountain Fir Well	0.38	0.21	0.006	<0.001	0.001	<0.001
Animal Shelter Well	0.54	0.14	0.024	0.009	0.003	<0.001
Klindt Well6/	0.53	0.43	0.254	0.051	0.007	0.001
Plant Effluent	19	3.1	1.229	0.069	0.229	0.033

1/ Based on four monthly analytical results.
2/ Based on monthly analyses April 1985 through September 1985, inclusive.
3/ New Cathode Waste Pile Leachate Collection System.
4/ Sampled when indurated November 1984 through February 1985, inclusive.
5/ Sampled when indurated November 1984 through March 1985, inclusive.
6/ Sampled when indurated November 1984 through December 1985, inclusive.

six month period from January 1985 through June 1985, the waste constituent concentrations within these wells was greatest at well 9A. Well 9A reportedly contained up to 9.2 mg/l fluoride, 5.46 mg/l total cyanide and 0.12 mg/l free cyanide.

The landfill area also appears to be contributing to some ground-water degradation. Elevated waste constituent concentrations have been detected within the downgradient monitor wells (2A, 2B, 6A, 6AA, 6B, 7A, and 7B), although the levels detected are less than those identified downgradient of the old cathode waste pile. The extent of the ground-water degradation emanating from the landfill has not been defined. However, the Rockline well, located approximately 1,300 ft north of the landfill, reportedly contains up to 4.1 mg/l fluoride, 0.633 mg/l total cyanide, and 0.024 mg/l free cyanide.

The analyses from the wells which monitor the new cathode waste pile (4S, 4A, 3A, 3C, 5A, and 10A) do not indicate substantial ground-water degradation in this area although the levels of waste contituents detected have increased since construction of the storage facility.

The analyses from the private domestic and industrial wells in the immediate vicinity of the MMRF (Rockline well, Mountain Fir well, Animal Shelter well and Klindt well) indicate that waste constituents may have migrated off-site to a limited extent. As discussed previously, elevated levels of fluoride, total cyanide, and free cyanide have been reported in the Rockline well. Total cyanide may be slightly elevated within the Klindt well (maximum concentration 0.254 mg/l) as well as free cyanide (maximum concentration 0.007 mg/l). The Animal Shelter well and the Mountain Fir well do not appear to contain elevated concentrations of the waste constituents analyzed.

The extent of surface-water degradation at the site has been evaluated to a limited extent. Leachate from the landfill has been analyzed and found to contain high concentrations of fluoride, total cyanide and free cyanide. The landfill leachate is currently intercepted by the leachate collection system, routed to a sump and pumped to the discharge channel. Intermittent ponded water at the quarry located east of the site has been sampled when present. These analyses reported elevated levels of fluoride (maximum concentration 390 mg/l), total cyanide (maximum concentration 20 mg/l), and free cyanide (maximum concentration 0.35 mg/l). The source of the water at the quarry has not been identified but is apparently derived from either overland flow or ground-water seepage.

The effluent from the recycle pond has been analyzed and contains fluoride, total cyanide and free cyanide (maximum concentrations of 19 mg/l, 1.229 mg/l, and 0.229 mg/l, respectively). The influent waters to the recycle pond have not been analyzed. Neither Chenoweth Creek nor the Columbia River have been analyzed for specific waste constituents.

The extent of the soil contamination at the site has not been investigated. The potential for soil contamination exists in all areas where spent potliner was stored or managed. Also, the areas exposed to leachate from the landfill, prior to installation of the leachate collection system, are additional sites of potential soil contamination.

Other waste management areas within the site may be potential sources of contamination. These sites include the reycle pond and the scrubber sludge ponds. The recyle pond is unlined and ultimately receives landfill leachate via the leachate collection sump. The DEQ (1985) is concerned that the lime used to neutralize waste materials within the scrubber sludge ponds may have been contaminated with arsenic. The presence and extent of contamination of these and other potential sources will be evaluated during the site investigation, as described in Section 4.0.

2.2.3 Toxicity of Contaminants

Among the chemical constituents identified or suspected to be present in the ground water, surface water, and soil at MMRF, five (5) constituents have the potential to impact human health: cyanide, fluoride, polyaromatic hydrocarbons, polychlorinated biphenyls, and arsenic. Specific toxicological data for these compounds is summarized in Table 2.2-2.

2.3 CONTAMINANT MIGRATION

2.3.1 Migration Pathways

The principal potential contaminant migration pathways are via air, surface water, and ground water. The waste materials at the landfill, new cathode waste pile, and secondary scrubber sludge ponds have potential for air transport by the gusty, northwest winds predominant at the

TABLE 2.2-2 SUMMARY OF TOXICOLOGICAL EFFECTS

Toxic Substance	Physical Properties	Chemical Properties	Toxic Effects	Current Levels of Exposure
CYANIDE (CN^-) May be present as metallic cyanides and hydrogen cyanide	HCN is volatile and has a tendency to escape the water column.	Cyanide exists in water in the free form (HCN,CN^-) which is extremely toxic and may bind to organic or inorganic complexes rendering it less toxic. The toxic criteria of cyanide is based upon the free form.	Cyanide (free form) is lethal at 50 ug per liter and adversely affects invertebrates and fish at 10 ug/l.	Cyanide is not common to either water supplies or the atmosphere. This is attributed to microbial degradation and chlorination of water supplies.
FLUORIDE (HF) Anhydrous Hydrofluoric acid	HF is a colorless foaming liquid or gas with a strong irritating odor. It is a non-combustible gas.	Hydrogen fluoride gas may be toxic to plants, animals, and human health.	Hydrogen fluoride is immediately dangerous to life and health at 20 ppm.	Fluoride is ubiquitous in our environment.
POLYAROMATIC HYDROCARBONS (PAHs,PNAs)	Consist of multiple benzene rings joined together.	PAHs exhibit properties similar to other simple aromatic hydrocarbons. They are stable and resistant to environmental degradation.	There is no published data that compare carcinogenic activity among PAHs. Some PAHs have been demonstrated as carcinogenic in test animals.	Environmental monitoring of PAHs is not common. Daily intake of PAHs may be present in all kinds of food (i.e., fruits, vegetables, cereals, dairy products.
POLYCHLORINATED BIPHENYLS (PCBs)	PCBs range in physical properties from colorless mobile oils (Aroclors, 1221-1243) to sticky, viscous liquids (Aroclors, 1254-1261).	PCBs are considered inert.	PCBs may exhibit profound toxic effects after repeated exposure.	Human exposure to PCBs in the USA is broad. Ambient concentrations are 100 ug/m^3.
ARSENIC (As)	Arsenic as a free element is rarely encountered. Soluble inorganic arsenate predominates under normal conditions.	Organic arsenates form the largest group of compounds.	Arsenic is toxic to both vertebrate and invertebrate fresh-water organisms. There is little data on the toxicity of arsenic on salt-water organisms.	A broad range of arsenic levels have been found in drinking-water supplies.

TABLE 2.2-2 Continued

Toxic Substance	Special Groups at Risk	Existing Guidelines and Standards	EPA Criteria		
			Fresh Water	Salt Water	Human Health
CYANIDE (CN^-) May be present as metallic cyanides and hydrogen cyanide	No experimental or epidemiological studies support identification of special groups at risk.	U.S. Public Health Service: 0.2 mg CN^-/liter. This standard is based upon fish toxicity.	For free cyanide, 1.4 ug/l as a 24-hour average and concentration not to exceed 38 ug/l at any time.	No criterion established.	0.2 mg CN^- per liter to protect human health.
FLUORIDE (HF) Anhydrous Hydrofluoric Acid	No experimental or epidemiological studies support identification of special groups at risk.	4.0 mg/l fluoride daily intake is proposed standard.	No criterion has been established.	"	"
POLYAROMATIC HYDROCARBONS (PAHS, PNA's)	There is uncertainty with regard to special risk groups exposed to PAHs. Genetic variation in enzyme structure have been implicated to provide a susceptibility risk factor for lung cancer.	World Health Organization recommends PAHs not to exceed 0.2 ug/l.	No criterion has been established.	No criterion has been established.	9.7 ug/l in order to keep a lifetime risk of 10^{-5}
POLYCHLORINATED BIPHENYLS (PCBs)	Workers exposed to PCBs, people who consume large quantities of fish and infants are the populations at greatest risk.	The manufacture, sale, distribution, and disposal of PCBs have been restricted since 10/77.	0.0015 ug/l as a 24-hr. average, not to exceed 0.2 ug/l at any time.	0.024 ug/l as a 24-hr. average, not to exceed 0.20 ug/l at any time.	0.26 ug/l to keep the lifetime cancer risk below 10^{-5}
ARSENIC (As)	All age groups and sexes are at risk.	OSHA standard for airborne inorganic arsenic is 10 ug/m^3 (time weighted average)	57 ug/l as a 24-hr average not to exceed 130 ug/l at any time.	29 ug/l as a 24-hr average not to exceed 0.7 ug/l at any time.	0.02 ug/l in order to keep a lifetime risk of 10^{-5}

site. Apparently, the volume and contaminant content of these airborne waste materials are relatively minor as significant air transport has not been observed. The air investigation (Section 4.0) will assess the migration of waste constituents via air transport.

The potential for migration of contaminants via surface water has been at least partially mitigated by construction of the leachate collection system around the landfill. The new cathode waste pile was originally constructed with a leachate collection system. The primary remaining surface-water migration pathway would be overland flow during percipitation events across areas of soil contamination, if present. The fate of the overland flow would be infiltration and discharge to Chenoweth Creek and/or the Columbia River.

Waste constituents can be transported via the ground-water pathway. Vertical contaminant migration is inhibited due to the stratified nature of the permeable zones. Although vertical migration of contamination occurs to some extent throughout the site, the rate of vertical migration is enhanced in areas of high fracture density. A downward flow gradient is present at the site from the upper zones to the "B" aquifer. The hydraulic gradient from the "B" aquifer to the DGWR may change through time. At times the gradient is from the "B" aquifer to the DGWR and at other times, the gradient is from the DGWR to the "B" aquifer. Apparently, the variations in potential vertical ground-water flow direction between these units is a function of the available recharge and possibly, the amount of ground-water withdrawals from the DGWR.

Horizontal migration of contaminants via the groundwater pathway will take place primarily through the more permeable units, i.e., aquifers "A" and "B", identified at the site. The direction of waste constituent migration within the "A" aquifer will be in the direction of decreasing potentiometric head, generally from the southwest to the northeast. The hydraulic gradient and direction of ground-water flow within the "A" aquifer has not been defined.

2.3.2 Potential Receptors

The topographic, geologic and climatic features of the MMRF suggest several mechanisms to transfer potentially harmful substances to receptors. Three contaminant transport mechanisms have been identified and include wind (airborne particulates), ground water and surface water (soluble organic and inorganic constituents).

The predominant northwest wind direction throughout the year (wind velocities in excess of 35 mph) suggest that airborne particulate emissions from the site may be transported to floral and faunal receptors downwind. Among the toxic constituents described (see Table 2.2-2), fluoride and cyanide emissions are the most likely to be carried from the site and impact the environment.

Ground waters, recharged by precipitation, carry soluble constituents from land surface to water-bearing strata. Environmental health concerns posed by this transport mechanism toward the DGWR, may position The Dalles community as a potential receptor of dissolved constituents from the site. Stormwater runoff contributes to the Columbia River system. Fauna and flora associated with the Columbia River biological community may be potentially impacted when runoff is not intercepted by surface-water impoundments.

2.4 INITIAL REMEDIAL MEASURES

Currently, the landfill is not secure from outside access. The standing leachate in the collection ditch represents a potential public health and environmental risk. Therefore, the proposed initial remedial measure will be to secure the site by installing a chainlink fence around the outside of the landfill and leachate collection ditches to minimize the potential risks to humans and fauna.

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SECTION 3.0

3.0 PRELIMINARY ASSESSMENT OF REMEDIAL ALTERNATIVES

This section contains a description of candidate remedial action alternatives which are being considered for implementation at the MMRF site. The candidate remedial alternatives are identified herein as a means of facilitating preparation of the scope of work for the RI/FS. It is not anticipated that the full range of candidate remedial alternatives can always be identified at the onset of a project and therefore as additional data are generated or technologies developed the list of candidate remedial alternatives may be modified throughout the course of the RI/FS. Identification of candidate remedial alternatives at this early stage of the project also affords EPA, DEQ, and the public the opportunity to provide input to the remedial alternative identification process.

The identification of candidate remedial alternatives also assists in the identification of data requirements by directing the remedial investigation towards generating data which can be applied to the evaluation of alternatives. The overall approach to the remedial investigation/feasibility study can also be better formulated based upon an understanding of the potential remedial alternatives which could be implemented at the site.

3.1 <u>REMEDIAL INVESTIGATION/FEASIBILITY STUDY OBJECTIVES</u>

The objectives of the RI/FS are to evaluate potential contamination sources, the extent of contaminant migration, and to identify and quantify the contaminant transport pathways. The initial phase of the RI/FS will include screening activities to identify all sources of contamination.

The site investigation phase of the RI/FS will include construction of soil borings and ground-water monitor wells which will help define the lateral and vertical extent of the contaminant source(s) and ground-water plume(s). Ground water and soil samples collected during construction of monitor wells or borings will be analyzed to determine the degree of both source and plume contamination. Geologic samples will be described, and utilized to define potential contaminant migration pathways. Hydrologic testing, water level monitoring, and water quality monitoring will be conducted to provide data to quantify plume movement, and to predict plume attenuation and potential impacts on downgradient receptors. Ground-water recovery systems or other remedial alternatives will be evaluated.

The Feasibility Study (FS), will evaluate the data collected during the RI. The remedial alternatives and technologies will be evaluated to select the alternatives which are cost effective, technically feasible, environmentally sound, and which will afford adequate protection of the health, safety, and welfare of the potentially affected populace.

3.2 IDENTIFICATION OF REMEDIAL ALTERNATIVES

In performance of an RI/FS, a reasonable number of remedial alternatives must be developed. Remedial alternatives must be identified for each of the following general categories:

- o No-action alternative;
- o Alternatives for treatment or disposal at an off-site facility approved by EPA (including RCRA, TSCA, CWA, CAA, MPRSA, and SDWA approved facilities), as appropriate (off-site treatment and disposal);
- o Alternatives which <u>attain</u> applicable and relevant Federal public health or environmental standards (alternative attaining standards);
- o As appropriate, alternatives which <u>exceed</u> applicable and relevant public health or environmental standards (alternative exceeding standards); and
- o Alternatives which do not attain applicable or relevant public health or environmetal standards but will reduce the likelihood of present or future threat from hazardous substances. This must include an alternative which closely approaches the level of protection rovided by the applicable or relevant standards and meets CERCLA's objective of adequately protecting public health, welfare, and the environment (alternatives not attaining standards).

Previous activities at the MMRF site have been inconclusive with regard to identification of the lateral and vertical extent of contamination, ground-water contaminant plume definition, ground-water flow direction, and extent of on-site and off-site contamination of soils and sediments.

Therefore, the primary focus of this RI/FS is to collect and analyze sufficient data to define the vertical and lateral extent of contaminated soils, ground-water flow direction, ground-water contaminant plume and extent of contamination.

3.2.1 No Action Alternative

The no action alternative would leave the MMRF site basically in its current condition. The ten (10) potential source locations will be left in current conditions and the impact on ground water would be left unchecked.

3.2.1.1 Source Controls

The landfill consists of approximately 178,000 cubic yards of material. Leachate from the landfill has ranged from 0.035 to 162.6 parts per million (ppm) total cyanide and .001 to 2.831 ppm free cyanide, (Century West, June 1985). Borings through the landfill suggest that the bottom is above the water table and that leachate is generated from precipitation.

The old cathode waste pile area was not lined and existed on top of fill material used to construct and level the MMRF site. In use for approximately 12 years, the old cathode waste pile covered an area of approximately two (2) acres. The area has scattered residual cathode waste which can continue to release cyanides, fluorides and other constituents.

The new cathode waste pile consists of approximately 80,000 tons of cathode waste from the old cathode waste pile. The pile is expected to be covered by late 1985 with a PVC flexible membrane liner which will eliminate exposure of the waste cathode to precipitation and the volume of leachate should gradually decrease. The leachate collection system under the concrete slab is collecting pile leachate and cyanide and fluoride are present.

The potliner handling and cathode wash areas have only residual cathode wastes from past activities and are no longer used. The metal pad storage area does have approximately fifty (50) metal pads which were not recycled prior to MMRF site shutdown in late 1984.

The lined pond has a single PVC flexible membrane liner and contains approximately 2.6 million gallons of sludge and water. The expected constituents are cyanide, fluoride, sulfur compounds, polynuclear aromatic hydrocarbons (PAHs), and possibly metals. The exposed PVC liner is a matter of concern.

The scrubber sludge ponds collectively contain approximately 290,000 cubic yards of material. Potential contaminants of concern are cyanide, fluoride and PAHs.

The recycle pond was used to recycle secondary scrubber liquids and allow solids to settle out. The sludge quantity is not known but parameters of concern consist of cyanides, fluorides, PAHs, and metals in the sludge and water phases.

The Duck Pond to the south of the process area is an additional potential source which is an area for concern, but it was never used to specifically manage waste at the MMRF site. It receives water from a sump in the alumina unloading building and surface water from the aluminum storage area. The potential exists for low levels of cyanide and fluorides to be present.

3.2.1.2 Management of Migration

Preliminary results of ground-water samples analyzed from the existing monitor wells indicate that shallow ground-water zones are contaminated with cyanides and fluorides. The lateral and vertical extent of contamination has not yet been determined nor has the direction or rate of migration. There are three (3) off-site wells which have the potential to be affected by shallow ground-water contamination including:

- o Klindt's well;
- o Animal shelter well; and
- o Rockline well.

The Klindt and animal shelter wells are used solely for domestic water supplies while the Rockline well is considered industrial but may be used as a domestic supply.

3.2.2 <u>Offsite Treatment And Disposal</u>

This alternative would require that all contaminated soils, wastes, sediments or ground water be taken offsite to a commerical hazardous waste disposal facility to be treated or disposed of in an appropriate manner. The commerical hazardous waste disposal facility to be considered for this alternative is Chem-Security Systems, Inc., in Arlington, Oregon.

3.2.2.1 Source Control

Quantity estimates for the ten (10) potential sources are presented in Table 3.2-1. There are an estimated 17.2 million gallons of surface water and approximately 500,000 cubic yards of solid waste or sediments to be treated or disposed to eliminate the sources. The solid materials would be excavated down to existing subgrades. Underlying subsoils would be examined for contamination and potential remediation as required. It is not expected that the basalt underlying the soils, sediments or sludges would be removed. The potential sources that contain water will be decanted using vacuum trucks. Sludges may require solidification prior to removal and disposal. Backfilling and capping of the remediated sources would depend on the location and potential for the source to continue releasing contamination.

3.2.2.2 Management of Migration

For the purpose of this discussion, it is assumed that all source materials would be removed down to the existing surface basalt layer. Existing ground-water monitoring data indicates that ground-water contamination is present but the lateral and vertical extent has not yet been determined. The management of migration would require a ground-water recovery system and storage. The recovery system can consist of appropriately placed recovery wells in groups or individually. The storage can consist of:

- o Construction of a reservior or tanks to temporarily hold recovered ground water;
- o Utilizing existing storage tanks on the site or the Primary Scrubber/Cyclone Catch Basin which is lined with PVC; or
- o Construction of a force main pipeline to the nearest publicly-owned treatment works (POTW).

Potential ground-water contamination constituents consist of cyanide, fluoride, organics and inorganics. Options for off-site treatment of contaminated ground water could consist of but not be limited to one of the following:

- o Biological;

Table 3.2-1

OFF-SITE DISPOSAL ALTERNATIVE
ESTIMATED VOLUMES
MARTIN MARIETTA REDUCTION FACILITY
THE DALLES, OREGON

Potential Sources	Waste Volumes Surface Water (million gallons)	Solids (cubic yards)
Landfill	-	178,000
Old Cathode Waste Pile	-	8,900
New Cathode Waste Pile	-	14,800
Potliner Handling Area	-	4,400
Cathode Wash Area	-	4,400
Metal Pad Storage Area	-	3,200
Primary Scrubber/Cyclone Catch Basin (Lined Pond)	0.7	10,000
Scrubber Sludge Ponds		
SSP1	-	135,000
SSP2	6.5	16,200
SSP3	-	90,300
SSP4	-	15,700
Recycle Pond	8.0	10,400
Duck Pond	2.0	3,200
TOTAL:	17.2	494,500

- o Chemical precipitation;
- o Filtration;
- o Sedimentation;
- o Oxidation; and
- o Adsorption.

Disposal of the contaminated ground water could consist of one or a combination of the following methods:

- o Spray irrigation;
- o NPDES system, or
- o Deep well injection.

The ground-water recovery would continue until satisfactory contaminant concentrations are achieved.

3.2.3 Alternatives Attaining Standards

Compliant alternatives are those which attain applicable and/or relevant Federal public health or environmental standards. Compliance with standards are identified below for source control and management of migration.

3.2.3.1 Source Control

Source control remedial alternatives which facilitate compliance with applicable and/or relevant Federal public health or environmental standards involve isolation of the contaminated material from interaction with the ground-water system.

Isolation may be accomplished through the use of physical barriers, capping, excavation, treatment or a combination of these on-site management technologies. A possible combination for a compliant on-site management alternative consists of construction of an on-site vault to meet minimum technology requirements (i.e. double liner) and a ground-water recovery system with on-site treatment.

3.2.3.2 Management of Migration

Management of migration of the contaminants to facilitate compliance with applicable public health or environmental standards may require removal of contaminated ground water from the MMRF area. The recovery would continue until satisfactory contaminant concentrations are achieved.

On-site water treatment could consist of the following technologies individually or in combination:

- o Filtration;
- o Biological;
- o Chemical oxidation;
- o Chemical precipitation;
- o Sedimentation;
- o Clarification; and
- o Carbon adsorption.

Sludges or residuals produced as a result of the treatment process may require handling and disposal as a hazardous waste. MMRF has an existing chemical precipitation treatment unit for fluoride removal from waters utilizing caustic (NaOH), lime ($Ca[OH]_2$) and calcium chloride ($CaCl_2$).

Disposal options of treated ground water could be accomplished by spray irrigation, discharge to surface waters, reinjection into the shallow ground water to flush the system, or on-site deep well injection.

Disposal to surface waters would require an NPDES permit while deep-well injection would be subject to applicable State and Federal regulations.

3.2.4 <u>Alternatives Exceeding Standards</u>

3.2.4.1 Source Control

To exceed requirements of all applicable and/or relevant Federal public health and/or environmental standards, all contaminated soils, wastes, and sediments must be excavated to the extent that no contamination is detected. The excavation should remove all contaminated soils to the depth of the seasonal low water table. Site geology, consisting of a very shallow soil/rubble surface layer followed by basalt, makes excavation to this extent impractical. Therefore, excavation would be limited to the extent contaminated soils, wastes, or sediments can be removed under reasonable excavation without blasting. Excavated areas would then be backfilled with clean material. Capping may be required and would be evaluated based upon the geology and hydrogeology associated with each potential source. The excavated materials would be transported off-site for disposal in a hazardous waste landfill or for treatment by a hazardous waste treatment facility.

3.2.4.2 Management of Migration

To exceed requirements of all applicable State and/or Federal public health and environmental standards, all contaminated ground water must be pumped from the aquifer system within the MMRF area to the extent that no detectable contamination is encountered in the collection system discharge or monitor wells.

The recovered contaminated ground water can be treated on-site by one or a combination of the following technologies:

- Filtration;
- Biological;
- Chemical precipitation;
- Chemical oxidation;
- Sedimentation;
- Clarification; and/or
- Carbon adsorption.

The disposal option would consist of discharging to the Columbia River through NPDES permit. Sludges or residuals produced as a result of the treatment process may require handling and disposal in an appropriate manner.

An alternate to the on-site water treatment system would be to temporarily store the recovered water on-site for later off-site treatment. Off-site treatment could consist of trucking or force maining the recovered water to the nearest POTW or industrial wastewater treatment system that could treat to the required levels.

3.2.5 Alternatives Not Attaining Standards

3.2.5.1 Source Control

The source controls will be limited to those technologies which may reduce the likelihood of present or future threat from contamination. Contaminated soils, wastes or sediments from the potential sources would be excavated and transported to the existing landfill located to the north of the reduction buildings. Once placed in the landfill, the site would be graded, a gas venting system emplaced and a flexible membrane liner with final cover installed. Grading and improvement around the landfill would be required to control runon. Previous drilling in the landfill has determined that the base is above the ground-water table making this an acceptable alternative. Potential sources would be backfilled and an individual local geologic assessment performed to determine capping requirements and effectiveness.

3.2.5.2 Management of Migration

The potential exists for the off-site contamination of three (3) water supply wells. Management of migration options consist of:

- o Replacement of existing wells with city water supplies or new wells;
- o Ground-water recovery and subsequent on-site treatment;
- o Development of alternate concentration limits (ACL); and/or
- o Prepare a public document describing th lateral and vertical extent of contamination and placing a moratorium on drilling of new wells in the affected area.

One possible strategy would be to manage and treat the ground water to a specific concentration which, if it migrated further off-site, would reduce the impact on the existing domestic water well supplies. An alternate strategy might consist of replacing the existing water well sources and based on hydrogeologic test results, assess the movement and direction of ground-water contamination and propose an ACL if ground-water flow directions are in the direction of the Columbia River. The potential contamiants consist of cyanide, fluoride, and PAHs. On-site water treatment could consist of the following technologies individually or in combination:

- o Filtration;
- o Biological;
- o Chemical oxidation;
- o Chemical precipitation;
- o Sedimentation;
- o Clarification; and
- o Carbon adsorption.

Sludges or residuals produced as a result of the treatment process may require handling and disposal as a hazardous waste.

The disposal would be a surface-water discharge to the Columbia River under an NPDES permit. Treatment would continue until the influent contaminant concentrations are equal to or less than the NPDES permit discharge limitations. At this time, recovered ground-water would not require treatment prior to discharge or recovery would be discontinued.

3.3 PERFORMANCE CRITERIA AND STANDARDS FOR REMEDIAL ALTERNATIVES

The screening and evaluation of remedial alternatives will require assessment of environmental, public health, institutional and cost considerations and reconciliation of conflicting objectives. The performance criteria and standards which must be considered for the previously described alternatives are outlined below.

3.3.1 Environmental Protection

Alternatives posing significant adverse environmental effects will be excluded from further consideration. Only those alternatives that satisfy the response objectives and contribute substantially to the protection of the environment shall be considered further. Environmental criteria which must be considered include the following:

- o Impact of pipeline construction for treatment system effluent disposal on flora, fauna, and the natural drainage system;
- o Impact of ground-water treatment system operation on ambient air quality;
- o Destruction of flora and wildlife habitat during excavation of contaminated soils;
- o Destruction of natural drainage systems during excavation of contaminated soils;
- o Impact of contaminants released to downgradient surface waters and/or sensitive habitats;
- o Impact of effluent discharge on surface waters via habitat modification;
- o Destruction of flora and wildlife habitat during construction of ground-water recovery and treatment system; and
- o Potential for off-site contaminant spill during transportation of soils or liquids for off-site treatment and disposal.

3.3.2 Public Health Protection

Only those alternatives which will minimize or mitigate the threat of harm to public health and welfare will be considered. Specific consideration will be given to the following:

- o Guidelines for allowable concentrations of contaminants in underground sources of drinking water (USDW) for all management of migration options;
- o Assessment of long-term risk to downgradient receptors for all management of migration options;
- o Potential for continued release of contaminants from the source;

- o Potential for contaminated ground-water interaction with surface water, and potential surface-water receptors;
- o Assessment of risk through air emissions from on-site treatment options and excavation of contaminated soils; and
- o Assessment of risk through off-site transport options.

3.3.3 Institutional Considerations

An alternative that does not meet the technical requirements of the applicable environmental laws will usually be excluded from further evaluation. Specific consideration will be given to:

- o Department of Transportation (State and Federal) requirements and restrictions for hazardous waste transport for all off-site treatment and disposal options;
- o Underground Injection Control regulations for deep well disposal options;
- o Pretreatment standards for discharge into publicly owned treatment works (POTW) for off-site treatment and disposal options;
- o National Pollution Discharge Elimination System (NPDES) permitting requirements for off-site discharge of ground water or effluent options;
- o Clean Air Act permitting requirements for on-site treatment options;
- o State and local land-use zoning restrictions for construction and operation of on-site treatment systems, pipelines, and wells; and
- o Evaluation of short and long term liabilities for each considered alternative.

3.3.4 Cost Effectiveness

An alternative whose cost far exceeds that of other alternatives and does not provide substantially greater public health or environmental benefits will usually be eliminated (except for RCRA alternatives). Total cost of an alternative should be considered and will include the cost of implementing the alternative and the cost of operation and maintenance.

All costs will be presented in terms of the net present worth to provide for comparison among systems having different useful lives. Specific cost considerations will include:

- o Transportation costs for all off-site disposal or treatment options;
- o Disposal fees for hazardous waste landfilling for all off-site disposal options;
- o Treatment costs and/or acceptance fees for all off-site treatment options;
- o Pipeline costs based on size, length, and construction constraints for off-site discharge of contaminated ground water;
- o Well construction costs for contaminated ground-water recovery systems and deep well injection options;
- o Operation and maintenance costs for ground-water recovery and treatment options;
- o Facilities construction costs for all on-site treatment options;
- o Excavation, filling and grading costs for all source removal options;
- o Permitting fees for off-site discharge (NPDES), and deep well disposal (RCRA) options; and
- o Engineering design fees for all recovery, treatment, and off-site discharge options; and
- o Consideration of short and long-term liabilities.

3.4 APPROACH TO ALTERNATIVE EVALUATION

The results of the screening of remedial alternatives will depend on factors selected for making comparisons and how they are applied. Alternatives will be evaluated and ranked in terms of cost-effectiveness, technological feasibility, reliability, and the ability to provide adequate protection to the public health, welfare and the environment. Detailed evaluation of selected alternatives will consider, at a minimum the following factors:

1. Description of appropriate treatment and disposal technologies.

2. Special engineering considerations required to implement the alternatives (e.g., pilot treatment facility, additional studies needed to proceed with final remedial design).

3. Environmental impacts and proposed methods and costs for mitigating any adverse effects.

4. Operation, maintenance, and monitoring requirements of the remedy.

5. Off-site disposal needs and transportation plans.

6. Temporary storage requirements.

7. Safety requirements for remedial implementation, including both on-site and off-site health and safety considerations.

8. A description of how the alternatives could be phased into operable units. The description will include a discussion of how various operable units of the total remedy could be implemented indivdually or in groups, resulting in a significant improvement to the environment or savings in cost.

9. A description of how the remedial alternative could be segmented into operable units to allow implementation of differing phases of the alternatives.

10. A review of any national off-site treatment and disposal facilities to ensure compliance with applicable RCRA requirements, both current and proposed. The current EPA policy for off-site disposal must be followed.

3.5 IDENTIFICATION OF DATA REQUIREMENTS

Through review of the remedial alternatives and anticipated performance criteria and standards, additional data requirements have been identified which must be fulfilled to facilitate thorough evaluation of each remedial alternative. Additional data requirements are identified below for source control and management of migration options. Site investigations to date have only partially filled these data requirements. The following list consists of areas which need further identification or quantification.

3.5.1 Source Control

a. Contaminated Soils

- Location, lateral, and vertical extent of contaminated soils;
- Degree of contamination;
- Soil types; and
- Verification of local drainage patterns.

b. Landfill

- Quantity and type of materials; and
- Surface water/leachate concentrations.

c. Old Cathode Waste Pile

- Lateral and vertical extent of contamination.

d. New Cathode Waste Pile

- Structural design;
- Flexible membrane liner type and thickness; and
- Leachate treatment process.

e. Potliner Handling Area

- Lateral and vertical extent of contamination.

f. <u>Cathode Wash Area</u>

- Lateral and vertical extent of contamination; and
- Drainage patterns.

g. <u>Metal Pad Storage Area</u>

- Lateral and vertical extent of contamination.

h. <u>Primary Scrubber/Cyclone Catch Basin (Lined pond)</u>

- Water quality;
- Sludge volume;
- Sludge quality; and
- Liner integrity.

i. <u>Scrubber Sludge Ponds</u>

- Sludge volumes and quality;
- Geology and hydrogeology; and
- Lateral and vertical extent of contamination.

j. <u>Secondary Scrubber/Recycle Pond</u>

- Water quality;
- Sludge volume;
- Sludge quantity; and
- Subsoil quality.

k. <u>Duck Pond</u>

- Water volume and quality;
- Sludge volume and quality; and
- Geology and hydrogeology.

3.4.2 Management of Migration

a. Groundwater Contamination

- Location, lateral, and vertical extent of contamaination;
- Degree of contamination;
- Geologic conditions including structural conditions;
- Local ground-water flow direction and seasonal variations;
- Aquifer coefficients (permeability, transmissivity, storage coefficient, leakance);
- Background water quality;
- Boundary conditions; and
- Existing ground-water users, on- and off-site.

b. Surface Water Contamination

- Water quality;
- Stream classification; and
- Discharge limitations (NPDES).

SECTION 4.0

4.0 REMEDIAL INVESTIGATION SCOPE OF WORK

The Remedial Investigation at the MMRF site emphasizes data collection and evaluation of site characteristics. The RI will support the evaluation of available technologies for the development of appropriate alternatives as part of the Feasibility Study (FS). The work scope of the RI will center on sampling and analysis of ground and surface waters, soils, and waste materials in order to make a determination of an appropriate treatment technology. The RI will include an evaluation of both onsite and offsite contamination, an assessment of transport pathways and identification of possible receptors.

The RI work scope consists of five (5) program elements consisting of:

- o Initial Activities;
- o Site Investigation;
- o Bench and Pilot Studies;
- o Community Relations; and
- o Reporting Requirements.

Initial activities shall consist of a project initiation meeting, site visit, existing data review, and development of an accurate site map of existing conditions. The site investigation shall include waste characterization; hydrogeologic, soils and sediments, surface waters, and air quality investigations, and an assessment that the data collected is sufficient in quality, as described in the Quality Assurance Project Plan (QAPP), and quantity to support the Feasibility Study. Bench and pilot studies will be performed if required based upon the results of the site investigation. Community relations will be administered by the EPA as specified in the Consent Order. Martin Marietta will support the community relations program by providing technical data to the EPA. Reporting requirements for the RI include monthly progress, preliminary, and final reports.

In support of the RI work plan for the MMRF site, the QAPP, and Health and Safety (H&S) Plan have been developed as separate documents. The QAPP describes the goals and objectives to assure that the samples obtained from the MMRF site will meet minimum requirements and provide confidence in sampling methodologies and laboratory analyses. The H&S Plan describes the areas of investigation and the precautions that will be taken to protect site personnel during on-site activities.

4.1 INITIAL ACTIVITIES

Initial activities for the RI of the MMRF site shall consist of the following four (4) tasks:

- o Project Initiation Meeting;
- o Initial Site Visit;
- o Preliminary Data Evaluation; and
- o Site Map Preparation;

Each of these tasks are described in more detail below.

Task 1.0 Project Initiation Meeting

Project initiation activites will consist of a one-day meeting with representatives of the EPA, Corps of Engineers, State of Oregon Department of Environmental Quality (DEQ), Martin Marietta Corporation, and Geraghty & Miller, Inc., to establish lines of communication and to discuss management procedures of the RI/FS. A review of the work scope and schedule will be performed to assure timely completion of the objectives.

Task 2.0 Site Visit

An initial site survey shall be conducted for all parties involved with the RI/FS. The purpose of the site visit will be to:

- o Familiarize the involved parties with the site, i.e. site history, topography, existing conditions, access routes, proximity of receptors to contamination, etc;
- o Information exchange between the Project Coordinator, Site Manager and the regulatory agencies;
- o Resolve any questions about the site and/or RI/FS Work Plan.

After the site inspection, a meeting allowing for a question and answer period will be provided. At this time representatives of EPA and DEQ will provide information relating to site history from a regulatory viewpoint leading up to current site conditions. The MMRF Plant Manager will describe facility operations; the Project Coordinator will provide a summary of the RI/FS objectives. Comments made affecting the scope of the RI/FS will be resolved by the

Project Coordinator and appropriate parties (EPA, DEQ and Martin Marietta) immediately after the conclusion of the meeting. Upon resolving any changes in the scope of work, the Project Coordinator will meet with the appropriate project personnel to discuss the schedule, assure proper program timing and resolve conflicts.

Task 3.0 Preliminary Data Evaluation

As part of the scoping process, considerable data have been obtained from various state and federal governmental agencies. Prior to implementation of the on-site investigation, additional evaluation of these data will be performed.

Subtask 3.1 Hydrogeologic Data Evaluation

Drillers logs of over thirty wells located in the general area of the site have been compiled. In order to further define the stratigraphy at the site, these logs will be used to prepare geologic cross sections. At least two regional sections and one local section will be prepared. The cross sections will delineate major water-bearing units, confining beds and significant stratigraphic marker beds. Selected monitor wells which may be impacted by the facility will be included on the cross sections to show the production zones for these wells. The cross sections will then be used to enhance interpretation of the local ground-water flow system. In addition, a stratigraphic column and well completion diagram will be prepared for each well for which a well log is available; an example is provided as Figure 4.1-1.

Various previous investigators have made differing interpretations as to the specific structural setting at the site. Bela (1982) identifies a synclinal axis, apparently The Dalles syncline, which passes through the immediate vicinity of the facility. Newcomb (1969) identifies a minor east-west splay fault of the Chenoweth fault, which trends toward the facility.

The character and precise location of these geologic features, if present, can be expected to have a significant influence upon the local ground-water flow system. Therefore, a more detailed evaluation of the local structural setting will be performed. Aerial photographs, Landsat imagery, and stereographic pairs of photographs will be used to perform a lineament study of the MMRF site. Subsequent to this evaluation, limited field mapping will be performed in order to characterize the nature of the lineaments identified.

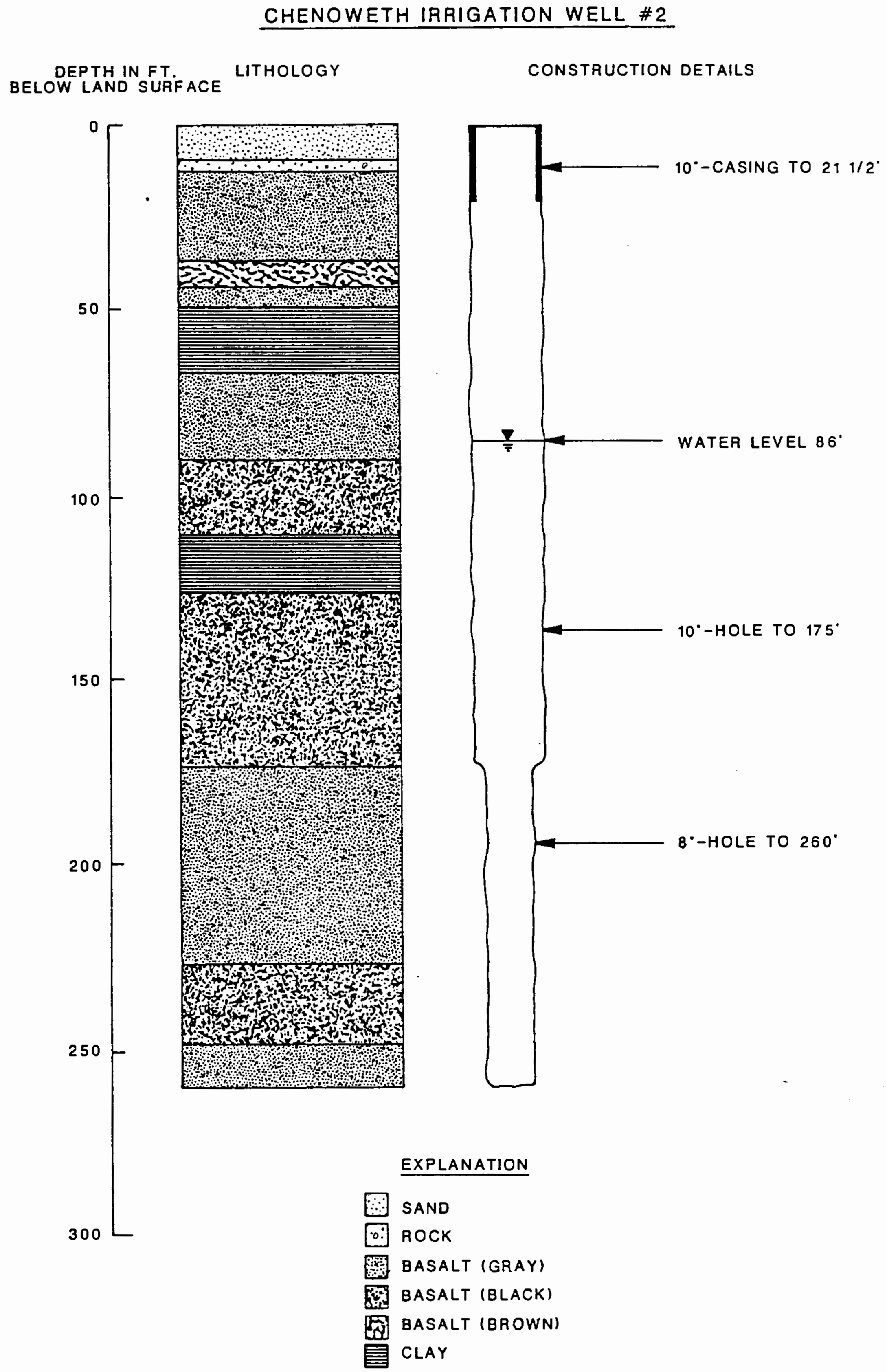

Figure 4.1-1. Typical Stratigraphic Column and Well Completion Diagram.

The potentiometric data from the existing well will be used to assess the hydrodynamic conditions within the aquifers at the site. Hydrographs will be prepared for each well and compared to the hydrographs of the DGWR obtained from the Oregon Department of Water Resources.

The ground-water quality data will be entered into a computer data base in order to facilitate data access and manipulation. Graphs of constituent concentration versus time will be prepared for each sampling source. Isochemical maps will be prepared for selected time intervals.

Subtask 3.2 Receptor Data Evaluation

The receptor study will identify the potential human health and environmental impacts or concerns resulting from the waste management activities at the site. The receptor study will focus upon previous investigations to define the floral and faunal communities present in the site vicinity and to define the published exposure limits for the identified receptors.

Preliminary receptor data has been compiled in the form of environmental impact studies for The Dalles and Bonneville Dams and population density statistics compiled by The Dalles Chamber of Commerce. Several governmental agencies and local colleges and universities have conducted studies of the flora and fauna distribution within the regional area of the MMRF. These organizations include the U.S. Corps of Engineers, the U.S. Fish and Wildlife Service, the Bonneville Power Administration and others. Local offices of these and other agencies will be visited and appropriate personnel interviewed to determine the availability of additional receptor data. The data identified will be obtained, organized and evaluated.

Task 4.0 Site Mapping

Detailed site maps, both of the general site vicinity and specific areas of interest within the site, will be prepared. The maps will be prepared using aerial photographs and a ground control survey.

The horizontal control for the maps will consist of a grid system with 100-foot centers located via a land survey. These control points will allow an exact location to be established for sampling points, borings, new and existing monitoring well locations, and existing structures and ponds.

In addition, the survey will establish vertical control for the MMRF site. This requires establishing the elevation of the site from the nearest public datum monument. This will allow the establishment of elevations from one permanant benchmark; and will establish elevations for temporary ground control to be used for the aerial survey.

After proper ground controls have been established, an aerial survey of the MMRF site will be performed. A map of the site and surrounding vicinity will be prepared with a horizontal scale of 1-inch equals 200 feet and with 5-foot contours. It is estimated that approximately 500 acres will be included in the site and vicinity map. The map will include areas of adjacent property including nearby drainage ways. A contour map prepared from the aerials will be used to delineate current site drainage directions.

Two area maps of more detail will be prepared for specific subsites at the MMRF. Maps will be prepared of the landfill and old cathode waste pile area, and of the recycle pond, scrubber sludge pond, primary scrubber/cyclone catch basin and new cathode waste pile area. These maps will be at a scale of 1-inch equals 50 ft, with a 2-foot contour interval.

The major utilization of the area maps will be during the FS for locating remedial features, layout of on-site alternatives, computing final closure elevations, determination of excavation quantities, if required, and fill quantities and to prepare a proper site drainage network.

4.2 SITE INVESTIGATION

This section of the work scope details the specific activities that will be performed at the MMRF site. The site activities will result in data of adequate technical content to assess preliminary remedial alternatives to be developed during the RI and to support the detailed evaluation of alternatives during the FS.

The site investigation shall consist of performing the following five (5) tasks:

- Waste Characterization;
- Hydrogeologic Investigation;
- Soil and Sediment Investigation;
- Surface Water Investigation; and
- Air Investigation.

The waste characterization investigation is designed to ascertain the specific waste constituents which may be present in the landfill. Representative samples from the landfill will be collected and analyzed.

The hydrogeologic investigation will include assessing the existing monitoring well system and evaluating available hydrologic data. Additional ground-water monitoring wells will be installed. The direction and rate of ground-water flow will be evaluated and the variation in water-quality determined. A prime objective of the hydrogeologic evaluation is to determine the fate of the waste constituents within the ground-water environment.

The soils and sediment investigation will include both on and off-site areas. Soil samples will be collected from all areas where potliner material was stored, handled, or treated soils on and off-site which may have been affected by seepage or surface water runoff containing waste constituents will also be sampled. Bottom sediments from the duck pond, recycle pond, scrubber sludge ponds, lined pond, discharge ditch, and the north drainage ditch will be sampled and analyzed.

The water quality within the building sumps, the duck pond, recycle pond, discharge channel, lined pond, north drainage ditch, leachate collection system and standing water at the quarry, if present, will be evaluated during the surface water investigation. Individual samples from the ponds will be collected and composited for analysis. At other areas, grab samples will be collected and analyzed individually.

The air investigation will involve monitoring conditions up and downwind of the site to evaluate existing site conditions. Air monitoring will be performed during drilling activities to ensure proper protection levels are maintained.

Task 5.0 Waste Characterization

Evaluation of the chemical properties of the various waste sources has been performed to varying degrees. More detailed evaluations are required to quantify the potential environmental impacts, migration rates and modes, and treatability of these waste constituent sources. The primary source requiring additional characterization is the landfill. Other potential contamination sources will be evaluated as part of the surface water and/or soils and sediment investigations including the lined pond, the scrubber sludge ponds, the potliner handling area, cathode wash area, and the duck pond.

Various waste and scrap materials have been disposed of at the landfill including cathode waste, refractory brick, asbestos, aluminum slag and skimmings, metal drums, off-spec briquettes, and old air emission control equipment and sludges. Although the landfill is known to generate leachate which contains elevated levels of cyanide and fluoride (Century West, 1985b), the potential for generation of other waste constituents has not been evaluated.

In order to characterize the waste materials and associated chemical constituents within the landfill, five test pits will be excavated with a backhoe and the excavated material will be sampled and analyzed. The locations of the proposed test pits are shown in Figure 4.2-1.

The materials excavated by the backhoe will be described by the on-site field personnel and stockpiled next to the excavation. Grab samples of the materials will be collected and composited to create two samples for chemical analyses from each excavation. The samples will be analyzed for cyanide, fluoride, sodium, EP toxicity metals; base-neutral extractables, acid extractables and purgeable organic compounds. One grab sample will be collected from each of the five test pits which will be composited to create a single sample representing all five pits. This sample will be analyzed for PCBs.

Task 6.0 Hydrogeologic Investigation

A detailed hydrogeologic investigation will be performed in order to define the extent, distribution and fate of waste constituents within the ground-water environment. The preliminary site assessment has indicated that the primary environmental impact of the site would be to the ground-water system. Therefore, the ground-water investigation is an integral part of the RI. The hydrogeologic investigation will focus upon five main areas: the landfill, the old cathode waste pile, the new cathode waste pile, the recycle pond, and the scrubber sludge ponds.

Subtask 6.1 Potentiometric Data Collection

Water-level measurements have been collected at each existing monitor well prior to water-quality sampling events. Water-level measurements within the production wells are available, on a less frequent basis. Available data indicates that considerable variation in potentiometric surface elevations occur seasonally within each of the three major water-bearing zones. The magnitude of water-level fluctuation varies between each of the water-bearing zones. Fluctuations of up to 20 ft have been observed in the DGWR

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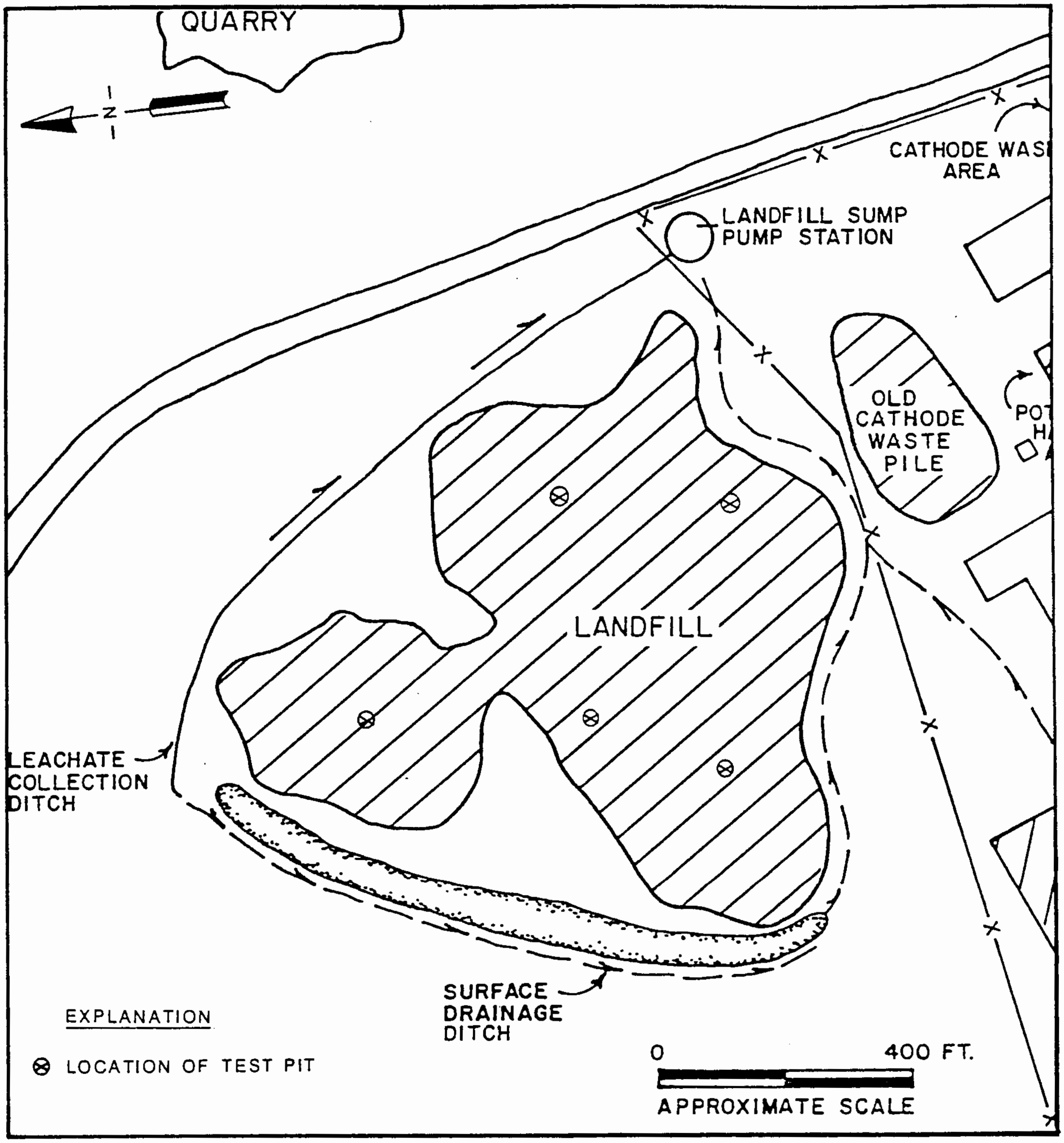

Figure 4.2-1. Location of Test Pits - Landfill.

and the "B" aquifer, whereas fluctuations of up to 10 ft have been observed in wells screened in the "A" aquifer.

The magnitude and timing of these fluctuations will influence the local ground-water flow system. Therefore, in order to characterize the rate and degree of water-level fluctuations within the water-bearing units at the site, water-level recording devices will be installed within selected wells.

Initially, pressure tranducers will be installed in existing wells 1A, 3A, 3C, 7A, 8B, and 11D. The data acquisition interval will be set at 1 hour. After approximately one month of data collection, the resultant water level data will be reviewed. Based upon this evaluation, the transducers will be moved to other wells or the data acquisition interval modified, as required. From the data collected during this portion of the study, potentiometric maps will be constructed for each aquifer system in order to determine direction of ground-water movement and the hydraulic relationships between the various aquifers.

Subtask 6.2 Slug Testing

In order to quantify the permeability of the various water-bearing intervals, slug tests will be performed upon existing and newly installed monitor wells. The tests will be performed using a pressure transducer and asssociated data logging device to collect data.

The transducers are placed within the well and lowered below static water level. After allowing the water level to stabilize, a PVC cylinder is lowered rapidly below static water level creating an "instantaneous" water-level rise. The subsequent rate of water-level decline is recorded by the data logger. Once the water level returns to static, the PVC cylinder is quickly removed creating a water-level decline. The subsequent water-level rise is also recorded by the data logger. The water-level response data will be evaluated by methods developed by Bouwer and Rice, 1976, and/or Horslev, 1965.

Subtask 6.3 Pumping Tests

Pumping tests of the DGWR will be performed using the existing production wells at the MMRF. The wells are currently used to supply cooling water for the rectifier. The wells will be turned off for a period of 24 to 48-hours prior to testing in order to allow water levels to recover. The rate of recovery within selected monitor and production wells will be measured during the recovery period.

Production well #4 will be used as the pumping well for the test and will be pumped at its maximum capacity - approximately 1,000 gallons per minute. Production wells 1 and 3 and monitor wells 11D, 1C, 5B, and 8B will be used as observation wells. The test will continue for a minimum of 48 hours; at that time, the water-level response data will be evaluated to determine if continuation of the test is justified.

The pump test data will be evaluated to determine the aquifer properties of the DGWR including transmissivity and storativity, and the degree of interconnection between the aquifer and overlying hydrogeologic units. The DGWR apparently best fits the assumptions of a semiconfined aquifer system and the pump test data will be evaluated by methods developed by Hantush (1960). However, the characteristics of the drawdown versus time data will further define the character of the aquifer and may dictate the use of alternate analytical techniques.

Subtask 6.4 Monitor Well Installation

Twenty-two (22) monitor wells, one (1) piezometer, three (3) production wells, and four (4) domestic wells are currently in place in the vicinity of the MMRF and are used to monitor local ground-water quality (Table 4.2-1). The majority of the existing monitor wells are located so as to monitor the ground-water quality near the landfill, the old cathode waste pile and the new cathode waste pile (Figure 4.2-2).

In order to determine the lateral and vertical extent of waste constituents within the various ground-water systems at the site and to determine the fate of these constituents within the subsurface, a total of 20 new monitor wells will be installed as part of the RI program. The newly installed wells and the existing monitor and production wells will form the basic monitoring network for the study area. Based on a review of ground-water level and ground-water quality data collected during the site investigation, the interim site assessment report will address the adequacy of the basic monitoring network and its ability to satisfy the objectives of the RI/FS work plan. Recommendations as to the need for modifying the network (adding or eliminating wells) and water-quality parameters of concern will be made at that time.

The new monitor wells will be screened within four (4) hydrogeologic units at the site: the fractured basalt containing the water table; the "A" aquifer; the "B"

TABLE 4.2-1
Existing Monitor Wells at the MMRF Site

Well No.	Screen Interval (ft below land surface)	Screen Interval (ft msl)	Source Monitored
1A	95 to 105	49 to 39	Background
1B	124 to 134	20 to 10	Background
1C	182 to 192	-38 to -48	Background
2A	72 to 82	38 to 28	Landfill
2B	158 to 168	-14 to -24	Landfill
3A	107 to 117	28 to 18	New Cathode Waste Pile
3B	148 to 158	-13 to -23	New Cathode Waste Pile
3C	170 to 180	-35 to -45	New Cathode Waste Pile
4S	37 to 42	101 to 96	Background
4A	100 to 105	38 to 33	Background
5A	90 to 100	49 to 39	New Cathode Waste Pile
6A	114 to 119	14 to 9	Landfill
6AA	121 to 126	7 to 2	Landfill
6B	173 to 183	-45 to -55	Landfill
7A	115 to 120	12 to 7	Landfill
7B	165 to 170	-38 to -43	Landfill
8A	128 to 133	12 to 7	Old Cathode Waste Pile
8B	180 to 190	-40 to -50	Old Cathode Waste Pile
9A	128 to 133	12 to 7	Old Cathode Waste Pile
9B	180 to 190	-40 to -50	Old Cathode Waste Pile
10A	107 to 117	30 to 20	New Cathode Waste Pile
11D	275 to 295	-139 to -159	Dalles Ground-Water Reservoir

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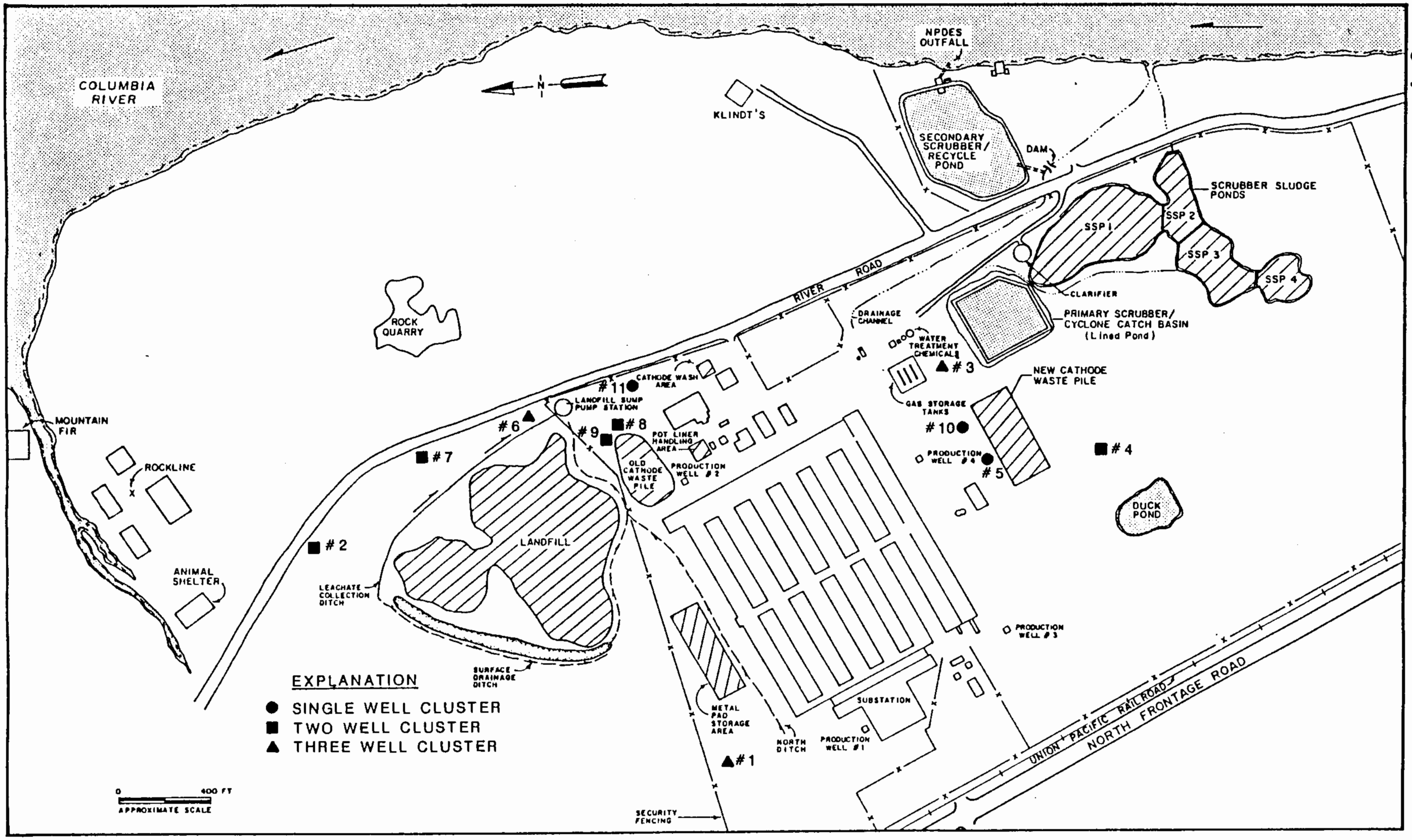

Figure 4.2-2. Location of Existing Wells.

aquifer; and, the DGWR. Proposed well locations are shown in Figure 4.2-3.

For the most part, the existing wells monitor the water quality within the three aquifers identified at the site. The term aquifer in this context is the classical definition; namely, a geologic unit capable of supplying significant quantities of water to a well. The uppermost aquifer monitored ("A" aquifer) is present from approximately 30 to 50 ft msl (feet, mean sea level). The potentiometric surface elevation within this zone ranges from 40 to 120 ft msl. Therefore, in some areas of the site the uppermost or "A" aquifer may be under water-table conditions whereas in other areas the "A" aquifer may be semiconfined.

The saturated fractured basalt units overlying the "A" aquifer and containing the water table are not currently monitored by the existing monitor-well network, with the exception of well 4S. Whereas, this unit would not be considered an aquifer in the classical sense due to the apparent low water yield potential, the water quality within this zone would be the first impacted by migration of waste constituents from overlying contaminant sources. Although a downward hydraulic gradient is present within the uppermost units at the site, some lateral ground-water migration may occur within the fractured basalt overlying the "A" aquifer. Therefore, one of the primary objectives of the RI well-installation program will be to evaluate the occurence and, if present, quality of the ground water within the fractured basalt overlying the "A" aquifer.

The presence of ground water within the fractured basalt will be tested at nine (9) locations. A boring will be advanced, using air-rotary drilling methods, through the fractured basalt to a depth of 10 ft below the potentiometric surface projected for the "A" aquifer at each testing location. If ground water is not immediately detected within the borehole, drilling activities will be suspended for a 1-hour period to allow water to collect in the borehole. If water is detected or is present within the borehole after the 1-hour standby, a monitor well will be constructed within the borehole. If water is not detected, the boring will be advanced at 10-ft intervals and checked for water as described above. Once water is identified within the borehole, a monitor well will be constructed.

In order to further define the water quality and ground-water flow system within the "A" aquifer, additional monitor wells will be installed within this zone. Previously installed wells have yielded sufficient data to define the general ground-water quality and ground-water flow system within this zone in proximity of the old cathode waste pile,

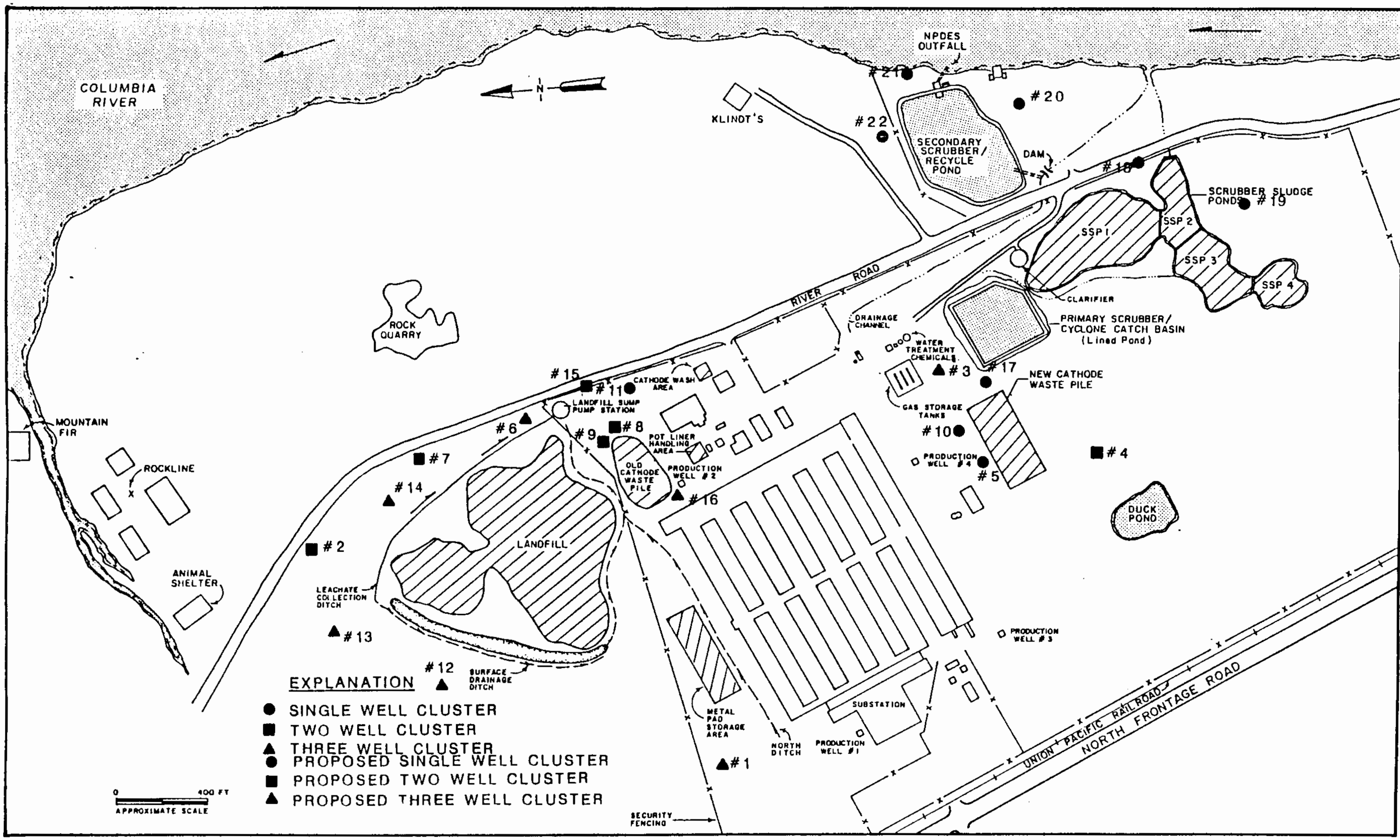

Figure 4.2-3. Location of Proposed Monitor Wells.

the new cathode waste pile and, to a limited extent, the landfill. Additional wells are required to define the potentiometric head distribution within the "A" aquifer near the apparent fracture zone in the vicinity of the old cathode waste pile. Monitor wells are also required to define the water quality within the "A" aquifer near the landfill. A total of five (5) "A" aquifer monitor wells will be installed during the RI.

Monitor wells in the "B" aquifer are required to define the potentiometric head distribution and water quality within this zone. As described previously, the hydraulic gradient within the "B" aquifer is very shallow and may be affected by mounding from downward ground-water flow near areas of enhanced fracture density. Consequently, the ground-water flow direction within the "B" aquifer cannot be adequately identified at this time. The available water-quality data for the "B" aquifer is more conducive to interpretation and it appears that the extent of elevated waste constituents within this zone is of limited areal extent. However, due to the proximity of this aquifer to the underlying DGWR, delineation of the water-quality distribution within the "B" aquifer is required during the RI. Therefore, five (5) additional "B" aquifer monitor wells will be installed.

Currently, four (4) wells exist at the MMRF to monitor the water quality within the DGWR underlying the facility: three production wells (1, 3, and 4) and one monitor well (11D). Potentiometric data is provided by the monitor well. A fourth production well was abandoned in March 1985 after elevated levels of waste constituents were reported for ground-water samples collected from this well. The source of the waste constituents was believed to be from downward ground-water movement along the annular seal around the well casing. The well was located near the old cathode waste pile and within an area in which the "B" aquifer apparently contains elevated levels of waste constituents. As discussed previously, a downward hydraulic gradient is present, at least during portions of the year, from the "B" aquifer to the DGWR. Neither the remaining production wells nor the DGWR monitor well (11D) appear to contain elevated levels of waste constituents.

The hydraulic gradient within the DGWR in the vicinity of the MMRF cannot be determined from existing data. In order to better define the ground-water quality and potentiometric head distribution within the aquifer, an additional DGWR monitor well will be installed in the vicinity of the old cathode waste pile.

As described above, the number, location, and screened interval of additional monitor wells were selected in order to obtain detailed water-level data and to define the lateral and vertical extent of ground-water quality impacts from facility operations. The wells have been designed to monitor specific areas and water-bearing zones and to define the potentiometric head distribution in areas of low data density. Table 4.2-2 summarizes the screen intervals and purpose for each proposed monitor well to be installed as part of the hydrogeologic investigation during the RI.

Well Construction Methods

Three different well designs will be used to construct the proposed wells: a single well design, a dual well design and a telescoping well design. The single well design will be used to construct the wells to be screened within the saturated fractured basalt (water-table). The dual well design will be used to construct "A" aquifer and "B" aquifer well clusters. The telescoping well design will be used to construct the wells screened within the DGWR.

The single wells will be installed within a nominal 6-inch-diameter borehole excavated with an air-rotary drilling rig equipped with an air hammer. The total depth of the fractured basalt (water table) wells will be approximately 40 to 80 ft below land surface (bls). During all drilling, samples of the drill stem cuttings will be collected and composited for each 5-ft interval drilled. The samples will be described by the on-site hydrogeologist who will record the lithology, competency and other pertinent features. The samples from each five-ft interval will be stored in plastic bags which will be labeled with indelible ink as to boring number and sample interval. The set of samples from each boring will be stored in wooden boxes and the boxes archived at the site for a minimum of one year.

The single wells will be constructed of nominal 2-inch-diameter, threaded, PVC well casing, a ten-ft length of #30 slot (0.030 inch), wire wound PVC screen and a 2.5-ft PVC sump. The casing will be installed in the borehole and centered with aluminum centralizers attached to the casing immediately above and below the screen and at 40-ft intervals along the remaining length of casing. The centralizers will be aligned to allow insertion of a tremie line within the annular space to the wells total depth. A graded filter pack will be installed by the tremie method from the total depth of borehole to 2-ft above the top of the well screen. The specifications of the filter pack are presented in Table 4.2-3. Above the filter pack, a one-ft thick, fine sand cap (65-40 sand) will be installed designed to prevent migration of grout into the screen interval. Above the fine sand cap,

TABLE 4.2-2 PROPOSED MONITOR WELLS

Well Cluster	Zones Monitored	Purpose
12	S, A, B	Define ground-water quality and potentiometric head distribution in upper aquifers west of the landfill.
13	S, A, B	Define ground-water quality and potentiometric head distribution between landfill and animal shelter.
14	S, A, B	Define distribution of free cyanide between and upgradient of clusters 2 and 7.
15	A, B	Define extent of elevated free cyanide and fluoride, identified in wells 8 and 9, to the east of the Old Cathode Waste Pile. Provide design criteria for ground-water remedial action.
16	A, B, D	Define extent of elevated free cyanide southwest of the Old Cathode Waste Pile. Provide monitoring point within Dalles aquifer.
17	S	Monitor ground-water quality within the water-table zone immediately downgradient of the New Cathode Waste Pile.
18 19	S S	Evaluate ground-water quality and potentiometric head within the water-table zone to the east (18) and south (19) of the scrubber sludge ponds.
20 21 22	S S S	Evaluate ground-water quality and potentiometric head within the water-table zone to the south (20), east (21), and north (22) of the recycle pond.

Notes:
S = water-table zone within fractured basalt
A = "A" aquifer B = "B" aquifer
D = Dalles aquifer

TABLE 4.2-3
Filter Pack Specifications

U.S. Standard Sieve No..	Percent Retained
12	0 - 10
16	15 - 40
20	84 - 90
30	96 - 100
Maximum Uniformity Coefficient	2.5
Maximum Calcareous Content	5%

a class A cement grout slurry containing 5% bentonite by volume will be installed by the pressure tremie method to land surface.

To complete the installation, a nominal 6-inch-diameter protective steel casing with locking cap and 3 ft x 3 ft concrete pad will be installed around the PVC well casing. Figure 4.2-4 presents a construction diagram for a typical single well installation.

The dual well design will be used to construct monitor-well clusters containing a well screened within the "A" aquifer and a well screened in the underlying "B" aquifer (Figure 4.2-5). A nominal 12-inch-diameter borehole will be drilled using an air-rotary drill rig to a total depth of approximately 200 ft bls. Drill stem cuttings will be collected, described, and archived as previously discused. The "B" aquifer monitor well will be constructed of nominal 4-inch-diameter, threaded, schedule 40 PVC casing; a 10-ft section of #30 slot (0.030 inch), wire-wound PVC well screen and a 2.5 ft PVC sump. The casing will be installed in the borehole and centered by placing aluminum centralizers on the well casing above and below the screen section and at 40-ft intervals along the remaining length of casing. The centralizers will be aligned to allow insertion of the tremie line and the 2-inch well casing of the "A" aquifer well through the annulus without obstruction. A graded filter pack will be installed within the well annulus by the tremie method from total depth to approximately 2 ft above the top of the "B" aquifer well screen. The specifications of the filter pack will be the same as that used for the single well design (see Table 4.2-3). Above the gravel pack, one ft of fine sand (60-45) will be installed by the tremie method to prevent migration of grout into the filter pack. Above the fine sand cap, a class A cement grout containing 5% bentonite by volume will be installed by the pressure tremie method. The top of the grout will be five feet below the base of the screen zone of the "A" aquifer monitor well.

The lower grout seal will be allowed to cure and a one-ft fine sand cap will be installed above the top of the grout. The "A" aquifer well will then be installed within the annular space. The well will be constructed of nominal 2-inch-diameter, threaded PVC casing; a 10-ft section of wire wound, #30 slot (0.030 inch), PVC screen and a 2.5 ft PVC sump. A graded filter pack material, with specifications as described previously, will be installed by the tremie method to a height of 2 ft above the top of the well screen. Above the gravel pack, a 1-ft thick fine sand cap (60-45) will be installed. The remaining annular space will be filled with a class A neat cement grout containing 5% bentonite by volume. The installation will be completed by installing a

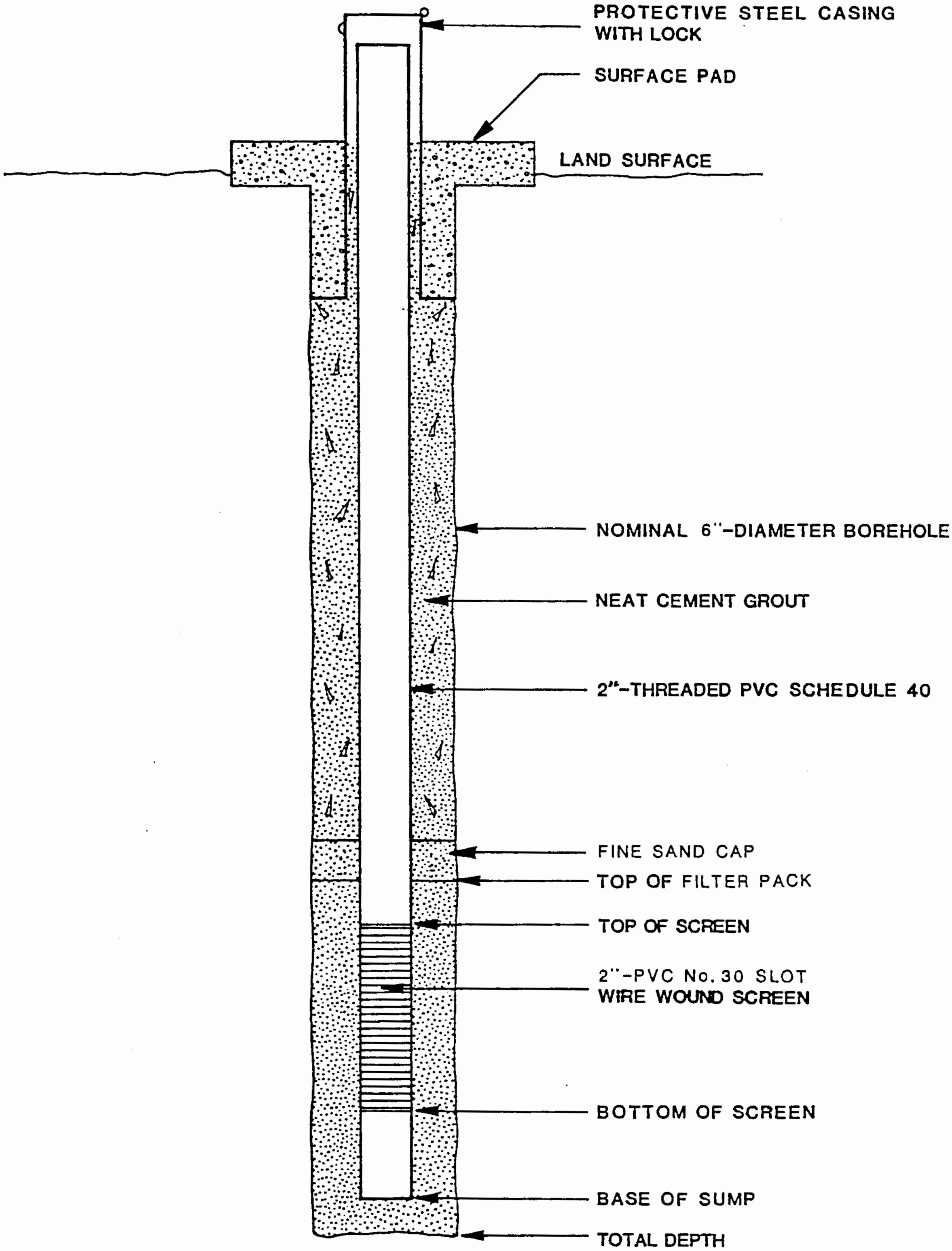

Figure 4.2-4. Construction Diagram of Single Well Design.

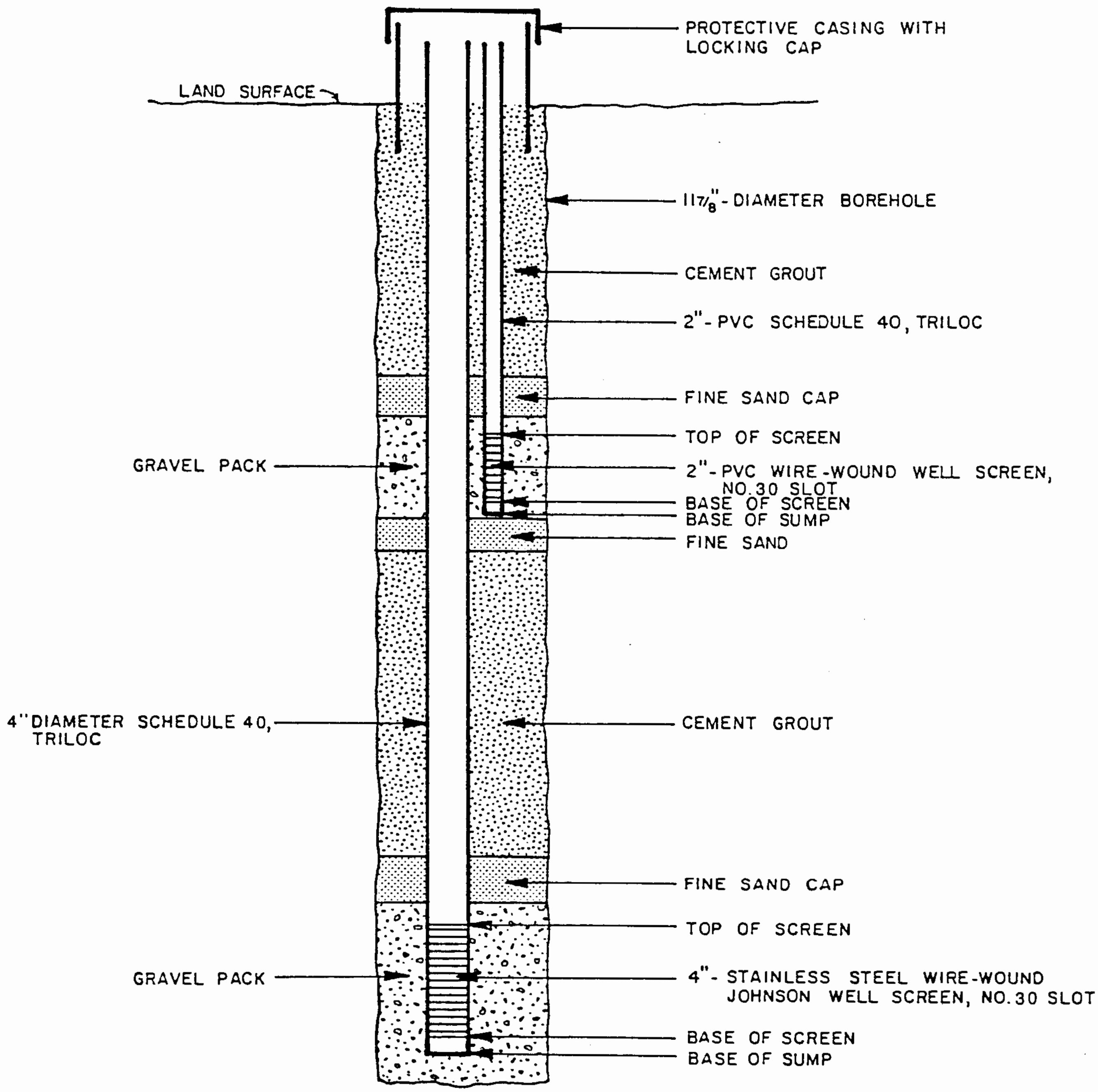

Figure 4.2-5. Construction Diagram of Dual Well Design.

12-inch-diameter surface casing and a 3 ft x 3 ft concrete pad around both PVC well casings.

A telescoping well design will be used to construct the well which screens the DGWR (Figure 4.2-6). The telescoping design will preclude communication, and potential cross contamination, between the "B" aquifer and the DGWR during well installation activities.

A continuous core will be obtained from a pilot hole drilled at the site of the DGWR well. The core will be acquired with a Christen CP Wireline coring system, or equivalent. The core hole will be advanced to 5 ft below the top of the "blue clay" unit which overlies the DGWR, and has an upper contact approximately 180 to 200 ft bls. The pilot hole will be reamed to a nominal 8-inch-diameter to total depth. A nominal 6-inch-diameter, threaded, schedule 40 PVC casing will be installed in the borehole and pressure grouted through the casing. After the grout has cured for a minimum of 24 hours, a core hole will be advanced to the DGWR, using the wireline coring system, to a total depth of approximately 280 ft bls. A nominal 3-inch-diameter string of threaded PVC casing with a 10-ft section of #30 slot (0.030 inch), wirewound, PVC well screen attached will be installed within the borehole. A graded filter pack will be installed around and 2 ft above the screen by the tremie method. A 1-ft thick fine sand (60-45) cap will be installed above the top of the filter pack. The remaining annular space will be filled with a class A neat cement grout, containing 5% bentonite by volume installed by the tremie method. A nominal 8-inch-diameter steel surface casing with locking cap and a 3 ft x 3 ft concrete pad will be installed around the PVC casing to complete the installation.

All well cuttings excavated during well-installation activities will be contained at the well site and subsequently transported to the lined pond for storage.

Well Development

After allowing the annular grout to cure for a minimum of 24 hours, the wells will be developed by surging and alternately blowing the hole with filtered compressed air. An oil filter will be used to remove all traces of compressor lubricant from the compressed air. Swabbing will be performed once most of the sediment has been removed from the well. Development will continue until sediment-free, clear water is produced. Bailing or pumping may be required to complete development.

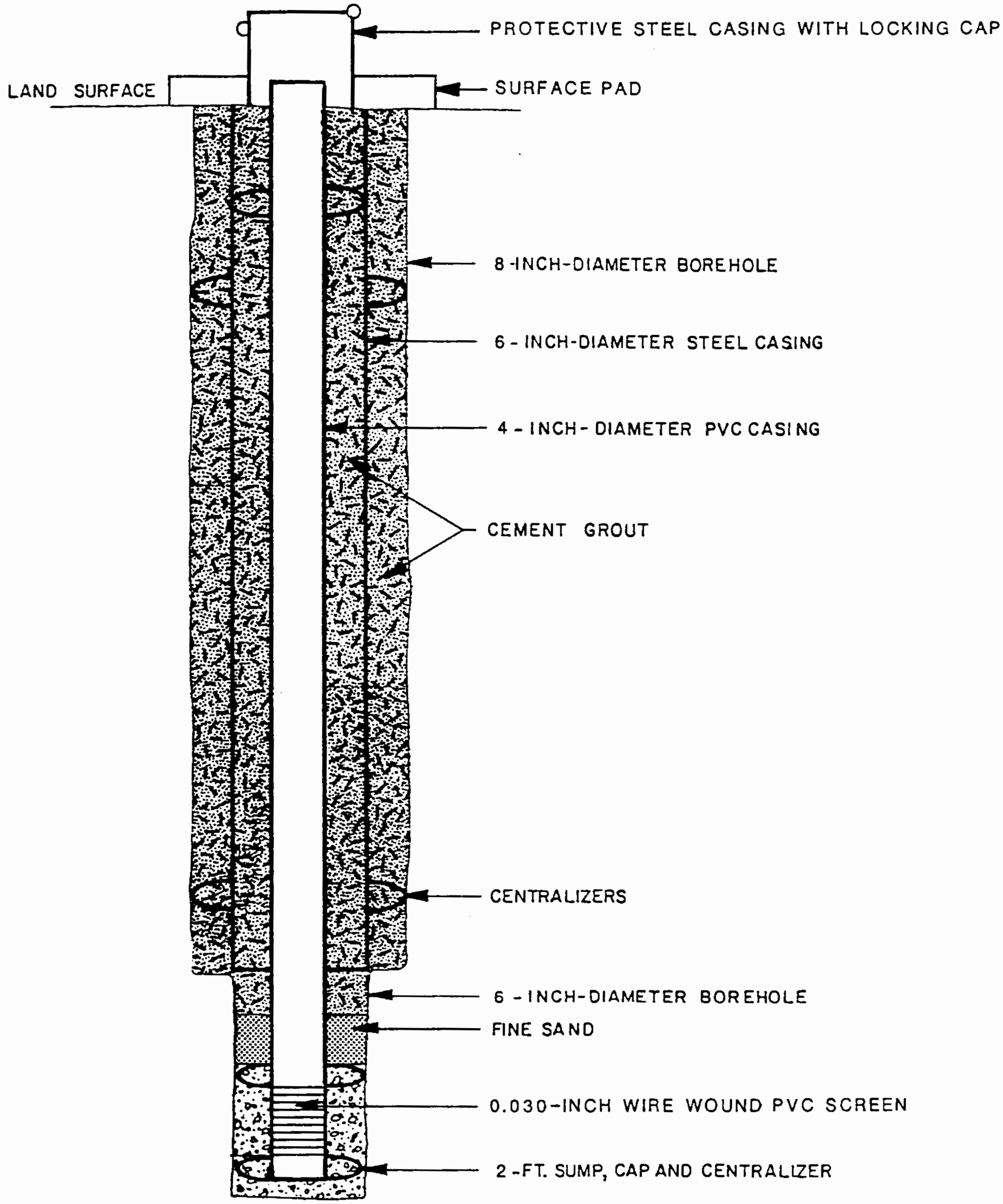

Figure 4.2-6. Construction Diagram of Telescoping Well Design.

Bailing will be performed utilizing teflon bailers. Pumps can be ejector or submersible type and must be constructed in a manner such that ground water cannot be contaminated by bearing seal lubricants. Submersible motors and pumps will be steamcleaned and dried prior to lowering into each well. Water removed by well development will be collected and placed in the lined pond.

Decontamination

All tools, drill rods, casing, screens, and working areas of the drill rigs shall be steam cleaned daily and between each boring to prevent the introduction of contaminants by well-construction activities. All down hole equipment shall be frequently inspected for possible contaminant sources. Down hole lubricants will be prohibited unless approved by the on-site coordinator. Potable water will be used for high pressure steamcleaning. Decontamination will be performed in the area of the lined pond which will be used to store the materials and waters generated from the cleaning process.

Subtask 6.5 Ground-Water Quality Sampling and Analyses

Sampling of all ground-water monitoring wells will be performed. Water levels will be determined prior to preparation of wells for sampling. Three (3) to five (5) well volumes will be removed or the well will be pumped dry and allowed to recharge prior to sample collection. Samples will be collected with teflon bailers or submersible pumps. Ground-water samples will be collected and placed into appropriate containers, labeled, preserved, if required, cooled and shipped to the laboratory for analysis. The complete sampling protocol is described in the QAPP (Quality Assurance Project Plan, Appendix A).

The samples will be analyzed for the specific waste constituents anticipated at the various storage facilities at the site. All ground-water samples will be analyzed for constituents identified in the consent order as presented below and hereinafter referred to as the standard list.

- o Standard List
  - pH (field and lab)
  - Temperature (field)
  - Conductivity (field and lab)
  - Cyanide (total and free)
  - Fluoride
  - Sulfate

- Sodium
- Arsenic

The presence of PCBs at the landfill and the recycle pond will be evaluated during the waste characterization and soils and sediments investigations. If PCBs are detected within the waste, sludge, or sediment samples from these sites, the newly installed water-table wells downgradient of these areas will be analyzed for PCBs.

During the waste characterization and soils and sediments investigations, samples from the landfill, recycle pond, scrubber sludge ponds, the discharge channel, the north drainage ditch and soils potentially exposed to waste constituents will be collected and analyzed for EP toxicity metals. If metal concentrations within these samples exceed the criteria for characterization of a hazardous waste, the wells monitoring the areas indicating metal contamination will be analyzed for the specific metals identified at each site.

Analyses for organic constituents, base-neutral and acid extractables and purgeable organics, will be performed upon ground-water samples from the upgradient wells (1A, 1B, 1C, 4S, and 4A), water-table wells downgradient of the old cathode waste pile (8A and 9A), water-table wells downgradient of the landfill (13S and 14S), water-table wells downgradient of the scrubber sludge ponds (18S and 19A) and wells downgradient of the recycle pond (20S, 21S, and 22S).

One monitoring well will be selected for a duplicate sample and trip or field blanks will be used as required by the QAPP. Table 4.2-4 indicates the chemical analyses to be performed on the ground-water samples from the various monitor wells.

Task 7.0 Soils and Sediment Investigation

The objectives of the Soils and Sediment Investigation are to:

- Identify any existing soil contamination;
- Determine the lateral and vertical extent of soil contamination, if present; and
- Evaluate contaminant concentrations in the sediments of the various ponds and ditches.

TABLE 4.2-4
Chemical Analyses of Ground-Water Quality Samples

	Chemical Analyses			
Well No.	Std. List[1]	Metals[2]	PCBs[3]	Organics[4]
1A	x	x		x
1B	x	x		x
1C	x	x		x
2A	x	x		
2B	x			
3A	x	x		
3B	x			
3C	x			
4S	x			x
4A	x			x
5A	x			
6A	x	x		
6AA	x			
6B	x			
7A	x	x		
7B	x			
8A	x	x		x
8B	x			
9A	x	x		x
9B	x			
10A	x			
11D	x	x		x
12S	x	x		
12A	x			
12B	x			
13S	x	x	x	x
13A	x			
13B	x			
14S	x	x	x	x
14A	x	x		
14B	x	x		
15A	x	x		
15B	x	x		
16A	x	x		
16B	x	x		
16D	x	x		
17S	x	x		
18S	x	x		x
19S	x	x		x
20S	x	x	x	x
21S	x	x	x	x
22S	x	x	x	x

Table 4.2-4 (continued)

Notes:

1 pH, temperature, specific conductivity, cyanide, fluoride, sulfate, sodium, arsenic

2 Analyses for selected metals will be performed if detected in hazardous concentrations from EP toxicity testing during waste characterization.

3 PCB analyses of ground-water samples will be performed if detected during waste characterization.

4 Base-neutral and acid extractable organics, purgeable organics.

Subtask 7.1 Surface Soils

Samples of the surficial soils at all areas where cathode waste material was stored, handled or treated will be collected for chemical analyses. Additional soil sampling will be performed in areas where surface water, expected to contain waste constituents, has collected in the past. The areas to be sampled include the old cathode waste pile area and surroundings, the potliner handling area, the cathode wash area and the low areas and natural drainage system to the east of River Road (Figure 4.2-7).

The soil samples will be collected with a stainless steel sampling scoop. At each sampling area, a sampling grid will be established containing 100 nodes. A random number generator will be used to select 10 sampling stations. A subsample will be collected from each of the 10 sampling stations and will be composited to create one soil sample from each of the sampling areas. The samples collected will be analyzed for cyanide, fluoride, and sodium.

Subtask 7.2 Sediments

Sediment samples will be collected from the following locations:

- o Scrubber Sludge Ponds;
- o Recycle Pond;
- o Lined Pond;
- o North Drainage Ditch;
- o Discharge Channel; and
- o Duck Pond.

Each sample will be collected, labeled, preserved, and shipped in accordance with QAPP protocol.

The scrubber sludge ponds will be investigated using an auger drill rig. Approximately one boring per acre will be augered through the ponds for a total of 10 auger borings (Figure 4.2-8). One composite sample will be compiled from the auger cuttings from each borehole. The composite samples will be analyzed for cyanide, fluoride, arsenic, sodium, base-neutral extractables, acid extractables, and purgeable organic compounds.

The recycle pond receives wastewater from the secondary scrubber system, rectifier cooling water and the sanitary

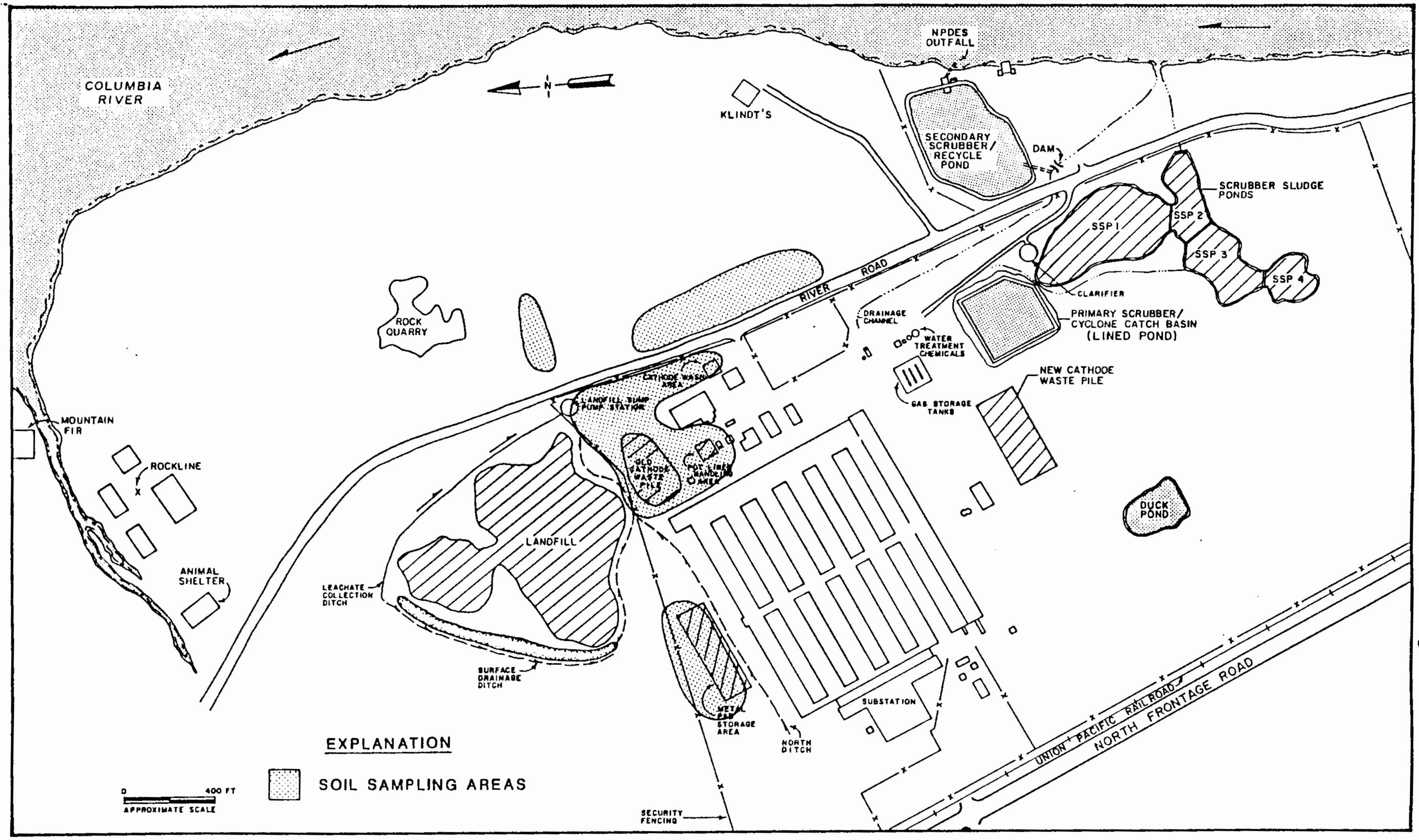

Figure 4.2-7. Soil Sampling Areas.

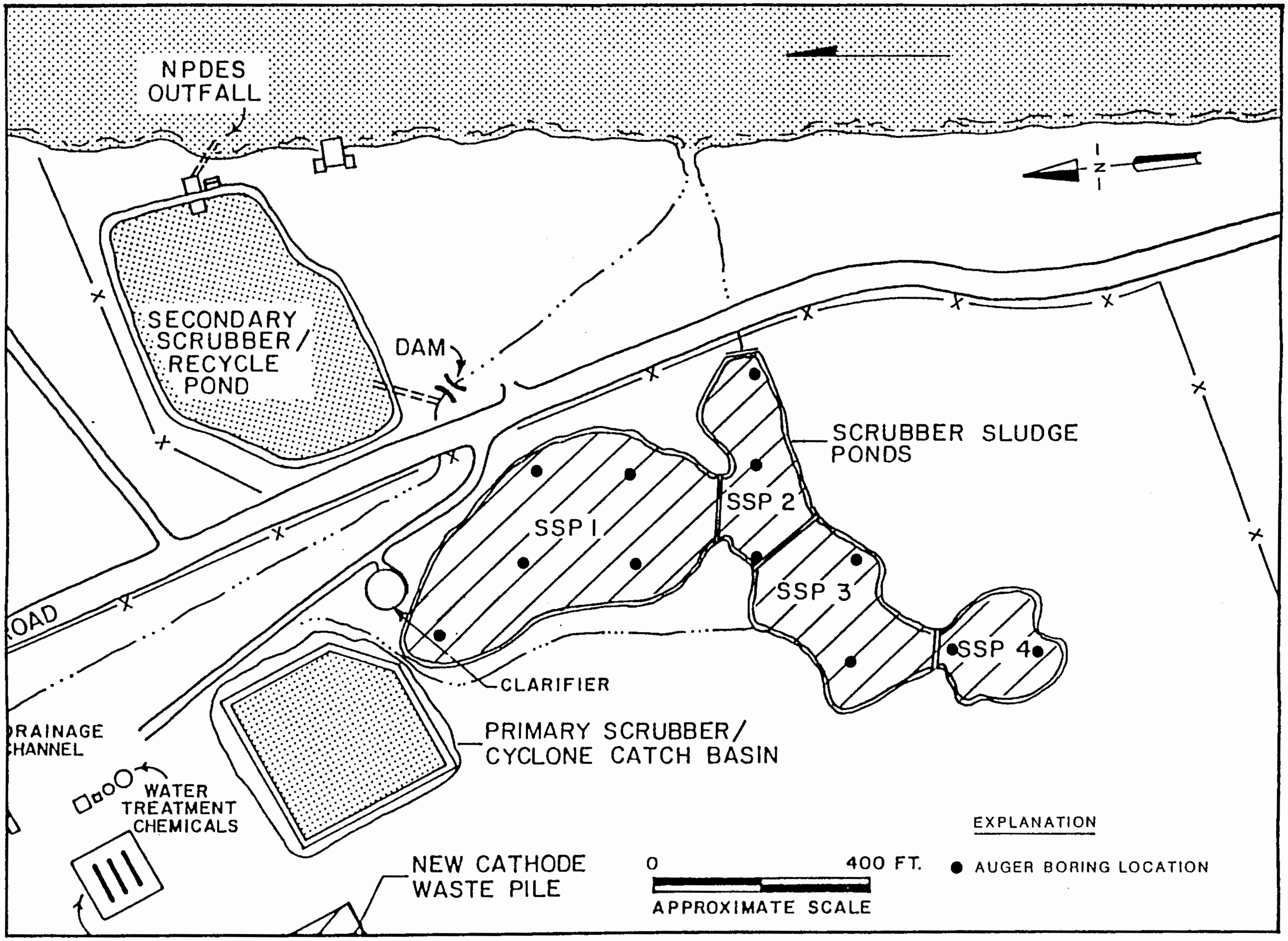

Figure 4.2-8. Auger Boring Locations - Scrubber Sludge Ponds.

waste treatment system. Four composite sediment samples will be collected from the recycle pond (Figure 4.2-9). The samples will be collected and composited such that each sample represents one-quarter of the pond. Within each quarter, six (6) subsamples will be collected with a clamshell dredge sampler, from a boat, and composited to create one sample for chemical analysis. The four composite samples from the recycle pond will be analyzed for cyanide, fluoride, sodium, EP toxicity metals; base neutral extractables, acid extractables and purgeable organic compounds. The laboratory will prepare a composite sample, from the four composites submitted, for PCB analyses.

The lined pond contains sludges derived from the primary air scrubber system. One composite sample of the sludges will be collected using a clamshell dredge sampler from a boat. The composite sample will consist of six subsamples collected from random sites within the basin. The composite sample will be analyzed for cyanide, fluoride, EP toxicity metals; base-neutral extractables, acid extractables and purgeable organic compounds.

Five (5) composite sediment samples will be collected from the north drainage ditch; the sample locations will be evenly spaced along the length of the drainage ditch, from the head to the collection sump (see Figure 4.2-9). Each composite sample will be comprised of three (3) subsamples collected across a cross-sectional profile of the ditch; one subsample will be collected from the south bank high-water mark, the second from the center of the ditch and the third from the north bank high-water mark. The samples will be collected with a stainless steel sampling scoop.

The north drainage ditch receives influent ground water, may receive leachate components from the landfill and the primary scrubber effluent transport pipeline, and surface-water runoff from, among other areas, the old cathode waste pile. The sediment samples from the north drainage ditch will be analyzed for cyanide, fluoride, and sodium, and EP toxicity metals.

Five composite samples will be collected from the discharge channel equally spaced along the length of the channel (see Figure 4.2-9). Each composite sample will consist of three subsamples collected along a cross-sectional profile of the channel; a subsample will be collected at the high-water mark on both banks of the channel and from the center of the channel. The discharge channel transports effluent from the sanitary wastewater treatment system, the rectifier cooling system, the secondary scrubber system and storm water runoff, to the recycle pond. The sediment samples from the discharge channel will be analyzed for

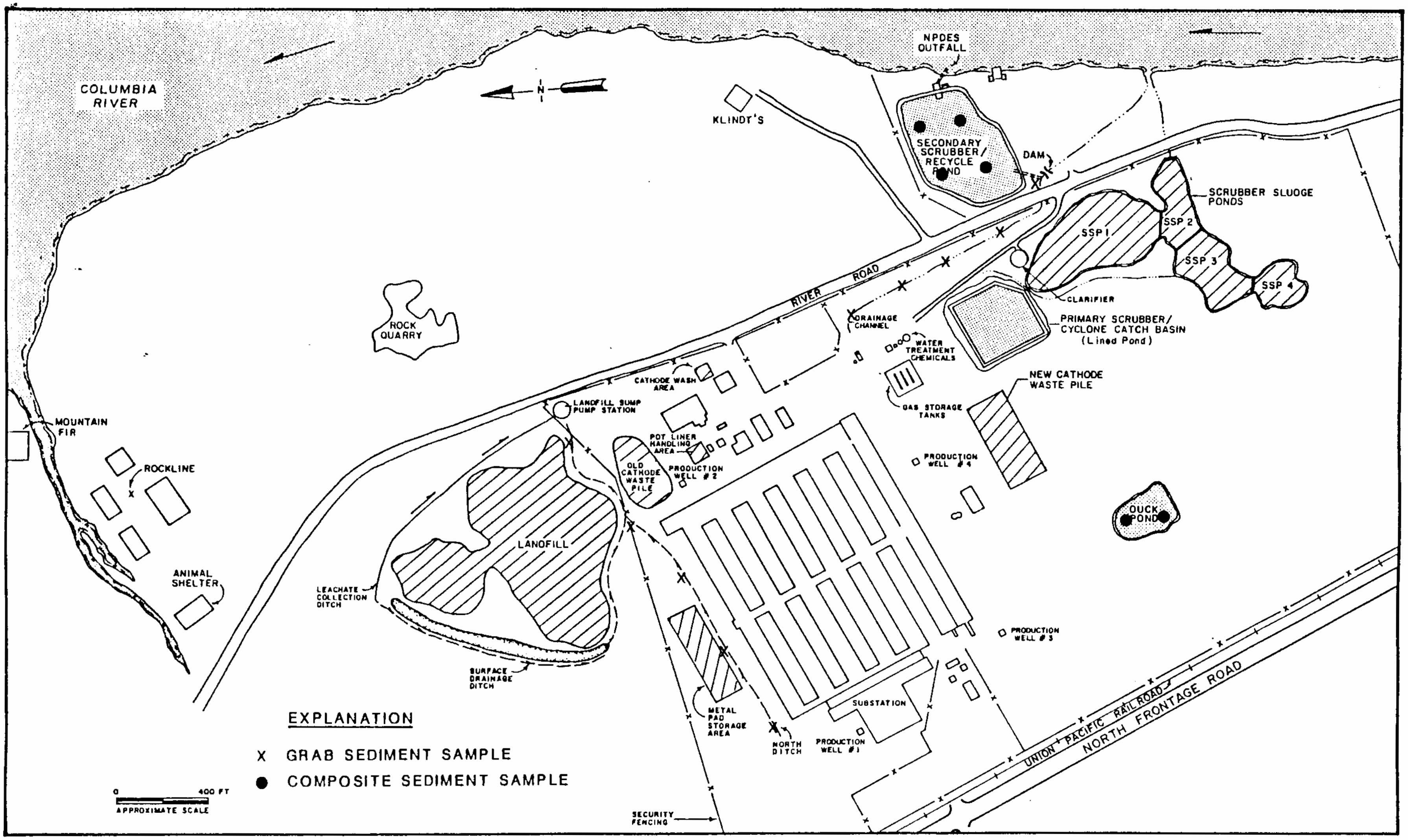

Figure 4.2-9. Sediment Sampling Locations.

cyanide, fluoride, sodium, EP toxicity metals; base neutral extractables, acid extractables, and purgeable organic compounds.

Samples of the bottom sediments of the Duck Pond will be collected and analyzed to characterize its chemical composition and waste characteristics. A total of three samples will be collected, two composite samples and a grab sample (see Figure 4.2-9). The grab sample will be collected near the influent pipe discharge to the pond. The sample will be collected with a clamshell-type dredge sampler from a boat. The composite samples will be collected to represent each half of the Duck Pond. A total of six subsamples will collected with a clamshell dredge sampler and composited to create a single sample for chemical analyses from each pond half. The Duck Pond receives storm water runoff and water pumped from the sump of the alumina off-loading facility. Low levels of cyanide and fluoride are believed to have been introduced into the pond. Each sediment sample from the Duck Pond will be analyzed for cyanide, fluoride, and sodium.

Task 8.0 Surface-Water Investigation

The surface-water investigation will determine water quality for the following:

- o Recycle pond;
- o Lined pond;
- o The Duck Pond;
- o North ditch;
- o Landfill leachate; and
- o Discharge channel.

Surface-water samples will be collected from the Duck Pond (9 samples), the Lined Pond (9 samples), and the Recycle Pond (10 samples) at locations assigned by the grid method. The north ditch will have five (5) samples taken of the water that is present. These samples will be longitudinally placed along the north ditch to assist in the evaluation of contaminant distribution. Landfill leachate will be sampled at four (4) locations corresponding to previous sampling locations performed by Century West Engineering Corporation. The discharge channel will have a single sample taken approximately 100 feet below the junction of the sanitary wastewater treatment and the secondary scrubber process sewers. The sample locations are illustrated in Figure 4.2-10.

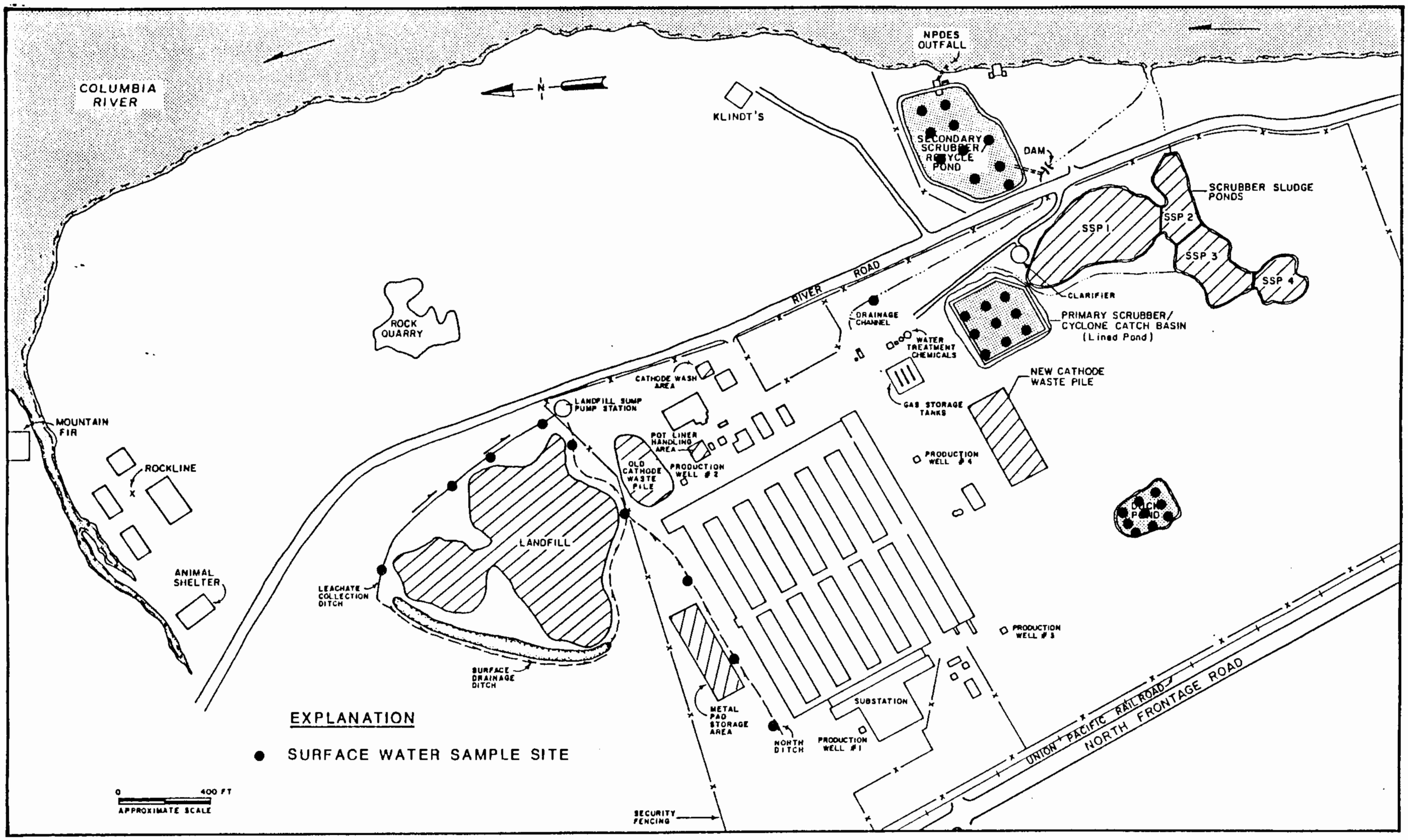

Figure 4.2-10. Surface-Water Sampling Locations.

The sampling method will consist of grab samples (volume) taken just below the surface at each location. The samples will be preserved and labeled in the field and transported to the laboratory as described in the QAPP. Prior to analysis, the laboratory will composite the samples from the Recycle Pond, Lined Pond, and the Duck Pond. Samples from the north ditch, landfill leachate, and discharge channel will be analyzed individually.

Task 9.0 Air Investigation

The impact from air emissions during the MMRF site investigation is a part of the overall environmental control strategy. The emission data will assist in determining the level of personnel protection needed during various remedial activities, the identification of potential "hot spots", and the identification of immediate or imminent threats to the public health.

The air investigation during the MMRF site activities will involve an assessment of the air quality to determine the following:

- o Impact on ambient air;
- o Impact on field personnel; and
- o Evaluation of airborne impact on areas downwind from the site.

Air quality measurements will be conducted at regular intervals during the field operations as described in the Health and Safety Plan. Measurements in the breathing zone on the drilling crew and the sampling (soil, surface water, ground water) team will include the use of precision gas detection tubes (Sensidyne/Gastec, hydrogen cyanide, Tube No. 12L, 2.5 - 120 ppm; hydrogen fluoride, Tube No 17, 0.5 - 20 ppm), a Total Ionizable Pollutants meter (Photovac, TIP, measures airborne concentrations between 0.1 and 2,000 ppm).

During the remedial investigation, additional air-quality monitoring will be provided through the use of an impinger system to capture both hydrogen cyanide and hydrogen fluoride gases that may be emitted from the remedial action activities. The method of sampling and analysis is described below.

Subtask 9.1 Background Air Quality

Prior to initiating sampling activities in the areas of known contamination, meteorological information (wind speed, direction, humidity, rain gage) will be obtained from the Dalles airport located approximately 1.5 miles from the MMRF. Meteorological data will be requested for the duration of the air-quality studies as described below.

Air sampling locations will be positioned at MMRF (1 upwind, 3 downwind). The upwind air sampling station will be located north of the landfill and 3 downwind stations south of the new cathode waste pile (1) and along the southern property boundary (2).

Each air monitoring location will be equipped with an impinger collection system including a midget impinger, a pump, volume meter, thermometer, manometer and stopwatch. The minimum volume of air sampled will be 2.5 liters per minute for a period of 5 to 10 minutes.

After sampling, the impinger stem will be cleaned and prepared for the next sampling location. Air sampling locations will be sampled twice each week in the morning and afternoon for a 4-week period. This will result in 64 air samples collected to quantitative cyanide and fluoride emissions. Analytical methods as described in <u>Methods of Air Sampling and Analysis</u> (Morris Katz, Ph.D., Editor) show Methods 808 (Cyanide in Air) and 809 (Fluoride in Air) using the same sampling apparatus.

Organic vapors will be monitored only in the vicinity of the drilling sites.

Following receipt of the first month's air sampling results, all data will be evaluated by the Health and Safety Officer and compared with ambient conditions to determine the potential of an environmental impact.

<u>Subtask 9.2 Air Monitoring During Implementation of the RI</u>

During the installation of new monitor wells, surface sampling, subsurface borings, and ediment data collection, two or three parameters will be monitored: hydrogen cyanide, hydrogen fluoride, and total ionizable pollutants (see Health and Safety Plan, Appendix B). Sampling of the breathing zone will be performed at a minimum of once per hour during the extent of the work day. All readings and calibration reports will be recorded in an instrument log book by the on-site Safety Coordinator.

Draeger tubes (Sensidyne/Gastec) will be used by the on-site Safety Coordinator to evaluate and document airborne concentrations of hydrogen cyanide and hydrogen fluoride. The method of analysis used will be consistent with that described by the manufacturer.

Task 10.0 Interim Site Investigation Report

The objective of this task is to ensure that data generated during the RI are sufficient in quality (e.g. QA/QC procedures as presented in the QAPP have been followed) and quantity to:

- Adequately characterize the site in terms of (1) types of wastes present (physical state, constituents, concentration, volume, and locations), (2) pathways of (potential) migration, (3) lateral and vertical extent of contamination by media (air, water, soil), and (4) exposure potential for the public and the environment; and

- Support the development and evaluation of remedial alternatives during the feasibility study.

The results and data generated from all of the site investigations will be consolidated and organized in order to make relationships between the site investigations apparent. Findings will be summarized and presented in an interim report which will logically organize the data to support subsequent work. This interim report will be incorporated into the final report detailed in Section 4.5.

4.3 BENCH AND PILOT STUDIES

Currently, no bench or pilot studies are proposed for the Work Plan. The two known waste constituents, cyanide and fluoride, have existing treatment technologies developed that will be considered. Any new or potentially promising technologies will be carefully evaluated before bench or pilot studies will be suggested or performed.. MMRF already has operational data on fluoride removal. Cyanide treatment studies have already been performed and will be used during the assessment.

In the event other constituents are identified, careful consideration will be given to waste matrix (i.e., solid or water contamination) prior to technology selection. In the event that bench or pilot tests are needed to fully evaluate the technology, a study protocol will be developed prior to assessment.

The proposal of a bench or pilot study will require an adjustment to the proposed schedule presented in Figure 1.4-1. An estimated duration and anticipated affect on the schedule will be developed as part of the bench or pilot study.

4.4 COMMUNITY RELATIONS

As directed by the consent order entered into between Martin Marietta and the EPA, community relations activities relevant to the implementation of the order are to be the responsibility of the EPA. Generally, a site-specific community relations plan (CRP) is prepared for CERCLA sites before any site work begins. The CRP details how EPA or DEQ will inform the affected community about the site and will elicit community input into response decisions. Martin Marietta and Geraghty & Miller, Inc., will support the EPA in its community relations efforts, as requested, including attendance at public meetings, briefings or news conferences, and through submission of monthly progress reports which describe the status of remedial investigation activities.

4.5 REPORTING REQUIREMENTS

The scope of work for the remedial investigation of the MMRF site as presented in this section requires the proper documentation and reporting of the data, assessments, and conclusions produced as a result of the implementation of this plan in order to result in a remediation plan which protects human health, welfare, and the environment and is cost-effective. Proper reporting throughout the RI will help achieve this goal by:

- Ensuring that the major issues are addressed adequately;
- Tracking project progress;
- Consolidating data;
- Recording the methods used and the results of the work done; and
- Supporting the decisions made and conclusions drawn during the subsequent feasibility study.

Reporting during the implementation of this work plan will involve the monthly reporting of the technical status of the RI (Task 11) and the preparation of a preliminary and final report presenting the results of the investigation (Task 12). The details of these tasks are presented below.

Task 11.0 Monthly Project Status Reports

Monthly project status reports will be prepared to assist in managing and evaluating the progress of the MMRF site RI. The reports will consist of a technical status report which will identify and/or summarize: (1) activities conducted during this reporting period; (2) work progress, during this reporting period and to date, and percent complete; (3) work planned for next reporting period; (4) work revisions; (5) schedule status; (6) testing/data results; and (7) support activities. These reports will be prepared by the MMRF site RI Project Manager and Project Coordinator on a monthly basis and will be submitted on the tenth day of each month following approval of the RI/FS Work Plan.

Task 12.0 Preliminary and Final Report

The preliminary RI report will be produced following the conclusion of the remedial investigation process and submitted to the EPA for review. The report will present the results of the RI by characterizing the site and summarizing the data collected and conclusions drawn from all investigative areas and levels. This report will support subsequent analysis of remedial alternatives during the feasibility study. Following review, revision, and approval, the final report for the MMRF site will be issued.

The recommended format for the RI report is described by the U.S. Environmental Protection Agency (EPA) in the document entitled Guidance on Remedial Investigations Under CERCLA (EPA/540/G-85/002). As stated in this document, the format has been designed to:

- Ensure that all major issues are adequately addressed;
- Produce comparable presentations from different sites;
- Promote high quality remedial investigation reports; and
- Ensure adequate documentation and complete data for use in decision making.

The various sections of the RI report are briefly described in the following paragraphs. The referenced document presents a more detailed discussions of the requirements of each section.

Executive Summary

This section will present a description of the site and its problems and should summarize the following key elements of the RI:

- Purpose of the RI;

- o Site description, background, and problems;
- o Work performed;
- o Major findings; and
- o Data gaps.

Introduction

The introduction to the RI report should present an overview of the nature of the MMRF site and should establish the background for the data collection and analysis activities reported in subsequent sections of the report. In particular, the section should address: (1) site background information; (2) problem definition and RI objectives; (3) a summary of the RI activities; and (4) and overview of the RI report.

Site Features Investigation

This section presents key features of the site and should include information pertinent to technical, public health, and environmental analyses to be conducted as part of the feasibility study of the remedial alternatives being considered.

Waste Characterization

The waste characteristics section should present data gathered during investigation of the site waste sources. A general description of the types of wastes on-site, including quantities, location, components, containment, and composition, as well as the chemical characteristics of the waste should be addressed.

Subsurface Investigation

The results of the subsurface investigation as related to the site geological, hydrogeological, and geotechnical characteristics are presented in this section. The site geology and subsurface features, soils types (classifications), depths, compositions, contamination levels, and engineering properties, as well as a discussion of the ground-water flow system underlying the site should be discussed and analytical results presented.

Surface-Water Investigation

This section presents the findings of the surface water investigation. Surface water bodies are identified and described and the impact the site may have had on these bodies will be presented. Site drainage and flood potential are then discussed followed by an evaluation of any sediment contamination present.

Air Investigation

Air investigation results including data on air concentrations of contaminants, contaminant plume (if any) dimensions and movement, and airborne particulates. Results of the investigation should support a decision as to whether or not remedial actions regarding air contamination are required and should support the selection and design of such alternatives if they are necessary.

Public Health and Environmental Concerns

This section presents a discussion of potential public health and environmental impacts. This section consists of three subsections:

- o Potential receptors;
- o Public health; and
- o Environmental impacts.

The potential receptors subsection identifies human or other receptors that are or may be affected by site contamination. The subsection on public health summarizes public health concerns resulting from site contaminants and contaminated areas of resources. The environmental impacts subsection reviews environmental damage to the site, if present.

SECTION 5.0

5.0 FEASIBILITY STUDY SCOPE OF WORK

The Feasibility Study (FS) is an integral part of the process of determining the appropriate remedial action to be implemented at the MMRF site. Together with the remedial investigation (RI), the FS allows the systematic and logical evaluation of remedial alternatives and supports the eventual choice of the alternative best suited to remediation criteria developed for the MMRF site.

Since the FS and the RI are interdependent, these activities are usually performed concurrently rather than sequentially. This approach allows data gaps identified during the FS to be filled by revising the RI accordingly. This ensures that the RI will address all the major data requirements and that the FS is complete in its scope. Emphasis during the RI is placed on data collection and site characterization, while the FS emphasizes data analysis and evaluation of alternatives.

5.1 STATEMENT OF OBJECTIVES

The objective of this FS is to develop and evaluate remedial action alternatives for the containment and/or cleanup of the waste constituents present at the MMRF site and to present these evaluations in a manner which will facilitate the choice of the alternative which best meets the remediation criteria. The FS will use the data acquired during all previous investigations, the results of the RI, and other technical and applicable literature to develop and screen appropriate remedial actions. The screened alternatives will then be evaluated based on technological, environmental, public health, institutional, and cost factors. These detailed evaluations will be presented for review and subsequent selection of the alternative most cost-effective yet both technically and environmentally sound. Recommendations for further evaluation of remedial alternatives will be made, if required.

The elements involved in completing the FS are presented below. The six elements are:

- Characterize the Problem and Develop Remediation Requirements;
- Preliminary Identification of Remedial Technologies;
- Development of Alternatives;

- o Initial Screening of Alternatives;
- o Detailed Evaluation of the Remaining Alternatives;
- o Conceptual Design of the Recommended Alternatives; and
- o FS Report.

These elements are described in more detail below.

5.2 CHARACTERIZATION OF THE PROBLEM/GENERAL RESPONSE ACTIONS

Task 1.0 Problem Characterization

The objective of this task is to define current conditions at the MMRF site and to develop requirements for the remedial action alternatives. This will form the foundation from which subsequent tasks can be defined.

Site background information and site characteristics will be obtained from the initial scoping task of the RI and should be updated as warranted by current data and the status of the RI. This information should provide a comprehensive overview of the site and should identify the wastes present and their characteristics as well as actual and potential exposure and/or migration pathways.

Following this summary of the current situation at the MMRF site, a detailed site-specific statement of purpose for the remedial action to be implemented, based on the results of the RI, will be prepared. This statement of purpose will present criteria to be used during the subsequent evaluation tasks.

Task 2.0 Identify General Response Actions

Based on the information pertaining to the MMRF site obtained from the RI, a list of general response actions for site remediation will be developed. The general response action list will be used to identify the universe of potential applicable technologies. Table 5.2-1 presents some general response actions which may be considered together with their associated remedial technologies.

TABLE 5.2-1

General Response Actions and Associated Remedial Technologies
Feasibility Study
Martin Marietta Reduction Facility
The Dalles, Oregon

General Response Action	Technologies
No Action	Some monitoring and analyses may be performed.
Containment	Capping; ground water containment barrier walls; bulkheads; gas barriers.
Pumping	Ground water pumping; liquid removal; dredging.
Collection	Sedimentation basins; French drains; gas vents; gas collections systems.
Diversion	Grading; dikes and berms; stream diversion ditches; trenches; terraces and benches; chutes and downpipes; levees; seepage basins.
Complete Removal	Tanks; drums; soils; sediments; liquid wastes; contaminated structures; sewers and water pipes.
Partial Removal	Tanks; drums; soils; sediments; liquid wastes.
On-site Treatment	Incineration; solidification; land treatment; biological, chemical, and physical treatment.
Off-site Treatment	Incineration; biological, chemical, and physical treatment.

TABLE 5.2-1
(Continued)

General Response Actions and Associated Remedial Technologies
Feasibility Study
Martin Marietta Reduction Facility
The Dalles, Oregon

General Response Action	Technologies
In Situ Treatment	Permeable treatment beds; bioreclamation; soil flushing; neutralization; land farming.
Storage	Temporary storage structures.
On-site Disposal	Landfills, land application.
Off-site Disposal	Landfills, surface impoundmnts; land application.
Alternative Water	Cisterns; above ground tanks; deeper or upgradient supply wells; municipal water system; relocation of intake structure; individual treatment devices.
Relocation	Relocate residents temporarily or permanently.

5.3 PRELIMINARY IDENTIFICATION OF REMEDIAL TECHNOLOGIES

Task 3.0 Technology Identification

At this point in the FS, feasible technologies for the general response actions will be identified recognizing that there may be combinations of source control and management of migration combinations that are compatible and incompatible. The remedial technologies will be classified according to the kinds of site problems they intend to mitigate.

Task 4.0 Screening of Technologies

Site data from the RI will be reviewed to identify conditions that may limit or promote the use of certain remedial technologies. Technologies whose use is clearly precluded by site characteristics will be eliminated from further consideration at this time.

The effectiveness or feasibility of the remedial technologies will also depend on the characteristics of the wastes. Such characteristics include but are not limited to physical, chemical and toxicological properties. Technologies clearly limited by waste characteristics will be eliminated from consideration.

Consideration of the proposed remedial technologies will require screening based on status of technology development, performance record, and construction, operation and maintenance problems. Technologies that are unreliable, not fully demonstrated, or that perform poorly will be eliminated.

5.4 DEVELOPMENT OF ALTERNATIVES

Task 5.0 Development of Alternatives

Site-specific remedial alternatives will be developed using the remedial technologies identified during the previous task. As part of the FS, at least one alternative for each of the following must be evaluated. The FS report will include those situations where no feasible alternative can be identified for a given category and detail the reasons why the specific alternative is not feasible.

- o Alternatives for treatment or disposal at an off-site facility approved by EPA (including RCRA, TSCA, CWA, CAA, MPRSA, and SDWA approved facilities), as appropriate;

- Alternatives which attain applicable and relevant Federal public health or environmental standards;

- As appropriate, alternatives which exceed applicable and relevant public health or environmental standards;

- Alternatives which do not attain applicable or relevant public health or environmental standards but will reduce the likelihood of present or future threat from the hazardous substances. This must include an alternative which closely approaches the level of protection provided by the applicable or relevant standards and meets CERCLA's objective of adequately protecting public health, welfare, and the environment; and

- A no action alternative.

Preliminary candidate remedial action alternatives being considered for implementation at the MMRF site are identified in Section 3.0 of this Work Plan as a means of facilitating preparation of the scope of work for the RI/FS. The list is not intended to be exhaustive, but will serve as a base for formal identification of the alternatives to be further evaluated during the course of the FS. The alternatives presented include:

- No action alternative; with limited site activities designed to stabilize the existing conditions at the site;

- Off-site treatment and/or disposal; at an off-site permitted facility, coupled with a ground-water recovery system (with off-site disposal of the water) and backfill, grading, and revegetation activities; and

- On-site management; consolidation of waste into one (1) management unit in conjunction with a ground-water recovery system using on-site water treatment;

Detailed descriptions of the alternatives synthesized by combining technologies will be prepared to assist in subsequent evaluations. Acceptable engineering practice will help determine which of the technologies are most appropriate for the site and consideration shall be given to recycle, reuse, waste minimization, destruction, or other advanced, innovative, or alternative technologies when detailing the alternatives to be assessed. The rationale behind the exclusion of any technology passing the preliminary technological screening will be documented.

5.5 INITIAL SCREENING OF ALTERNATIVES

Task 6.0 Initial Alternative Screening

The alternatives developed in Section 5.4 will be screened to eliminate those alternatives which are clearly infeasible or inappropriate, prior to undertaking detailed evaluations of the remaining alternatives. Technical, environmental, and economic criteria to assist in performing an initial review of the remedial alternatives will be developed. Basic criteria will include: 1) order-of-magnitude cost estimates consisting of capital and lifetime operational and maintenance costs and the present-worth value of these costs; 2) resulting adverse public health or environmental effects from implementation of the alternative; 3) reliability, effectiveness, implementability (including public acceptance, legal and institutional issues), and technical feasibility in meeting the defined objectives.

Three broad considerations must be used as a basis for the initial screening: cost, public health, and the environment. More specifically, the following factors must be considered:

1. Environmental Protection. Only those alternatives that satisfy the response objectives and contribute substantially to the protection of public health, welfare, or the environment will be considered further. Source control alternatives 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.

2. Environmental Effects. Alternatives posting significant adverse environmental effects will be excluded.

3. Technical Feasibility. Technologies that may prove extremely difficult to implement, will not achieve the remedial objectives in a reasonable time period, or will rely upon unproven technology should be modified or eliminated.

4. Cost. An alternative whose cost far exceeds that of other alternatives will usually be eliminated unless other significant benefits may also be realized. Total costs will include the cost of implementing the alternatives and the cost of operation and maintenance.

The cost screening will be conducted only after the environmental and public health screenings have been performed.

Environmental and public health criteria must be evaluated first, followed by "order of magnitude" cost screening. This two-step screening process allows an initial assessment of the applicabilty of each alternative relative to the others and eliminates alternatives that do not provide adequate protection of public health, welfare, and the environment, and those that are much more costly than others without providing significantly greater protection.

5.6 DETAILED EVALUATION OF REMAINING ALTERNATIVES

Task 7.0 Detail Alternative Evaluation

The next task of the FS is to prepare a comparative technical assessment of each of the remaining alternatives and to use this assessment in preparing a decision matrix to allow the most appropriate alternative to be selected.

Each remaining alternative will first be developed in sufficient detail to allow comparative technical assessment. This task includes the following components: 1) refine the alternatives and specify major logistic, equipment and utility requirements. Use of established technologies will be emphasized; 2) prepare a basic component diagram; 3) define operation and maintenance/monitoring requirements; 4) define implementation requirements including safety considerations, regulatory and permit requirements, temporary storage, off-site disposal and transportation; 5) prepare a conceptual site layout drawing; 6) develop a schedule for implementation and address phasing and segmenting options; 7) list potential adverse environmental impacts, describe methods to mitigate those impacts and costs of mitigation; and 8) prepare a preliminary opinion of probable costs associated with the alternative including distribution of cost over time.

After development of the alternatives, the evaluation of the alternatives will proceed with analysis of technical, environmental, public health, institutional and cost feasibility of the alternative in light of the remediation criteria established in previous tasks.

Subtask 7.1 Technical Analysis

The technical analysis involves the evaluation of each remedial alternative for performance, reliability, implementability, and safety. Two aspects of remedial actions determine their desirability on the basis of performance: effectiveness and useful life. Effectiveness refers to the degree to which an action will prevent or minimize substantial danger to public health, welfare, or the environment. The useful life is the length of time this level of effectiveness can be maintained. Because of the importance of implementing a remedial action which is protective of human health and the environment, reliability of the alternative is of serious concern. Two aspects of remedial technologies that provide information about reliability are their operation and maintenance requirements and their demonstrated reliability at similar sites. Another important aspect of the remedial alternatives which must be evaluated is their implementability or the relative ease of installation and the time required to achieve a given level of response. Finally, each alternative should be evaluated to assess the short and long-term threat to the safety of nearby communities and environments as well as those to workers during implementation. Evaluation of these aspects (performance, reliability, implementability, and safety) will result in an estimate of each alternative's technical feasibility.

Subtask 7.2 Environmental Analysis

The environmental analysis involves the preparation of an Environmental Assessment (EA) for each alternative. The EA should focus on the site problems and pathways of contamination actually addressed by each alternative. The EA for each alternative will include, at a minimum, an evaluation of beneficial effects of the response, adverse effects of the response, and an analysis of measures to mitigate 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 serve as the baseline for the analysis.

Subtask 7.3 Public Health Analysis

Each alternative will be assessed in terms of the extent to which it mitigates long-term exposure to any residual contamination and protects public health both during and after completion of the remedial action. The assessment will describe the levels and characterizations of contaminants on-site, potential exposure routes, and potentially affected population. The effect of "no action" should be described in terms of short-term effects (e.g., lagoon failure), long-term exposure to hazardous substances, and resulting public health impacts.

Each remedial alternative will be evaluated to determine the level of exposure to contaminants and the reduction over time. The relative reduction in public health impacts for each alternative will be compared to the no-action level.

For management of migration measures, the relative reduction in impact will be determined by comparing residual levels of each alternative with existing criteria, standards, or guidelines acceptable to EPA. For source control measures or when criteria, standards or guidelines are not available, the comparison should be based on the relative effectiveness of technologies. The no-action alternative will serve as the baseline for the analysis.

Subtask 7.4 Institutional Analysis

Each alternative will be evaluated based on relevant institutional needs. Specifically, regulatory requirements, permits, community relations, and participating agency coordination will be assessed.

Subtask 7.5 Cost Analysis

Evaluate the cost of each feasible remedial action alternative (and for each phase or segment of the alternative). 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 distribution of costs over time will be provided.

Subtask 7.6 Alternative Evaluation

Finally, the individual analyses presented above will be compiled and the alternatives compared and a decision matrix constructed to assist in the selection of the most appropriate remedial action alternative.

Alternatives will be compared using technical, environmental, and economic criteria. The following areas should be used to compare alternatives:

- o <u>Present Worth of Total Costs.</u> The net present value of capital and operating and maintenance costs also must be presented.

- o <u>Health Information.</u> For the no-action alternative, prepare a quantitative statement including a range estimate of maximum individual risks. Where quantification is not possible, a qualitive analysis may suffice. For source control options, a quantitative risk assessment is not required. For management of migration measures, present a quantitative risk assessment including a range estimate of maximum individual risks.

- o <u>Environmental Effects.</u> Only the most important effects or impacts should be summarized. Reference can be made to supplemental information arrayed in a separate table, if necessary.

- o <u>Technical Aspects of the Remedial Alternatives.</u> The technical aspects of each remedial alternative relative to the others should be clearly delineated. Such information generally will be based on the professional opinions regarding the site and the technologies comprising the remedial alternative.

- o <u>Extent of Compliance With Applicable Environmental Regulations.</u> This information should be arrayed so that differences in how remedial alternatives satisfy such standards are readily apparent. The general types of standards that may be applicable at the site include:

  - o RCRA design and operating standards; and
  - o Drinking water standards and criteria.

- o Information on Community Effects. The type of information that should be provided is the extent to which implementation of a remedial alternative disrupts the community (e.g., traffic, temporary health risks, and relocation).

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

The decision matrix will assign a numerical ranking system to these (or possibly other) criteria, thus allowing a quantitative comparison of the alternatives and the recommendation of the most appropriate alternative.

5.7 CONCEPTUAL DESIGN OF THE RECOMMENDED ALTERNATIVE

Task 8.0 Conceptual Design

Following the selection of the remedial action alternative found to be most appropriate for implementation at the MMRF site, a conceptual design of the alternative will be prepared. This conceptual design will identify the major items to be addressed during the detailed design of the facility remediation plan and shall present the major elements of the selected alternative (i.e. cap and/or vault configurations, grading requirements, ground-water/ surface-water treatment facilities location/configuration, traffic patterns and access requirements, decontamination requirements, etc.) as applicable in a preliminary form. An integral part of the conceptual design process will be to formalize design criteria and to define data gaps, evaluate their impact, if any, and provide a method for resolving such gaps in the subsequent detail design preparation.

5.8 REPORTING REQUIREMENTS

The scope of work for the feasibility study of the MMRF site as presented in this section requires the proper documentation and reporting of the data, assessments, and conclusions produced as a result of the implementation of this plan in order to result in a remedial action which protects human health, welfare, and the environment and is cost effective. Proper reporting throughout the FS will help achieve this goal by:

- o Ensuring that the major issues are addressed adequately;
- o Tracking project progress;
- o Consolidating data;
- o Recording the methods used and the results of the work done; and
- o Supporting the decisions made and conclusions drawn during the feasibility study.

Reporting during the implementation of this Work Plan will involve the monthly reporting of the technical status off the FS (Task 9.0) and the preparation of the final report presenting the results of the investigation (Task 10.0). The details of these tasks are presented below.

Task 9.0 Monthly Project Status Reports

Monthly project status reports will be prepared to assist in managing and evaluating the progress of the MMRF site RI/FS. The reports will consist of a technical status report which will identify and/or summarize: (1) activities conducted during this reporting period; (2) work progress, during this reporting period and to date, and percent complete; (3) work planned for next reporting period; (4) work revisions; (5) schedule status; (6) testing/data results; and (7) support activities. These reports will be prepared by the MMRF site FS Officer and Project Coordinator on a monthly basis and will be submitted by the tenth day of each month following approval of the RI/FS Work Plan.

Task 10.0 FS Report

The final step of the FS will be the preparation of a preliminary and final report which documents and summarizes the evaluation of the remedial action alternatives and presents the recommendations resulting from these evaluations. The conceptual design of the selected alternative will also be presented. The report will include any revisions required after submittal of the report in preliminary form.

Table 5.8-1 presents the format that will be used for the report which is designed to ensure: (1) all major issues are addressed, (2) ease of comparison with reports from similar sites, (3) that decisions are adequately documented, and (4) that proper recommendations are made and a conceptual design is presented. The information discussed in the sections of the report presented in this table are briefly described in the following paragraphs.

Executive Summary Section

The executive summary is a brief overview of the study and the analyses underlying the recommended remedial action.

Information about the site and the feasibility analysis is summarized so the reader can review the findings in logical order.

The major topics addressed in the executive summary are: (1) the purpose of the FS; (2) the site, its background, and its problems; (3) the promising remedial action alternatives; and (4) the recommended remedial action and its advantages over other alternatives.

Introduction

The introduction to the report characterizes the site in terms relevant to the analysis of remedial action strategies. The introduction has three main topics: (1) site background information, (2) the nature and extent of contamination problems at the site, and (3) remedial action objectives.

Development of Alternatives

This section presents the initial master list of remedial action technologies prepared at the start of the FS and briefly discusses their applications. Initial subjective screening of technologies is presented along with documentation of why given technologies were not further developed. These technologies are then synthesized into applicable preliminary remedial action alternatives and described.

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TABLE 5.8-1

Suggested Feasibility Study Report Format
Feasibility Study
Martin Marietta Reduction Facility
The Dalles, Oregon

EXECUTIVE SUMMARY

1.0 INTRODUCTION

- 1.1 Site Background Information
- 1.2 Nature and Extent of Problem
- 1.3 Objectives of Remedial Action

2.0 DEVELOPMENT OF ALTERNATIVES

- 2.1 Preliminary Remedial Technologies
- 2.2 Synthesis of Alternatives

3.0 INITIAL SCREENING OF ALTERNATIVES

- 3.1 Technical Criteria
- 3.2 Environmental and Public Health Criteria
- 3.3 Other Screening Criteria (As Required)
- 3.4 Cost Criteria

4.0 REMEDIAL ACTION ALTERNATIVES

- 4.1 Alternative 1 - No Action
- 4.2 Alternative 2 - . . . .

  .
  .
  .
- 4.N Alternative N - . . . .

5.0 ANALYSIS OF REMEDIAL ACTION ALTERNATIVES

- 5.1 Non-cost Criteria Analyses
  - 5.1.1 Technical Analysis
  - 5.1.2 Environmental Analysis
  - 5.1.3 Public Health Analysis
  - 5.1.4 Institutional Analysis

TABLE 5.8-1
(Continued)

Suggested Feasibility Study Report Format
Feasibility Study
Martin Marietta Reduction Facility
The Dalles, Oregon

5.2 Cost Analysis

6.0 SUMMARY OF ALTERNATIVES

7.0 RECOMMENDED REMEDIAL ACTION: CONCEPTUAL DESIGN

REFERENCES

APPENDICES

Initial Screening of Alternatives

This section summarizes the screening process used to identify the most appropriate remedial action alternatives to undergo detailed analysis. It should also discuss the following four categories of screening criteria:

- o Technical criteria;
- o Environmental and public health criteria;
- o Cost criteria; and
- o Other site-related criteria.

The discussion should explain the reasons for eliminating any alternatives.

Remedial Action Alternatives

A summary of the remedial action alternatives identified as promising during the initial screening is presented in this section. Specific elements discussed should include:

- o Intent of the alternative (i.e. source control vs. mitigation of migration);
- o Key features of the alternative;
- o Control, storage, treatment, and/or disposal requirements;
- o Phasing of work;
- o Special considerations;
- o Operation, maintenance, and monitoring requirements (short and long term); and
- o Strengths/shortcomings of the alternative.

Analysis of Remedial Action Alternatives

The detailed analyses of the alternatives presented in the preceeding section are discussed here. The majority of the analyses (i.e. support calculations, raw data, etc.) will be presented as appendices to the FS report. This section presents an overview of these analyses and is divided into two subsections: non-cost criteria analyses (technical, environmental, public health, and institutional analyses) and cost analysis.

Summary of Alternatives

This section of the FS report summarizes the remedial alternatives and presents the results of the analyses using appropriate summary tables and figures. The alternatives are compared, with clear statements of advantages and disadvantages. The decision matrix will be presented here and the recommended alternative identified.

Recommended Remedial Action: Conceptual Design

The final section of the FS will present the conceptual design of the recommended alternative, including final design criteria, additional data requirements, and preliminary layouts and specifications. Recommendations for implementation of the choosen action shall conclude the report.

APPENDIX A

APPENDIX A

QUALITY ASSURANCE PROJECT PLAN
MARTIN MARIETTA REDUCTION FACILITY
THE DALLES, OREGON

GERAGHTY & MILLER, INC.

QUALITY ASSURANCE PROJECT PLAN
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
MARTIN MARIETTA REDUCTION FACILITY
THE DALLES, OREGON

Prepared for:
MARTIN MARIETTA CORPORATION

Prepared by:
GERAGHTY & MILLER, INC.

	APPROVAL:	DATE:
Geraghty & Miller, Inc. Project Coordinator	JERRY E. KUBAL	12/10/85
Geraghty & Miller, Inc. Quality Assurance Officer	RICHARD C. SMALLEY	12-9-85
Martin Marietta Corporation Project Officer	JOSE R. BOU	
Environmental Protection Agency Quality Assurance Officer		

TABLE OF CONTENTS

3.0 PROJECT DESCRIPTION

Geraghty & Miller, Inc., (G&M) has been retained by Martin Marietta Corporation (MMC) to prepare a Work Plan and support documents for the Remedial Investigation and Feasibility Study (RI/FS) at the Martin Marietta Reduction Facility (MMRF) located at The Dalles, Oregon. The Quality Assurance Project Plan (described below) has been prepared as part of the required documentation.

Standard Operating Procedures for Martin Marietta Environmental Systems and Century West Engineering Corporation are described in Volume 2 of the support documentation. Analytical responsibilities described in the Work Plan have been divided into two portions with all inorganic analyses to be performed by Century West Engineering Corporation, and all organic analyses performed by Martin Marietta Environmental Systems.

3.1 PROJECT BACKGROUND

The Martin Marietta Reduction Facility is located in Wasco County, along the western side of the Columbia River at The Dalles, Oregon. The MMRF produced approximately 90,000 tons of reduced aluminum annually. The plant consists of 300 aluminum reduction cells housed in five (5) production buildings. Aluminum is produced at the facility using the Hall-Heroult reduction process. This process electrolytically reduces alumina in a molten bath of cryolite as illustrated in Figure 3.1-1.

The anode is made up of steel supports, aluminum bus bars, steel electrical contact studs with aluminum risers and the constant forming carbon anode normally referred to as the Vertical Stud Soderberg anode. The anode is sacrificed during the reduction process and consists of briquettes produced from a variable mixture of petroleum pitch and coke. The briquettes are formulated in a separate process plant and vary in pitch content from 20 to 35 percent. The reason for various pitch content depends on the need of the anode to prevent cracking or softening.

The space between the anode and cathode is where the alumina reduction occurs. Alumina added to form the crust above the cryolite and periodically added to the cryolite to be reduced to aluminum. This process occurs between 950 to 1,000 degrees celsius. Aluminum settles to the bottom being attracted to the cathode. Improper temperature can cause the

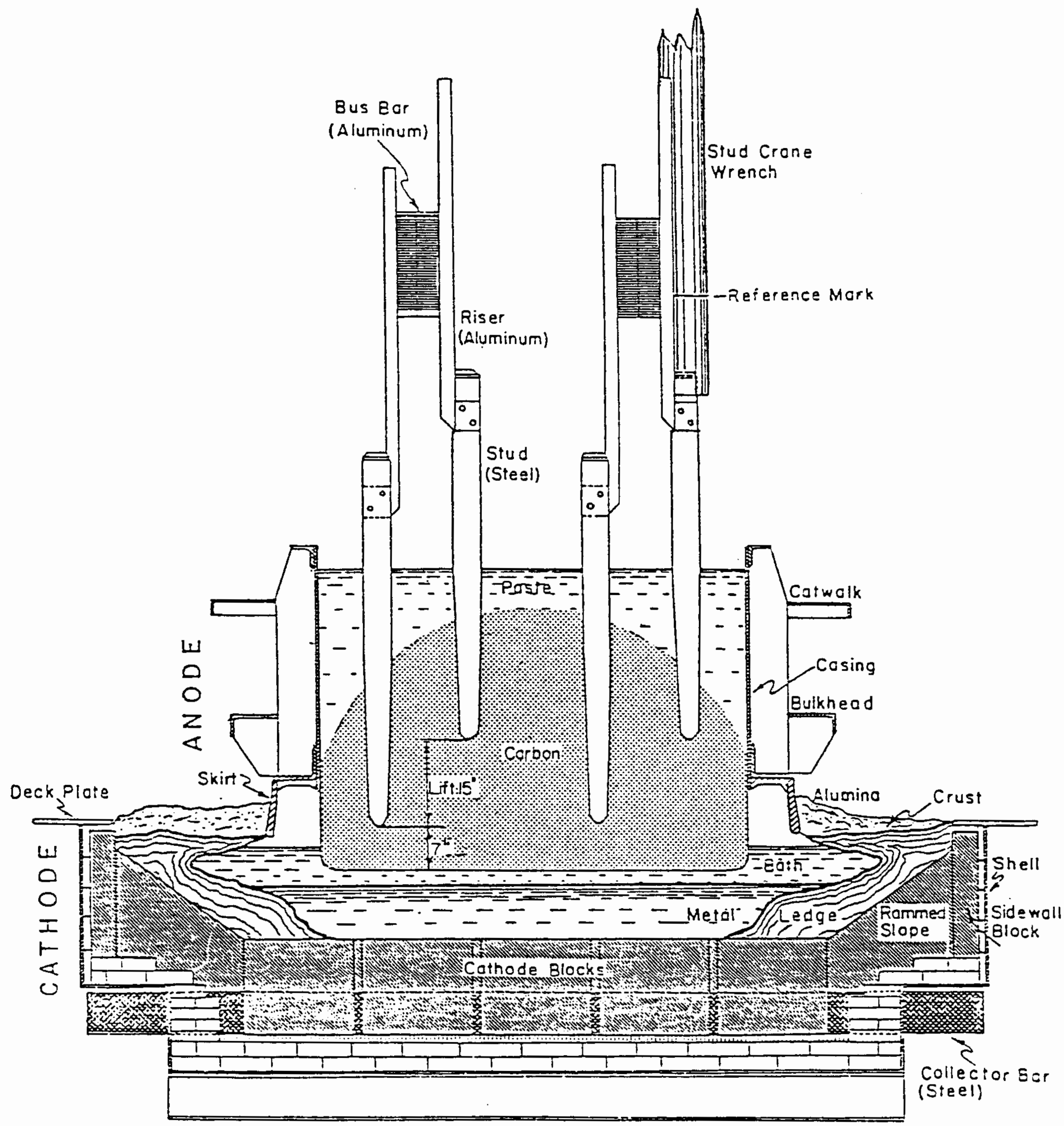

FIGURE 3.1-1. Alumina Reduction Process

cryolite bath and aluminum to invert and short circuit the process. Molten aluminum is siphoned out of all the cells approximately every other day and collectively transferred to the casthouse. In the casthouse, the aluminum is cast into various shapes and sizes as required by other manufacturers.

The cathode is made up of several members consisting of a steel shell, refractory bricks, and carbon blocks rammed into place utilizing a carbon paste. Through the carbon blocks, is placed a steel collector bar to complete the electrical circuit. As the cathode ages, the seams between the carbon blocks erode and eventually molten aluminum contacts the collector bar. This event is determined by analyzing the molten aluminum for iron concentrations. Eventually the iron concentration will be high enough to affect the aluminum properties and the reduction process must be stopped to replace the cathode. The average life of the cathode is approximately five (5) years, which means approximately 60 cathodes were replaced annually at MMRF. From 1958 to approximately 1972, cathodes were disassembled and sent off-site. Softening of the cathode by water washing for several days began in the early 1960's to assist in the disassembly process. After 1972, spent cathodes were stored on-site. In 1984, an engineered waste pile was constructed consisting of a reinforced concrete pad, leachate collection system, and a PVC flexible membrane liner. Cathode waste was transferred from the old waste pile to the new waste pile after its construction in 1984 and before the end of 1984.

Complexed and free cyanide were detected by sampling and chemical analyses of the soil, ground water and surface water on the Site and in ground water adjacent to the Site. These analyses showed that both new and old waste piles were identified as known sources of contamination from cathode waste leachate containing cyanide. Contaminated leachate was determined by the EPA to be a threat to ground-water aquifers located beneath the Site which serve as drinking-water sources for The Dalles, adjacent domestic supplies, and as process water for nearby businesses.

Based upon the results of routine ground-water quality monitoring required by the Oregon Department of Environmental Quality (DEQ), MMC has entered into a Consent Order with the United States Environmental Protection Agency, Region X, to evaluate the presence and the areal and vertical extent of any ground-water contamination.

As described in the Consent Order, a written Work Plan is required for a complete remedial investigation to evaluate soil, ground water, surface water and air emissions at all areas on and adjacent to the site that may be potential sources of contamination. All sources of potential contamination have been reviewed and are summarized in Table 3.1-1 and shown in Figure 3.1-2.

3.2 REMEDIAL INVESTIGATION/FEASIBILITY STUDY OBJECTIVES

The National Oil and Hazardous Substances Pollution Contingency Plan, (National Contingency Plan) comprise the Federal regulations established under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), known as "Superfund". CERCLA authorizes and funds U.S. Environmental Protection Agency (EPA) responses and joint EPA/State responses, to abandoned hazardous waste sites. The National Contingency Plan establishes a sequence of activities in response to the discovery of "a release or threat of a release into the environment of any pollutant or contaminant which may present an imminent and substantial danger to the public health or welfare. This sequence of activities is termed the preliminary assessment. During the assessment, a decision is made to initiate immediate removal of the source or to continue further evaluation. Further evaluation of the site may occur if the site is listed on the National Priorities List (NPL). If the site is ranked high enough to be on the NPL, the EPA/State respond with a Remedial Action "consistent with a permanent remedy to prevent or mitigate the migration of a release of hazardous substances into the environment."

The course of Remedial Action measures is generally broken down into four extended phases:

- Phase I is a Remedial Investigation to determine the nature and extent of the problem;
- Phase II is a Feasibility Study of alternative actions;
- Phase III is the development of an Engineering Design, and;
- Phase IV is the Implementation of the Design.

The National Contingency Plan and associated EPA guidelines have recognized that the development of a site-specific response is an evolutionary process which requires examination of clean-up objectives and feasible

TABLE 3.1-1

IDENTIFICATION OF POTENTIAL SOURCES OF CONTAMINATION

1. Landfill (1)
2. Old Cathode Waste Pile (1)
3. New Cathode Waste Pile (1)
4. Potliner Handling Area (2)
5. Cathode Waste Area (2)
6. Metal Pad Area (2)
7. Primary Scrubber/Cyclone Catch Basin (3)
8. Scrubber Sludge Ponds (3)
9. Surface Water Pond (Duck Pond) (3)
10. Recycle Pond (3)

NOTES:

(1) Monitored as of April 1985
(2) Other storage area of spent potliner waste
(3) Non-Cathode waste sites

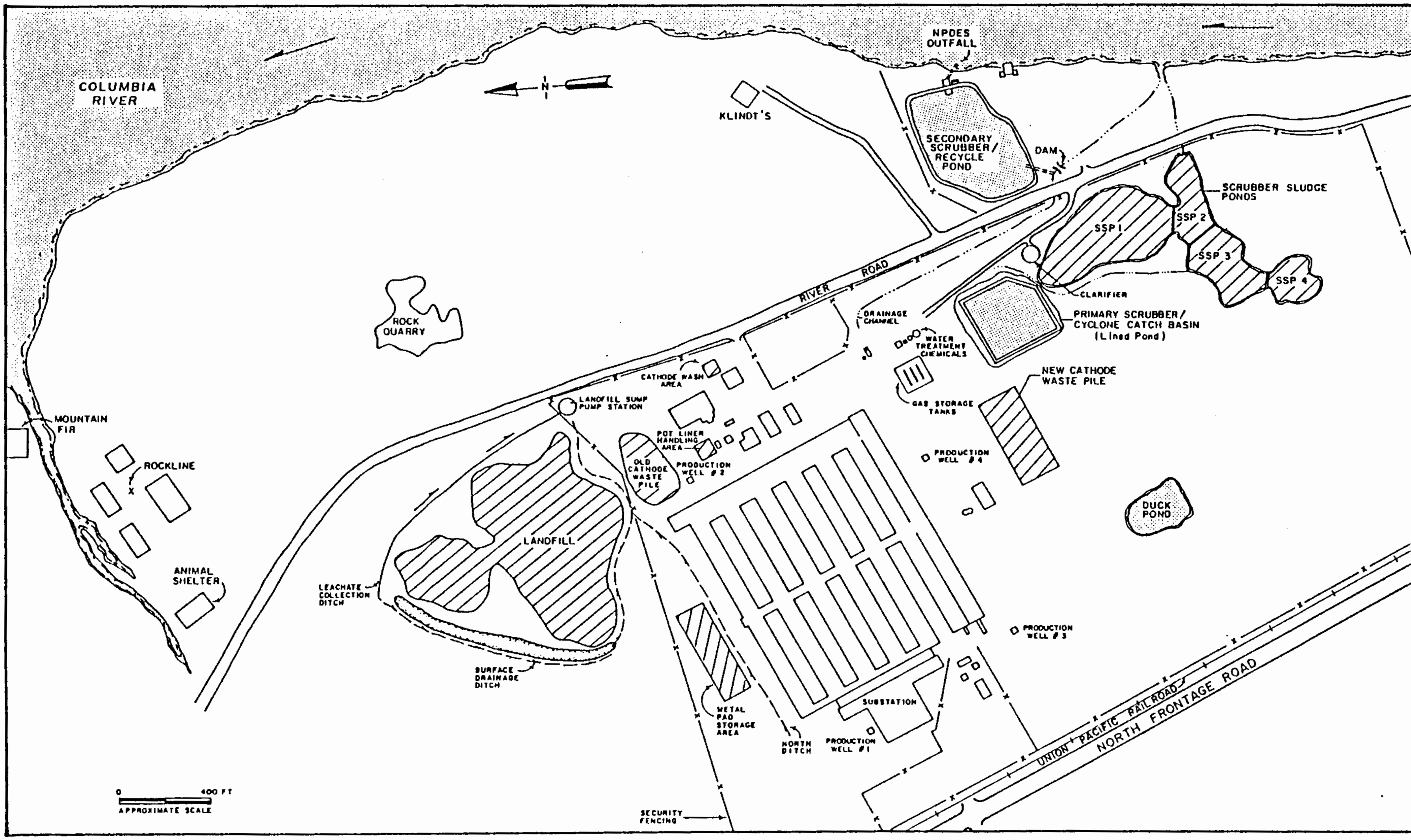

FIGURE 3.1-2. Location of Potential Sources of Contamination.

actions. Based upon the goals of the National Contingency Plan and the findings of the Remedial Investigation, site-specific measures must be defined.

The overall design of the RI/FS recognizes the National Contingency Plan (NCP) requirements to determine the extent (level) of remedial action necessary while providing a cost-effective study which will produce timely results. An understanding of existing site-specific data and the goals and objectives of the Superfund Program were the basis of the study presented in this Work Plan.

The RI objectives have been directed toward the determination of the presence or absence of contaminants and the nature and extent of contamination. The following objectives have been defined for the RI:

- o To determine the nature and the lateral and vertical extent of contaminant sources above and beneath the site surface;
- o To characterize the wastes in the various contaminant sources identified at the site;
- o To determine the presence or absence of contaminants in sediments, soils, and surface waters on and adjacent to the site;
- o To determine the presence or absence of contaminants in the various ground-water systems underlying the site; and
- o To determine the types and nature of the materials separating the water-bearing zones beneath the site.

The following objectives have been defined for the Feasibility Study:

- o To identify preliminary remedial technologies appropriate for the site;
- o To recommend a cost-effective remedial alternative which effectively mitigates and minimizes damages to, and provides adequate protection of public health, welfare, or the environment; and
- o To prepare a conceptual design for the selected remedial action, unless the no-action alternative is selected.

4.0 PROJECT ORGANIZATION AND RESPONSIBILITY

This section provides a description of the organizational structure of personnel to be used on this project. This description illustrates the lines of authority and identifies the key personnel assigned to each function for this project as shown in Figure 4.0-1. Resumes of key personnel are contained in Appendix D.

4.1 AUTHORITY AND RESPONSIBILITIES

The responsibilities of the individual positions for this project are described in the following sections.

4.1.1. Project Coordinator - Jerry E. Kubal

The Project Coordinator will serve as the primary contact for all environmental agency representatives, Martin Marietta personnel and subcontractors. He will be responsible for the day-to-day management of the technical, financial, and scheduling activities for the project. Other duties, as required, may include:

- o Arranging subcontractor services;
- o Assigning duties to the project staff and orientation of the staff to the requirements of the project;
- o Approval of project-specific procedures and internally prepared plans, drawings, and reports;
- o Insuring that the technical, schedule and control requirements established by the QA Officer are enforced on the project;
- o Serving as the "collection point" for project staff reporting any changes or deviations from the project work plan; and
- o Determining the significance of these changes or deviations to the work plan, the appropriateness for reporting such items to the appropriate regulatory and MMC representative.

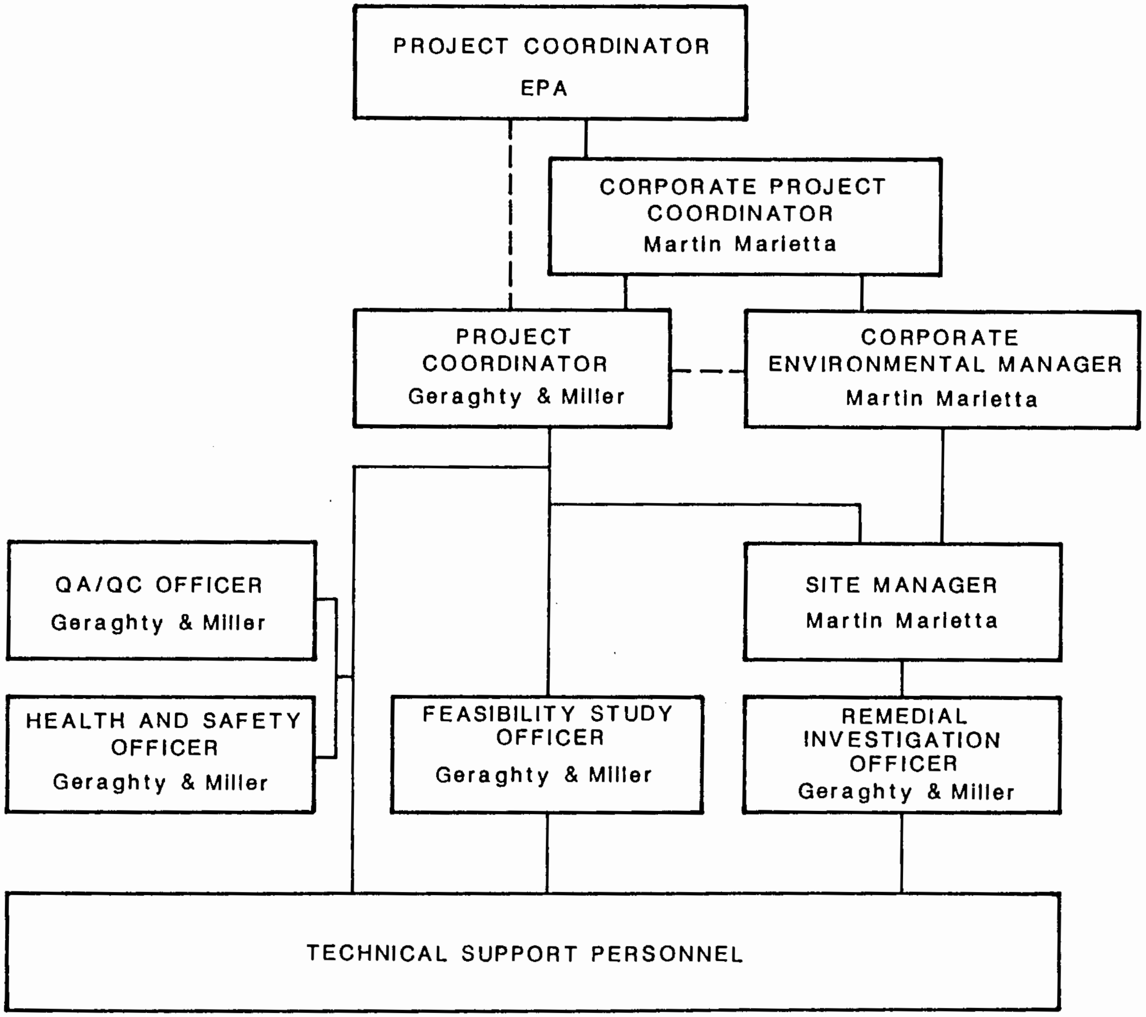

Figure 4.0-1. Project Organizational Chart.

4.1.2 Corporate Project Coordinator - Mr. Jose R. Bou

The Corporate Project Coordinator will review the work plans for the duration of the Remedial Investigation and Feasibility Study and assist the coordination of corporate policy and environmental agency objectives.

4.1.3 Corporate Environmental Manager - Dr. Leonard H. Bongers

The Corporate Environmental Manager will assist the Corporate Project Coordinator and the Project Coordinator to assure that activities of the work plan do not conflict with corporate environmental policy.

4.1.4 Site Manager - Ms. Loretta V. Grabowski

The Site Manager will assist the Project Coordinator in carrying out the on-site activities described in the Remedial Investigation and Feasibility Study. These activities include the coordination of all the technical support groups and assurance that all Site activities are in agreement with the environmental policies of the corporation.

4.1.5 Remedial Investigation Officer - Mr. David L. Smith

The Remedial Investigation Officer is responsible for fulfilling the tasks of the Remedial Investigation by overseeing all drilling and sampling activities. He is initially responsible for the technical requirements described in the work plan.

4.1.6 QA/QC Officer - Mr. Richard C. Smalley

The QA/QC officer is responsible for assuring the validity and accuracy of the field data. This will be accomplished through the review of field and laboratory data and checks of quality control including the evaluation of field blanks, duplicate samples, spiked samples, chain of custody, handling procedures and communications with the analytical laboratory QA/QC representative.

4.1.7 Health and Safety Officer - Dr. Ralph E. Moon

The Health and Safety Officer is responsible for the evaluation of health and safety risks imposed by all on-site activities as described in the plan. In addition, he is responsible for the enforcement of all safety procedures that satisfy State and Federal regulations appropriate to the Site.

4.1.8 <u>Feasibility Study Officer</u> - Mr. David J. Jessup, P.E.

The Feasibility Study Officer is responsible for the description of the technical activities required to remediate the site. These responsibilities are described in the EPA guidance document for CERCLA investigations. He is initially responsible for the preliminary assessment of remedial alternatives presented in the Work Plan, and the Feasibility Study Scope of Work.

5.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, COMPLETENESS, REPRESENTATIVENESS, AND COMPARIBILITY

For each major measurement parameter, including all pollutant measurement systems, the QA objectives for precision, accuracy and completeness are described in Volume 2, Chapter 1, Table 1 of Martin Marietta Environmental Systems Standard Operating Procedures and each test method as provided by the Century West Engineering Corporation QA/QC Program. Discussions on the QA objectives outlined in this plan will be held with the personnel of the contracted laboratories, and amendments will be made as needed in each laboratory QA plan. All measurements will be made so that results are representative of the media (air, water, soil, and sediment) and conditions present during the measurements. All data will be calculated and reported in units consistent with other organizations reporting similar data to allow comparisons of data bases among organizations. A description of the quality assurance objectives for the measurement of sample data is provided in Volume 2 for each contract laboratory. The goals set for the program are given below:

5.1 PRECISION

The QA/QC aim in testing the precision is to demonstrate the reproducibility of the data. The precision of measurements during the project will: (a) be evaluated and reported along with the method reference; (b) use high purity materials, standards, solutions, knowledgeable laboratory personnel, procedures consistent with scientific practice, and internal quality controls; and (c) be consistent with previously published data on precision.

5.2 ACCURACY

Accuracy is the relationship of the reported data to the "true" value, and will be (a) reported with the data; (b) attained by independent audits using standards which are different from those used during routine operations; and (c) consistent with any previously published accuracy data from the applicable literature, and Federal and State regulations and guidelines.

5.3 COMPLETENESS

Completeness is a measure of the amount of valid data obtained from a measurement program compared to the amount that would be expected to be obtained under correct normal conditions. The data base resulting from any project will be routinely assessed on the basis of expected versus actual data capture. The data base will allow a statistical analysis of the results.

5.4 REPRESENTATIVENESS

All data will be representative of the actual conditions at the sampling location. This will involve consideration of the location being sampled, the methods used to obtain environmental samples at the site, and the appropriateness of the analytical method to the type of sample obtained.

5.5 COMPARABILITY

All data will be reported in units consistent with both Federal and State regulations, methods, and guidelines; and in units comparable with previously published work with similar methods within the same type of sample. Comparability between data bases will also be achieved by siting standardized sampling methods of analysis and standardized data formats.

The following table details the quality assurance objectives for the general chemical and physical analyses. The values listed in the table represent this QAPP's goals with respect to the accuracy and completeness of the chemical and physical analyses conducted under this project. Item 9 of this QAPP lists in detail, references for the methods to be followed under this project.

The constitutents selected for analysis represent those constituents that have been determined to be present from earlier investigations at this Site, as well as methodologies that will be used to judge the efficacy of remedial action alternatives. The analyses that will be performed for both solids and water samples may include, but are not limited to:

- o Standard List
  - pH (field and lab)
  - Temperature (field)
  - Conductivity (field and lab)
  - Cyanide (total and free)

- Fluoride
- Sulfate
- Sodium
- Arsenic

o PCBs (selected samples)

o Base neutral/acid extractables (selected samples)

o Purgeable organics (selected samples)

o EP toxicity metals (selected samples)

6.0 SAMPLING PROCEDURES

This section of the QAPP presents the scope and methodology of sampling activities at the MMRF. The primary QA objectives for the sampling procedures are: (a) that the samples obtained are representative; (b) that a sufficient amount of sample is taken; (c) that the proper handling procedures are maintained; and (d) that sampling procedures are documented. These QA objectives form the basis for the site-specific sampling program:

- o Proper locations for sampling;
- o Equipment and procedures for safe sampling;
- o Methods of sampling to be used;
- o Number of samples to be collected;
- o Volume of samples to be collected;
- o Type and kind of field analyses;
- o Laboratory analyses to be performed;
- o Methods of preservation and shipment; and
- o Execution of proper Chain-of-Custody Procedures.

Samples will be collected from various locations from the waste disposal areas to obtain representative samples. The procedures for sampling ground water, surface water, soil, and if necessary, wastes, will vary depending on the sampling situation, the nature of the material to be sampled, the medium sampled, the type of facility being sampled, and the type of structure containing the waste(s). References for sampling procedures that will be used include:

1. <u>NPDES Compliance Sampling Manual,</u> EPA, Office of Water Enforcement, October 1979.
2. <u>Sampling Procedures for Hazardous Waste Streams,</u> deVera et.al.
3. <u>Safety Manual for Hazardous Waste Site Investigations</u>, EPA.

4. NIOSH Manual of Analytical Methods, Volumes 1-7, National Institute of Occupational Safety and Health, U.S. Department of Health, Education and Welfare, 1981.

5. Methods for Chemical Analysis of Municipal and Industrial Wastewater, U.S. EPA, EPA-600/482-057

6.1 SAMPLING SAFETY AND GENERAL FIELD ACTIVITIES

The Health and Safety Plan will detail the safety procedures for sample collection, and will include the following considerations: (a) respiratory protection required while sampling concentrated sources; (b) protective clothing required for personnel involved in sampling; (c) procedures for sampling open drums, tanks, or other vessels; (d) contingency plans for emergencies, including a list of telephone numbers, addresses, and directions to the nearest medical facility, ambulance service, fire department, police department; and (e) identification of the person handling the field samples.

In addition to identifying the sampling personnel, all field investigations and testing will be documented in a daily log of project activities. Examples of the documents used to record the daily activities in the field are included as Figures 6.1-1 to 6.1-4. Items that will be included in the daily log include:

- Field activity subject;
- General work performed;
- Changes to the plans and specifications;
- Visitors to the site;
- Subcontractor progress or problems;
- Communication with the EPA, DEQ, or others;
- Weather conditions; and
- Personnel on site involved in field activities.

DAILY PROGRESS REPORT

Project: ______________________________ Sheet ___ of ___

Location: ______________________________ Observer: __________

Date: __________________ Hours Worked: From ________ to ________

DESCRIPTION OF ACTIVITIES

FIGURE 6.1-1
DAILY PROGRESS REPORT

FIGURE 6.1-2 DAILY WORK DESCRIPTION REPORT

DAILY WORK DESCRIPTION REPORT

Project ______________________________ Week Ending ____________________

Name ______________________________

	Date	Work Description (by task if appropriate)	Hours	For Accounting Use Only: Rate	Labor Cost	Expenses	Cost
Monday							
Tuesday							
Wednesday							
Thursday							
Friday							
Saturday							
Sunday							
		TOTAL:					

Hand In To Project Manager

GERAGHTY & MILLER, INC.
January 1980

CREW REPORT

DAY ______ DATE ______

6:00	PROJECT ______
	CLIENT ______
7:00	LOCATION ______
	FILE NO. ______
8:00	
	TECH. ______
9:00	DRILLER ______
	HELPER ______
10:00	OTHER ______
	RIG ______ P.-U. ______
11:00	WATER ______ OTHER ______
	FOOTAGE ______ BORINGS ______
12:00	MATERIAL ______
1:00	TIME FROM ______ TO ______
	1) SHOP ______
2:00	2) FIELD MAINT. ______
	3) TRAVEL ______
3:00	4) STAND-BY ______
	5) DIFF. ACC. ______
4:00	6/7) DRILL/LOG ______
	OTHER ______
5:00	
	TOTAL ______
	CHARGEABLE ______
6:00	
	REMARKS ______
7:00	______
	______
8:00	
	FILED BY ______

FIGURE 6.1-3
CREW REPORT

BORING LOG

PROJECT NAME ____________ PROJECT NUMBER ____________
LOGGED BY ____________ APPROX. ELEV. ____________
COORDINATES ____________ DRILLING METHOD ____________
GWL: DEPTH ____________ ACTUAL TIME ____________

CASING INFORMATION		GROUNDWATER LEVEL DATA			
SIZE	DEPTH	ACTUAL TIME	DEPTH	ACTUAL TIME	DEPTH

DEPTH	SAMPLER RECOVERY	SAMPLE NO. AND TYPE	STRATA LOG	U.S.C.S. SYMBOL	MEASURED CONSISTENCY (TSF)	DESCRIPTION

NOTE:

TRACE	0 – 5 %
LITTLE	5 – 12 %
SOME	12 – 30 %
——Y	30 – 45 %
AND	45 – 55 %

FIGURE 6.1-4 SAMPLE BORING LOG

Soil and ground-water sampling will require documentation of procedures. The stanles steel scoop (soil samples) and well bailers (ground-water samples) will be rinsed with water and methanol prior to reuse. Decontamination of equipment other than sampling instruments will include steamcleaning between measurements or successive drilling locations. Equipment that will be steamcleaned include the drill rig, bit, auger stem, slug testing equipment (stainless steel cylinder), pump testing equipment and water-measuring probes.

Copies of the daily log entries will be sent to the Project Coordinator approximately once a week. If the logs are not submitted as required, it is the responsibility of the Project Coordinator to contact the field personnel. All field records shall be collected and maintained by the On-Site Manager until completion of the field program. During the performance of a field program, it is anticipated that copies of the field records will be sent on a weekly basis to the Project Coordinator. These copies will provide adequate documentation of work activities should the originals be destroyed, lost, or stolen.

6.2 SAMPLE COLLECTION

In general, sampling procedures require a sampling plan that maximizes the safety of sampling personnel, minimizes the sampling time and cost, reduces errors in sampling, protects the integrity of the samples after sampling, and exercises judicious selection of analytical parameters to minimize analytical costs. The number and location of samples will be governed by access, sampling method, sample quantity, sampling equipment, exposure and required safety equipment.

6.2.1. Sampling Points

A representative sample is dependent upon proper selection of sampling points. All sampling points will be carefully selected. No single series of sampling points can be specified for all types of samples to be collected. Section 6.2.4 refers to the Work Plan, which lists the required samples and the recommended sampling points. Once these points have been selected, the sampling teams will be instructed specifically where and how to collect each sample.

6.2.2. Volume of Samples

The Work Plan will detail the statistical scheme whereby the sample collected is representative of the main body under investigation. The sample volume collected will be of adequate size for all needs, including splitting with EPA or DEQ personnel if requested.

6.2.3. Sampling Equipment

Careful selection of sampling equipment is important. If EPA-approved or otherwise designated reference or equivalent instrumentation exists, it will be used.

6.2.4. Sampling Techniques

Samples for the Remedial Investigation will be required from the following sources:

- Landfill;
- Old Cathode Waste Pile;
- New Cathode Waste Pile;
- Potliner Handling Area;
- Cathode Wash Area;
- Metal Pad Storage Area;
- Primary Scrubber/Cyclone Catch Basin
- Scrubber Sludge Ponds;
- Secondary Scrubber/Recycle Pond; and
- The Duck Pond.

For each source to be sampled, the work plan lists in detail: (a) the sample procedures that will be used; (b) the locations for the samples; (c) the requirements for health and safety that are to be followed; and (d) all other relevant information that needs to be collected to obtain representative samples.

6.3. SAMPLE FILTRATION, PRESERVATION, SHIPPING, AND STORAGE

6.3.1 Samples for Chemical Analysis

If the concentrations of dissolved inorganic constituents are to be determined in a water sample, the sample will be filtered in the field immediately after collection. Samples will be filtered through a 0.45 micron filter using a filtration apparatus equipped with a hand or electrical vacuum pump. The filtering apparatus or equivalent should be cleaned and rinsed thoroughly with distilled water before filtering each sample. The filtered sample should be transferred immediately to sample containers containing the appropriate preservatives.

Table 6.3.1-1 provides a compilation of the sampling containers, sample preservatives, and storage procedures that will be used by the sampling personnel in all field sampling activities.

In general, as work scheduling permits, samples should be analyzed as soon as possible after collection. The time listed in Table 6.3.1-1 represents the maximum time that samples may be held before analysis and still have the results considered valid. Some samples may not be stable for the maximum time period given in the table. If such a case exists, an approximately shorter holding time will be used.

Samples to be shipped off-site for chemical testing shall be placed in ice chests containing "blue ice" or similar frozen packs of gel, and wrapped with tape to prevent breakage during shipping. The ice chest shall be addressed, identified, and placarded as appropriate. Samples shall be taken or shipped to the designated shipper by designated personnel. No samples shall be accepted by the receiving laboratory personnel unless they are properly labeled and sealed. Sample storage in the laboratory will generally be in a refrigerated, secure area until all required analyses are completed.

6.3.2 Samples for Geotechnical Testing

Geotechnical samples shall be sealed, shipped, and stored in accordance with the following procedures:

TABLE 6.3.1-1

SAMPLE CONTAINERS, PRESERVATIVES, AND STORAGE REQUIREMENTS

Measurement[a]	Container[b]	Preservative[c]	Maxium Holding Time[c]
METALS[e]			
Chromium VI	P,G	Cool, 4°C	48 Hours
Mercury	P,G	HNO_3 to pH <2[e] 0.05% $K_2Cr_2O_7$	28 days
Metals (except above)	P,G	HNO_3 to pH <2[e]	6 months
Oil and Grease	G	Cool, 4°C H_2SO_4 to pH <2	28 days
Hydrogen ion (pH)	P,G	Determine on site	2 hours
ORGANIC COMPOUNDS[f]			
Extractable (including phthalates, nitrosamines organochlorine pesticides, PCD's nitroaromatics, isophorono, polynuclear aromatic hydrocarbons, haloethers, chlorinated hydrocarbons and TCDD)	G, Teflon-lined cap	Cool, 4°C 0.008% $Na^2S^2O^3$	7 days (Until extraction) 30 days (after extraction)
Extractables (phenols)	G, Teflon-lined septum	Cool, 4°C H_2SO_4 to pH <2 0.008% $Na_2S_2O_3$	7 days (until extraction) 30 days (after extraction)
Purgeables (halocarbons)	G, Teflon-lined septum	Cool, 4°C 0.008% $Na_2S_2O_3$	14 days
Purgeables (acrolein and acrylonitrite)	G, Teflon-lined septum	Cool, 4°C 0.008%, $Na_2S_2O_3$	3 days

TABLE 6.3.1-1

SAMPLE CONTAINERS, PRESERVATIVES, AND STORAGE REQUIREMENTS

Measurement[a]	Container[b]	Preservative[c]	Maximum Holding Time[d]
Phenols	P,G	Cool, 4 °C H_2SO_4 to pH <2	28 days
Specific Conductance	P,G	Cool, 4 °C	28 days
Temperature	P,G	Determine on site	Immediately

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a Parameter to be measured in sample.

b Polyethylene (P) or Glass (G).

c Sample preservation should be performed immediately upon sample collection. For composite samples each aliquot should be preserved at the time of collection, if possible. Aliquots of the composite, which would require multiple preservatives, should be preserved only by maintaining at 4 C until compositing and sample splitting is completed.

d Samples should be analyzed as soon as possbile after collection. the times listed are the maximum times that samples may be held before analysis and still considered valid.

e Samples should be filtered immediately on-site before adding preservative for dissolved metals.

f Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific organic compounds.

6.3.2.1 Disturbed soil samples

Disturbed soil samples shall be placed in sealable airtight jars. Jar samples shall then be placed in containers, such as cardboard boxes, with dividers for each jar to prevent movement. The boxes should be taped shut in the field and labeled on the top and two adjacent sides to show the project number, name, and identification of the jar samples contained in the box. Other information, such as the Table total depth of the borings, and the interval of the samples, shall be indicated as required by the On-Site Manager.

If the jar samples are to be temporarily stored on site, they will be protected from the weather, including excessive heat and freezing. Indoor storage shall be employed, where possible. For commercial shipment, the boxes should be marked "keep from heat and freezing". Samples shipped or hand-carried to the laboratory shall be accompanied by a laboratory log form, which will provide a record of the samples.

7.0 CHAIN-OF-CUSTODY

Sample custody is an important part of field and laboratory operations when samples are needed for enforcement actions or litigation. Chain-of-custody procedures will document sample possession from time of collection to disposal, in accordance with the guidelines established in the EPA Safety Manual for Hazardous Waste Site Investigations (September, 1980). In order to maintain and document sample custody, the following chain-of-custody procedures will be followed. For the purpose of these procedures, a sample is considered in custody if it is:

- o In actual possession of the responsible person;
- o In view, after being in physical possession;
- o Locked so that no one can tamper with it, after having been in physical custody; or
- o In a secured area, restricted to authorized personnel.

The field samples to be collected can be classified into two categories: (a) in-situ measurements, and (b) laboratory analyses. Section 7.1, Field Custody Procedures, and 7.2, Laboratory Custody Procedures will be followed for all samples collected during the progress of the Remedial Investigation and Feasibility Study.

7.1 FIELD CUSTODY PROCEDURES

The field samples to be collected can be classified into two categories:

- o In-situ measurements - are those measurements made immediately after the sample has been collected. The data will be recorded directly in bound logbooks with sequentially numbered pages, along with identifying information on sampling conditions and location. In-situ measurements include the following: pH, temperature, conductivity, flow measurements, and air monitoring.
- o Laboratory Measurements - Samples collected and preserved in the field, to be shipped to the

appropriate laboratory for chemical analysis. Identifying information on sampling conditions and location will be recorded as indicated above together with a record of the required analyses for each of the samples collected.

7.1.1 Sample Identification

Each field sample will be identified by a sample tag which is filled out using water resistant ink. Included on the tag (usually supplied by the laboratory) are the sample identification number, date, time and location of sample collection, designation of the sample (grab, pumped, or composite), the type of sample and preservative, any pertinent remarks, and the signature of the sampler.

This information will be recorded in the bound logbook along with any in-situ measurement data and field observations. After collection and identification, the sample will be indicated for and maintained under the Chain-of-Custody procedures outlined below. If the sample collected is to be split with Federal or State agencies, then the appropriate sample receiver will be indicated on the split sample tag which is affixed on the container containing the split sample aliquot.

7.1.2 Sample Custody in the Field

The following general guidelines will be used for establishing and maintaining custody of field samples:

- o Sample tags will be completed for each sample, using waterproof ink, making sure that the tags are legible and affixed firmly on the sample container;

- o All information will be recorded in the field in bound notebooks with sequentially numbered pages, using the sample identification numbers from the tags as references;

- o The field investigator will be personally responsible for the care and custody of the samples collected until they are transferred or properly dispatched; and

- o A chain-of-custody record (Figure 7.1.2-1) will be initiated in the field for every sample or set of samples that are being shipped to the same laboratory. A copy of this record will accompany the sample.

Prior to sampling, all personnel involved will have received copies of the chain-of-custody procedure. A briefing for these personnel will be held and documented in conjunction with the Health and Safety training program. The chain-of-custody procedure will be covered, as well as sampling and sample handling procedures. Briefing of personnel is the responsibility of the On-Site Manager.

7.1.3 Sample Transfer and Shipment

The following guidelines will be followed in transferring and shipping samples:

- o Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate record prepared for each laboratory. Shipping containers will be padlocked or otherwise secured for shipment to the laboratory;

- o When transferring possession of samples, the individual relinquishing the sample and the new custodian will sign the record and denote the date and time. A copy of the signed record will be made by the previous custodian and sent to the receiving laboratory to allow tracking of sample possession. All change of custody of samples must be a person-to-person exchange of custody documents and samples;

- o The following documentation will supplement the chain-of-custody records:

- o Field log book, which will be filed upon completion in the project files;

- o Sample tags on each sample;

- o Sample seal on each sample; and

- o Photographic records, wherever practical and to the extent economically feasible.

SAMPLE COLLECTOR'S NAME:

DATE	TIME	SAMPLE #	SAMPLE SOURCE	SAMPLE VOLUME	# OF CONTAINERS	ANALYSIS REQUIRED

Relinquished by: (signature) ____________ Received by: (signature) ____________ Date/Time ____________

Relinquished by: (signature) ____________ Received by: (signature) ____________ Date/Time ____________

Relinquished by: (signature) ____________ Received by: (signature) ____________ Date/Time ____________

Dispatched by: (signature) ____________ Date/Time: ____________ Method of Shipment: ____________

Received at Laboratory ____________ Date/Time: ____________

FIGURE 7.1.2-1. Sample Chain-of-Custody Record

7.2 LABORATORY CUSTODY PROCEDURES

General guidelines describing methods for laboratory sample custody are provided in Volume 2, Chapter 1 (Martin marietta Environmental Systems) and page 11 (Century West Engineering Corporation).

8.0 CALIBRATION PROCEDURES AND FREQUENCY

A calibration procedure establishes the relationship between a known calibration standard and the measurement of that standard by an instrument or analytical procedure. Standards are run each time an instrument or procedure is used.

8.1 CALIBRATION FOR FIELD ANALYSES

Plans will be developed and implemented for all field analyses tests, collection equipment, and calibration standards used, which will include the following: (a) calibration and maintenance intervals; (b) a list of the required calibration standards; (c) the environmental conditions that warrant calibration; and (d) a system of recording documents.

Any equipment used to qualitatively detect unsafe/unhealthful or potentially dangerous conditions for workers, such as photoionizers, will be calibrated before each measurement period (daily). Equipment used to quantitatively measure environmental parameters (e.g. pH, conductivity) will be calibrated at a minimum of once a day by comparison to a calibration standard prepared either gravimetrically or from commercially prepared stock solutions. Measurement devices that do not allow calibration (i.e. thermometers) will have their accuracy determined by comparison to thermometers that have been calibrated according to the relevant ASTM standards.

For sampling of hazardous waste streams and containers, the sampling methods described by the EPA or EPA-approved methodologies (e.g. ASTM standards) will be followed, including any calibration procedures described.

8.2 CALIBRATION OF LABORATORY EQUIPMENT

For all chemical analyses, contract laboratories have provided a description of calibration techniques in Volume 2, Chapter 1, Section IIC (Martin Marietta Environmental Systems) and in individual test methods (Century West Engineering Corporation) as cited in EPA Document 570/9-82-002, an exerpt in Century West Quality Assurance Manual.

8.3 AIR QUALITY ANALYSIS

8.3.1 Draeger Tubes

Draeger tubes will be used by field personnel during drilling and/or exploratory activities to check for airborne gases, i.e. hydrogen fluoride and hydrogen cyanide. A known volume of air is pulled through a gas specific tube which allows direct reading from a scale with the calibrations shown in parts per million. As the reading is taken, the chemicals in the tubes are discolored by the suspected gas. The longer the stain, the greater the concentration. A hand metering pump is used to pull the known volume of air through the tube. The hand metering pump will be calibrated prior to use as follows:

1) A detector tube will be connected between the inlet of the pump and the outlet of a soap bubble meter.

2) The time (seconds) required to displace various volumes will be checked using a stop watch.

3) The calibration data will be entered in the field personnel logbook. Each pump will be identified with a serial number and/or pump number.

4) Detector tubes that have been certified by NIOSH (National Institute for Occupational Safety and Health) will be used.

5) All calibration data and field measurements will be recorded and maintained in the field personnel logbook.

8.3.2 Total Ionizable Pollutant Meter

A Total Ionizable Pollutant meter (TIP) will be used to spot check for "hot spots" of volatile organic vapors. The TIP will be used by field personnel during drilling and/or exploratory activities and whenever the potential exists for high concentrations of volatile organic vapors. The TIP will be calibrated as follows:

1) The Manufacturer's operating procedures will be followed.

2) The TIP will be spanned and zeroed in accordance with the operating instructions.

3) The appropriate documentations relative to the span, zero, drifts, etc., of the TIP will be noted in the field personnel log.

4) All field measurements will be recorded and maintained in the field personnel logbook.

9.0 ANALYTICAL PROCEDURES

9.1 LABORATORY CHEMICAL ANALYSIS

Laboratory testing performed for the MMRF site will consist of chemical analyses of water, sludge, soil/sludge mixtures. For laboratories performing water, sludge and soil/waste chemical analyses, the following references may be used:

- o U.S. Environmental Protection Agency. Test Methods for Evaluating Solid Waste. Physical/Chemical Methods. SW-846. Second Edition.

- o Federal Register. Vol. 49, No. 209. Friday, October 26, 1984. 40 CFR 136. Guidelines Establishing Test Procedures for the Analysis of Pollutants under the Clean Water Act; Final Rule and Interim Final Rule and Proposed Rule. Appendix A - Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater. pp. 29-174. Appendix B - Definition and Procedure form the Determination of Method Detection Limit. Appendix C - Inductively Coupled Plasma-Atomic Emission Spectrometric method for Trace Element Analysis of Water and Wastes Method. pp. 199-204.

- o U.S. EPA Contract Laboratory Program. Inorganic Analysis: Multi-Media, Multi-Concentration. SOW No. 785 July 1985. Sample Management Office, Alexandria, VA.

- o Handbook for Analytical Quality Control in Water and Wastewater Laboratories. March 1979. EMSL. EPA-600/4-79-019.

- o Procedures for Handling and Chemical Analysis of Sediment and Water Samples. May 1981. U.S. EPA/corps of Engineers. Technical Report EPA/CE-81-1.

9.2 LABORATORY GEOTECHNICAL ANALYSIS

9.2.1 Receipt of Samples

The sampling personnel shall complete a record (Figure 7.1.2-1) of each group of samples shipped to the laboratory. Laboratory personnel shall compare this record against the samples received. Any samples that are damaged in shipment shall be noted. If samples are improperly or incorrectly identified, they shall be set aside prior to testing until sufficient information is supplied by project personnel.

9.2.2 Laboratory Testing Procedures

Applicable procedures of American Society of Testing and Materials (ASTM) shall be utilized for geotechnical laboratory testing. Individual procedures for each type of test are summarized in Table 9.2.2-1. If an ASTM procedure is not applicable or available, a testing procedure will be developed and documented appropriately.

9.2.3 Analysis Quality Controls

Statistical controls are normally not applicable to geotechnical testing, and the following procedures will be employed for MMRF RI/FS:

- o Proper storage of samples;
- o Use of qualified and/or certified technicians;
- o Use of calibrated equipment traceable to National Bureau of Standards or equivalent standards;
- o Formal independent checking of all computation and reduction of laboratory data and results; and
- o Use of standardized test procedures.

The Laboratory Director is responsible for the implementation of these controls on a continuing basis.

9.2.4 Data Validation

Prior to transmittal of final data from the laboratory, the Laboratory Director shall review the data for:

- o Reasonableness and consistency with anticipated results; and
- o Proper implementation of the analysis control procedures cited in Section 9.2.3, above.

If this review indicates that the analyses meet project quality requirements and Geraghty & Miller, Inc., quality

TABLE 9.2.2-1

LABORATORY PROCEDURES - GEOTECHNICAL TESTING PROGRAM

Test	Method/Procedure[(1)]
Visual Classification of Soils	ASTM D 2488
Engineering Classification of Soils	ASTM D 2487
Atterberg Limits and Indices	
Liquid Limit	ASTM D 423
Plastic Limit	ASTM D 424
Shrinkage Limit	ASTM D 427
Water Content	ASTM D 2216
Grain Size Analysis	
Sample Preparation (wet)	ASTM D 2217
Sample Preparation (dry)	ASTM D 421
Sieve and Hydrometer Analysis	ASTM D 422
Permeability	ASTM D 2434
Direct Shear	ASTM D 3080
Unconfined Compression	ASTM D 2166

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(1) All ASTM procedures used shall be the latest revision issued.

standards, the data are considered "final" and may be released to the Project Coordinator.

9.3 FIELD ANALYSES

The field equipment will be checked prior to being used for collection of field data in accordance with the manufacturer's recommended procedures. The field analyses will consist of temperature, pH, conductivity, and photoionizer. All equipment will be calibrated per the procedures outlined in Item 8. The field parameters will be measured in-situ by collecting the water samples in an appropriate container.

10.0 DATA REDUCTION, VALIDATION AND REPORTING

10.1 LABORATORY PROCEDURES

The procedures for the data reduction and validation are desribed in the Martin Marietta Environmental Systems and Century West Engineering Corporation Quality Assurance/-Quality Control documents in Volume 2.

10.2 FIELD PROCEDURES

Data collected in the field will be entered into the appropriate form by the sampler. Periodically, the data will be reviewed by the on-site quality assurance personnel and comparied to the calibration sheets for the instrument. The objective of this review will be to verify the sample numbers, calibration and response factors, output parameters such as units, and the numerical values. Once the quality of the data generated as part of the field activities is validated, it will be available for input into the RI/FS decision making process.

10.3 DOCUMENTATION

Laboratory and field testing programs will utilize prepared forms to systematically and uniformly document administrative and technical information. These forms shall be prepared prior to initiating the testing programs. Chemical analysis documentation and soil-sample test forms shall be completed during the testing and subsequent data reduction. All requested information shall be addressed. This information shall include, as appropriate:

- o Project name and number;
- o Identification of test personnel;
- o Testing date;
- o Identification of calibrated equipment used (test equipment list giving equipment and identification number);
- o Identification of and descriptions of sample(s) tested;

- o Test data and subsequent data reduction;
- o Test results in the form of tables and curves; and
- o Unusual conditions encountered.

All laboratory administrative forms, test data, computer printouts and checkpoints shall be organized and maintained by the Laboratory Directors until transferred to the Project Coordinator.

11.0 INTERNAL QUALITY CONTROL CHECKS

11.1 LABORATORY QUALITY CONTROL CHECKS

Procedures for laboratory quality control checks are documented in Volume 2 for Martin Marietta Environmental Systems and Century West Environmental Quality Assurance/-Quality Control documents.

11.2 INTERLABORATORY VERIFICATION SAMPLES

As specified in the supporting documents and individual laboratory Standard Operating Procedures (Volume 2), Martin Marietta Environmental Systems Laboratory (MMES) will perform organic analyses and Century West Engineering Corporation (CWEC) will perform inorganic analyses during the project. In addition to the other quality control checks planned for the project, samples will be split periodically between MMES and CWEC in which each laboratory will perform redundant analyses. This will allow an additional quality control check on laboratory analytical performance.

11.3 FIELD QUALITY CONTROL CHECKS

During the collection of field related data, standard solutions will be used to check the function of the pH and conductivity meters. While in use, the meter(s) will be checked at least once per day in addition to the normal calibration procedures.

12.0 PERFORMANCE AND SYSTEM AUDITS

To verify compliance with the stated Quality Assurance/Quality Control objectives, the Quality Assurance Officer can perform planned and documented audits of project activities. These audits will consist, as appropriate, of an evaluation of quality assurance/quality control procedures and the effectiveness of their implementation, an evaluation of work areas and activities, and a review of project documentation. Audits will be performed in accordance with written checklists and results will be documented and sent to the Project Coordinator.

Audits may include, but are limited to, the following area:

- Subcontractor performance;
- Field operations and records;
- Laboratory testing and records;
- Identification and control of samples;
- Numerical analyses;
- Computer program documentation and verification;
- Transmittal of information; and
- Record Control and Retention.

Audits for the MMRF project will cover the field and laboratory activities relating to the site during the work performed in the RI/FS.

12.1 PERFORMANCE OF AUDITS

An individual audit plan will describe the basis for each audit. This plan will identify the scope of the audit, activities to be audited and all applicable documents. Personnel responsible for the audit will include the QA/QC Officer, the On-site Project Manager, and other project perssonnel as designated by the Project Coordinator.

The audit plan will be consistent with the Work plan, schedule and requirements.

12.1.1 Field Audit

The field operations audit will involve an examination of: the availability and implementation of approved work procedures; calibration and operation of equipment; labeling, packaging, storage and shipping of samples obtained; site investigation; and testing performance, documentation subcontractor performance, and nonconformance documentation.

The report audit may examine, as appropriate: the documentation and verification of field and laboratory data and results; performance, documentation, and verification of analyses; documentation and verification of computer programs; content, consistency and conclusions of the report; compliance with project specifications; and, maintenance and filing of project records.

The records of all field operations shall be reviewed to verify that field-related activites were performed in accordance with appropriate project procedures. Items reviewed will include, but are not limited to: the calibration records of field equipment; daily field activity logs; photographs; and all data, logs, and checkprints resulting from the field operations.

Auditing of analyses will include a complete review of all calculations, computer input, sketches, charts, tables and their associated checkprints that were prepared by the laboratory staff. These items will be reviewed to verify conformity to project requirements.

The report preparation process will be reviewed so that:

- o The report correctly and accurately presents the results obtained by the project work;
- o All information presented in the report is substantiated by the project work;
- o The tables and figures presented in the report are prepared and checked according to the project requirements; and
- o The report satisfies the scope of work, the requirements of Martin Marietta and regulatory requirements.

The report audit will be performed prior to issuance of the final report. The issuance of the final submittal will be postponed if the Quality Assurance Officer determines that the work does not meet the requirements. If the project schedule demands issuance of the report prior to audit, it may be issued as a "Draft", with the final report being submitted only after acceptance by the Quality Assurance Officer.

Checklists will be prepared by the auditor and used to conduct all audits. They will be developed so that necessary items are reviewed and to document the results of the audit.

During an audit and upon its completion, the auditor will discuss the findings with the individuals audited and cite corrective actions to be initiated. Minor administrative findings which can be resolved to the satisfaction of the auditor during an audit are not required to be cited as items requiring corrective action. All findings that are not resolved during the course of the audit and all findings affecting the quality of the project, regardless of when they are resolved, will be noted on the audit checklists.

12.1.2 Laboratory Audit

The auditing of laboratory testing records will include: the originals and checkprints of all laboratory data sheets; originals and checkprints of all data presentations prepared by each member of the laboratory staff; and laboratory test scheduling records for the project.

12.2 REPORTS TO MANAGEMENT

Following completion of an audit, the auditor will prepare and submit a post-audit report to the Project Coordinator and to the Quality Assurance Officer. This report will serve to notify management of audit results. The report may also be sent to individuals contacted during the audit and the management of any affected subcontractor.

13.0 PREVENTIVE MAINTENANCE

13.1 LABORATORY PREVENTATIVE MAINTENANCE

All procedures necessary to avoid maintenance delays in the laboratory are decribed in Volume 2, Standard Operating Procedures for the MMES and CWEC laboratories.

13.2 FIELD PREVENTATIVE MAINTENANCE

The field sampling personnel will protect the temperature, conductivity, and pH instruments by placing each in a portable box and/or protective case. An extensive maintenance program is not anticipated, however, frequent calibration measurements will anticipate maintenance problems.

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14.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

14.1 LABORATORY PROCEDURES TO ASSESS ANALYTICAL DATA

All procedures used to document laboratory methods to assess data precision, accuracy, and completeness is described in Volume 2 for the MMES and CWEC laboratories.

14.2 Field Procedures to Assess Field Measurements

Field measurements will be carried out and accompanied by methods to assess acuracy. These will include:

- Reference or Spike Sample - Recoveries must be within predetermined acceptance limits; and
- Performance audits - Each task will include performance audits to demonstrate that all measurements are within acceptable limits. The standards used for preparing audit samples must be independent of, or different from, those used during routine analyses. If available, EPA quality control or Performance Evaulation samples will be used.

Examples of field activities which will be carried out to assess precision are:

- Replicate Samples - Replicate sample data must be within predetermined acceptance limits; and
- Instrument Performance Checks - For each measurement device routine checks must be performed as part of the analyses to demonstrate that the variables are within predetermined acceptance limits. Control charts will be kept for each parameter in the study.

15.0 CORRECTIVE ACTION

Non-conforming items and activities are those which do not meet the project requirements, or the approved work procedures. Non-conformances may be detected and identified by:

15.1 LABORATORY CORRECTIVE ACTION

MMES and CWEC laboratories have described procedures to address irregular items that may be identified in Volume 2 of the Work Plan.

15.2 FIELD CORRECTIVE ACTION

In the field sampling program, each non-conformance will be documented by the personnel identifying or originating it. Documentation of these events will include:

- o Identification of the individual(s) identifying or originating the non-conformance;
- o Description of the non-conformance;
- o Any required signatures;
- o The method(s) used to correct the non-conformance (corrective action) or description of the variance granted; and
- o Schedule for implementing corrective action.

The Project Coordinator will notify Martin Marietta and the EPA of significant non-conformances which could have an impact on the results of the work.

If, at any time, the analytical non-conformances and audit reports indicate a review of the appropriateness and adequacy of the tasks, the laboratory manager(s) can present recommended changes to the Project Quality Assurance Officer.

16.0 QUALITY ASSURANCE REPORTS

Once chemical testing of environmental samples is started under this project, a schedule for the laboratories to periodically report to the Quality Assurance Officer on the performance of the measurement systems and the reliability of the data will be established. Both the Laboratory Quality Control Coordinator and the Project Quality Assurance Officer are responsible for preparing reports to management indicating effectiveness of the QAPP. As a minimum, these reports will include:

- Periodic assessments of measurement data accuracy, precision, and completeness;
- Results of performance, systems, data, and instrument audits;
- Results of interlaboratory testing; and
- Any corrective actions which need to be taken.

APPENDIX B

APPENDIX B

HEALTH AND SAFETY PLAN
MARTIN MARIETTA REDUCTION FACILITY
THE DALLES, OREGON

GERAGHTY & MILLER, INC.

TABLE OF CONTENTS

2.0 INTRODUCTION

This RIFS represents an investigation of ten (10) potential contamination sources at the Martin Marietta Reduction Facility (MMRF) located at The Dalles, Oregon (the Site). The Health and Safety Plan and associated RIFS work plan were initiated in September of 1985 by Geraghty & Miller, Inc. (G&M) for Martin Marietta Corporation (MMC). The general nature and extent of the study has been described in an Order of Consent (No. 1085-04-02-106) by Region X of the United States Environmental Protection Agency (EPA).

The RIFS work plan outlines the construction and installation of shallow and deep ground-water monitoring wells to define the vertical and horizontal extent of contamination at the Site. Historical data describe waste disposal practices and support ground-water analyses that show the presence of selected constituents (cyanide, fluoride, polynuclear aromatics) at the Site. These results necessitate a plan to protect the health and safety of workers at the Site.

A personnel Site Health and Safety Plan has been assembled based upon requirements described in the "Standard Operating Safety Guides" written by the Environmental Response Branch, Hazardous Response Support Division, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. Guidelines provided in this EPA publication have been supplemented by a Site visit conducted November 11 - 15, 1985, by Dr. Ralph E. Moon (G&M), Mr. David L. Smith (G&M), Mr. David J. Jessup (G&M), Mr. Jerry E. Kubal (G&M), Ms. Loretta V. Grabowski (MMC), and Mr. Tom Miller (Century West Engineering). The on-site visit was supplemented by aerial photographs, and interviews with personnel associated with the Site (Mr. Joe Byrne) prior to the preparation of the Health and Safety Plan.

3.0 GERAGHTY & MILLER, INC. RESPONSIBILITY

G&M is responsible for its personnel and subcontractors' adherence to the Site Health and Safety Plan during the investigation. G&M agrees to perform all work in accordance with the health and safety requirements described herein, the current edition of the Standard Operating Safety Guides prepared by the EPA office of Emergency and Remedial Response, Hazardous Response Support Division, and all Federal, OSHA, State and local health and safety regulations.

G&M has designated Dr. Ralph E. Moon as the Site Health and Safety Officer to implement, monitor, and enforce the Site Health and Safety Plan. Dr. Moon has experience in Federal and State environmental laws and Federal and State occupational safety and health regulations. His formal educational training in occupational safety and health includes: (1) three years working experience in chemical laboratory safety at an academic and industrial research facility; and (2) certification as a Hazardous Materials Manager at the masters level.

The Site Health and Safety Officer has the option to implement requirements in addition to those described herein on a case-by-case basis. Should an unforeseen or site-specific safety related factor, hazard or condition become evident during the drilling, G&M will take action to re-establish safe working conditions and to safeguard site personnel, the public and the environment. Actions taken by G&M to safeguard workers beyond those measures described in this plan will be verbally communicated to Ms. Loretta V. Grabowski (MMC) prior to implementation and submitted in writing at the request of the Contractor.

4.0 POTENTIAL CONTAMINATION SOURCES AND WASTE CHARACTERISTICS

A description of each potential contamination source (Figure 4.0-1), past disposal practices, and the substances that may be present are assembled in the following pages (also listed in Table 4.0-1) along with G&M's recommendation for the level of personnel protection and the on-site monitoring that will be conducted by G&M throughout the progress of the work. Human health, toxicity, and proper protective clothing for specific chemicals referenced for each site are described in Table 4.0-2.

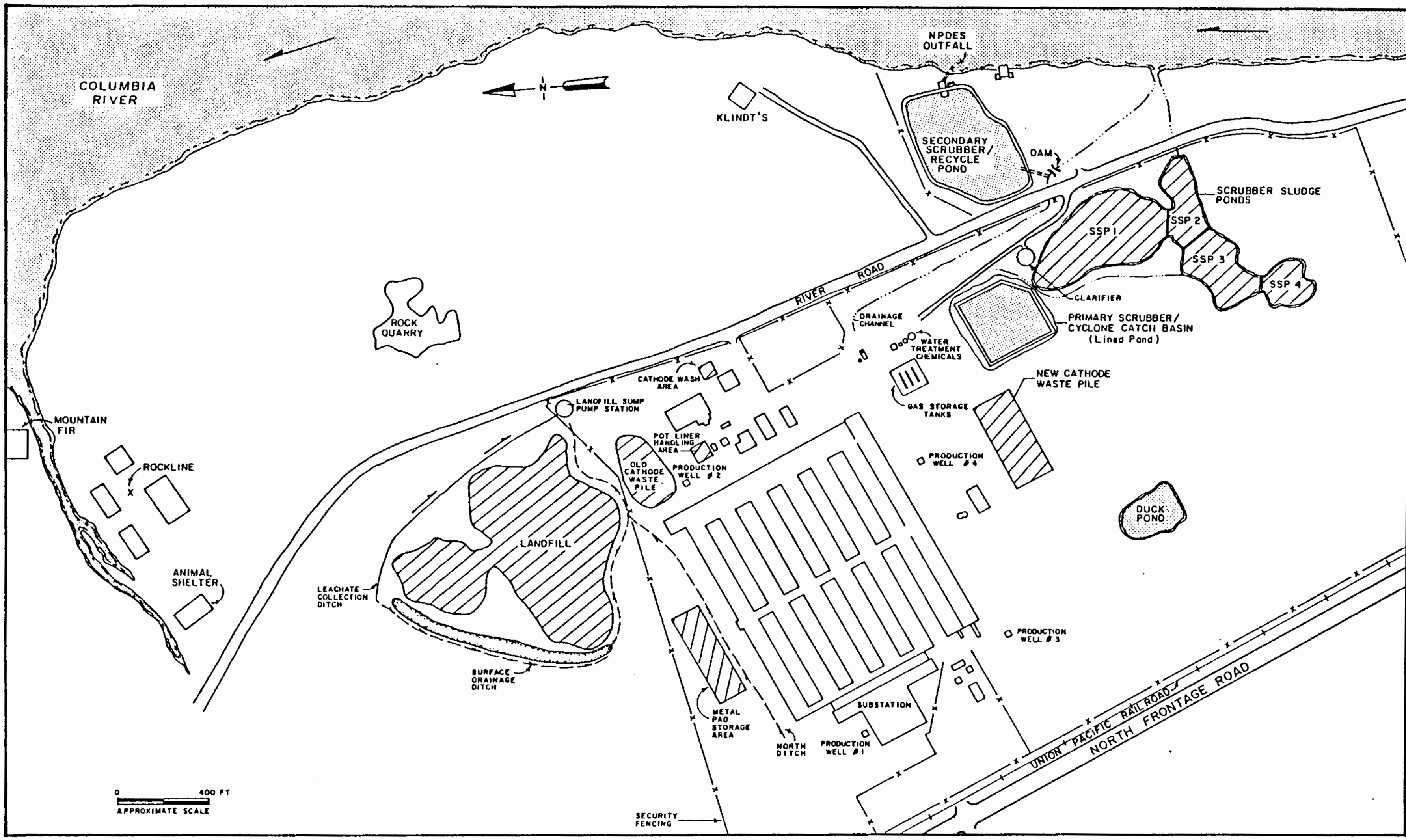

FIGURE 4.0-1. Location of Potential Sources of Contamination.

TABLE 4.0-1

STUDY SITES TO BE INVESTIGATED
AND CORRESPONDING LEVEL OF PROTECTION

	Potential Source	Level of Protection
1.	Landfill (1)	D
2.	Old Cathode Waste Pile (1)	D
3.	New Cathode Waste Pile (1)	D
4.	Potliner Handling Area (2)	D
5.	Cathode Wash Area (2)	D
6.	Metal Pad Storage Area (2)	D
7.	Primary Scrubber/Cyclone Catch Basin (3)	D
8.	Scrubber Sludge Ponds (3)	D
9.	Surface Water Pond (3)	D
10.	Recycle Pond (3) (Duck Pond)	D

NOTES:

(1) Monitored as of April 1985
(2) Other storage areas of spent potliner waste
(3) Non-Cathode waste sites

TABLE 4.0-2

SUBSTANCES OF HEALTH AND SAFETY CONCERN

HYDROGEN CYANIDE

SYNONYMS:	Hydrocyanic acid, Prussic acid, Formonitrite
PERMISSIBLE EXPOSURE LIMIT:	10 ppm (11 mg/m3) (NIOSH) 5 mg/m3 10 min ceil
IDLH LEVEL:	50 ppm
PHYSICAL DESCRIPTION:	Colorless or pale blue liquid or gas with a bitter almond odor
PERSONNEL PROTECTION AND SANITATION:	Clothing: Any possible Goggles: Any possible Wash: Immediately upon contamination Change: N/A Remove: Any wet immediately (flammable) Provide: Eyewash, quick drench
ROUTES OF ENTRY:	Inhalation, adsorption, ingestion, contact
SYMPTOMS:	Asphyxia and death at high levels; weak, headache, confusion, nausea, vomiting; increase rate & depth of respiration or respiration slow and gasping
FIRST AID:	Eye: Irrigate immediately Skin: Water flush immediately Breath: Artificial respiration/ use Amyl Nitrite Pearls Swallow: Drink water, force vomit
TARGET ORGANS:	CNS, CVS, liver, kidneys

TABLE 4.0-2
(Continued)

HYDROGEN FLUORIDE

SYNONYMS:	Anhydrous hydrofluoric acid; HF-A
PERMISSIBLE EXPOSURE LIMIT:	3 ppm (2 mg/m^3) (NIOSH) 2.5 mg/m^3 5 mg/m^3 15 min ceil
IDLH LEVEL:	20 ppm
PHYSICAL DESCRIPTION:	Colorless, fuming liquid or gas with a strong, irritating odor
PERSONNEL PROTECTION AND SANITATION:	Clothing: Any possible Goggles: Any possible Wash: Immediately upon contamination Change: N/A Remove: Immediately upon contamination non-imperv Provide: Eyewash, quick drench
ROUTES OF ENTRY:	Inhalation, adsorption, ingestion, contact
SYMPTOMS:	Eye, nose, throat, irrit; pulmedema; skin, eye burns, nasal congestion, bronchial irritation
FIRST AID:	Eye: Irrigate immediately Skin: Water flush immediately Breath: Artificial respiration Swallow: Water, NO VOMIT
TARGET ORGANS:	Eyes, respiratory system, skin, lungs

TABLE 4.0-2
(Continued)

POLYNUCLEAR AROMATIC HYDROCARBONS

SYNONYMS:	Polynuclear aromatics, i.e., Fluoranthene, Napthalene
PERMISSIBLE EXPOSURE LIMIT:	150 mg/m^3 OSHA 8 hour time weighted average
IDLH LEVEL:	N/A
PHYSICAL DESCRIPTION:	Yellowish crystalline solid
PERSONNEL PROTECTION AND SANITATION:	Clothing: Any possible Goggles: Any possible Wash: Immediately upon contact Change: N/A Remove: Any wet immediately Provide: Eyewash, quick drench
SYMPTOMS:	Lung irritation
FIRST AID:	Eye: Irrigate immediately Skin: Water and soap Breath: Artificial respiration
TARGET ORGANS:	Skin, lungs

4.1 LANDFILL

Site Description: The landfill was started in 1958 and operated through December of 1984. During this period of activity, the landfill was used to store construction rubble, and non-hazardous wastes including wooden pallets, refractory brick, bagged asbestos (1979-1982) and non-specific wastes. In the early 1970's, the area was used to disassemble the collector bar and carbon block assembly unit. The landfill, however, was not designated as a cathode disposal area. PCB's were not disposed of at the landfill.

Substances of Health and Safety Concern:

Waste Solvents and Degreasing Agents	
Radioactive Wastes	
Treated Industrial Wastes	
Liquid Waste/Free Product Potential	
Asbestos Disposal	X
PCB Disposal	
Air Scrubber Wastes	
Fluoride Containing Wastes	X
Sludge Disposal	
Corrosive Liquids	
Plating Wastes	
Metal Wastes	X
Cleaning Solutions	
Paint Wastes	
Non-hazardous Wastes	X
Cyanide Containing Wastes	X

Level of Personnel Protection

Level A	
Level B	
Level C	
Level D	X

Monitoring Parameters

Total Ionizable Pollutants	
Explosion Potential	
Radiation	
Cyanide	X
Fluoride	X

4.2 OLD CATHODE WASTE PILE

Site Description: The Old Cathode Waste Pile was activated in 1972 and served as a periodic accumulation area until late 1984. During this time period, cathode waste and incidental core wastes were disposed.

Substances of Health and Safety Concern:

Waste Solvents and Degreasing Agents	____	Sludge Disposal	____
Radioactive Wastes	____	Corrosive Liquids	____
Treated Industrial Wastes	____	Plating Wastes	____
Liquid Waste/Free Product Potential	____	Metal Wastes	X
Asbestos Disposal	____	Cleaning Solutions	____
PCB Disposal	____	Paint Wastes	____
Cyanide Containing Wastes	X	Non-hazardous Wastes	____
		Fluoride Containing Wastes	X

Level of Personnel Protection		Monitoring Parameters	
Level A	____	Total Ionizable Pollutants	____
Level B	____	Explosion Potential	____
Level C	____	Radiation	____
Level D	X	Cyanide	X
		Fluoride	X

4.3 NEW CATHODE WASTE PILE

Site Description: The New Cathode Waste Pile was in operation for approximately one year prior to plant shutdown in 1984. The new waste pile consists of relocated wastes from the Old Cathode Waste Pile.

Substances of Health and Safety Concern:

Substance		Substance	
Waste Solvents and Degreasing Agents		Sludge Disposal	
Radioactive Wastes		Corrosive Liquids	
Treated Industrial Wastes		Plating Wastes	
		Metal Wastes	X
Liquid Waste/Free Product Potential		Cleaning Solutions	
Asbestos Disposal		Paint Wastes	
PCB Disposal		Non-hazardous Wastes	
Cyanide Containing Wastes	X	Fluoride Containing Wastes	X

Level of Personnel Protection

Level	
Level A	
Level B	
Level C	
Level D	X

Monitoring Parameters

Parameter	
Total Ionizable Pollutants	
Explosion Potential	
Radiation	
Cyanide	X
Fluoride	X

4.4 POTLINER HANDLING AREA

Site Description: Located along the west side of the facility, the Potliner Handling Area was in operation from 1959 through 1977. The area was used to crush cathode waste and to separate refractory brick (where it was accumulated and shipped to a recovery facility). The area also includes an incidental cathode shell storage area.

Substances of Health and Safety Concern:

Waste Solvents and Degreasing Agents	____	Sludge Disposal	____
Radioactive Wastes	____	Corrosive Liquids	____
Treated Industrial Wastes	____	Plating Wastes	____
Liquid Waste/Free Product Potential	____	Metal Wastes	____
Asbestos Disposal	____	Cleaning Solutions	____
PCB Disposal	____	Paint Wastes	____
Cyanide Containing Wastes	X	Non-hazardous Wastes	____
		Fluoride Containing Wastes	X

Level of Personnel Protection		Monitoring Parameters	
Level A	____	Total Ionizable Pollutants	____
Level B	____	Explosion Potential	____
Level C	____	Radiation	____
Level D	X	Cyanide	X
		Fluoride	X

4.5 CATHODE WASH AREA

Site Description: The Cathode Wash Area was used to cool down the hot cathode pot and soften the potliner prior to dismantling. This area was used for cathode washing from the early 1960's through late 1984.

Substances of Health and Safety Concern:

Waste Solvents and Degreasing Agents	
Radioactive Wastes	
Treated Industrial Wastes	
Liquid Waste/Free Product Potential	
Asbestos Disposal	
PCB Disposal	
Cyanide Containing Wastes	X
Sludge Disposal	
Corrosive Liquids	
Plating Wastes	
Metal Wastes	
Cleaning Solutions	
Paint Wastes	
Non-hazardous Wastes	
Fluoride Containing Wastes	X

Level of Personnel Protection

Level A	
Level B	
Level C	
Level D	X

Monitoring Parameters

Total Ionizable Pollutants	
Explosion Potential	
Radiation	
Cyanide	X
Fluoride	X

4.6 METAL PAD STORAGE AREA

Site Description: The Metal Pad Storage Area was used discontinuously to store cooled metal pads (aluminum) from the pot after disassembly. The slag material may have had attached spent bath material and cathode block.

Substances of Health and Safety Concern:

Waste Solvents and Degreasing Agents	____	Sludge Disposal	____
Radioactive Wastes	____	Corrosive Liquids	____
Treated Industrial Wastes	____	Plating Wastes	____
Liquid Waste/Free Product Potential	____	Metal Wastes	____
Asbestos Disposal	____	Cleaning Solutions	____
PCB Disposal	____	Paint Wastes	____
Cyanide Containing Wastes	X	Non-hazardous Wastes	____
		Fluoride Containing Wastes	X

Level of Personnel Protection		Monitoring Parameters	
Level A	____	Total Ionizable Pollutants	____
Level B	____	Explosion Potential	____
Level C	____	Radiation	____
Level D	X	Cyanide	X
		Fluoride	X

4.7 PRIMARY SCRUBBER/CYCLONE CATCH BASIN

Site Description: The Cyclone Catch Basin was operated from 1977 until late 1984, and received blowdown from the roof scrubbers including particulate alumina, carbon, fugitive fluoride, and sulfur dioxide. The purpose of the device was to capture particulates from air that may have been emitted from the aluminum reduction cell.

Substances of Health and Safety Concern:

Waste Solvents and Degreasing Agents		Sludge Disposal	
Radioactive Wastes		Corrosive Liquids	
Treated Industrial Wastes		Plating Wastes	
Liquid Waste/Free Product Potential		Metal Wastes	
Asbestos Disposal		Cleaning Solutions	
PCB Disposal		Paint Wastes	
Cyanide Containing Wastes	X	Non-hazardous Wastes	
		Fluoride Containing Wastes	X

Level of Personnel Protection

Level A	
Level B	
Level C	
Level D	X

Monitoring Parameters

Total Ionizable Pollutants	
Explosion Potential	
Radiation	
Cyanide	X
Fluoride	X

4.8 SCRUBBER SLUDGE PONDS

Site Description: The Scrubber Sludge Ponds and sedimentation ponds were active from the mid 1960's through 1977. The wastes received at the ponds were segregated into three areas and included: primary (treated and untreated) air scrubber wastes, secondary (treated and untreated) air scrubber wastes and dredging wastes from the secondary recycle pond (1975).

Substances of Health and Safety Concern:

Waste Solvents and Degreasing Agents	
Radioactive Wastes	
Treated Industrial Wastes	
Liquid Waste/Free Product Potential	
Asbestos Disposal	
PCB Disposal	
Polynuclear Aromatics	X
Sludge Disposal	
Corrosive Liquids	
Plating Wastes	
Metal Wastes	
Cleaning Solutions	
Paint Wastes	
Non-hazardous Wastes	
Cyanide Containing Wastes	X
Fluoride Containing Wastes	X

Level of Personnel Protection

Level A	
Level B	
Level C	
Level D	X

Monitoring Parameters

Total Ionizable Pollutants	
Explosion Potential	
Radiation	
Cyanide	X
Fluoride	X

4.9 SURFACE WATER POND (DUCK POND)

Site Description: The Duck Pond was present at the site prior to construction of the facility. As a natural drainage and accumulation feature, the pond was incorporated into the storm water drainage system and received wastewater from one sump pump at the alumina unloading facility. Low level concentrations of cyanide and fluoride are possibly present.

Substances of Health and Safety Concern:

Waste Solvents and Degreasing Agents		Sludge Disposal	
Radioactive Wastes		Corrosive Liquids	
Treated Industrial Wastes		Plating Wastes	
Liquid Waste/Free Product Potential		Metal Wastes	
Asbestos Disposal		Cleaning Solutions	
PCB Disposal		Paint Wastes	
Cyanide Containing Wastes	X	Non-hazardous Wastes	
		Fluoride Containing Wastes	X

Level of Personnel Protection

Level A	
Level B	
Level C	
Level D	X

Monitoring Parameters

Total Ionizable Pollutants	
Explosion Potential	
Radiation	
Cyanide	X
Fluoride	X

4.10 RECYCLE POND

Site Description: The Recycle Pond was constructed in 1975 to incorporate water discharged from all sumps from the building, storm water runoff, the sump from the landfill, the domestic waste facility and wastes from the secondary scrubber system (the primary purpose for construction). These waste streams may contain fluoride, cyanide and polynuclear aromatic substances.

Substances of Health and Safety Concern:

Substance		Substance	
Waste Solvents and Degreasing Agents		Sludge Disposal	
Radioactive Wastes		Corrosive Liquids	
Treated Industrial Wastes		Plating Wastes	
Liquid Waste/Free Product Potential		Metal Wastes	
Asbestos Disposal		Cleaning Solutions	
PCB Disposal		Paint Wastes	
Polynuclear Aromatics	X	Non-hazardous Wastes	
		Cyanide Containing Wastes	X
		Fluoride Containing Wastes	X

Level of Personnel Protection

Level	
Level A	
Level B	
Level C	
Level D	X

Monitoring Parameters

Parameter	
Total Ionizable Pollutants	
Explosion Potential	
Radiation	
Cyanide	X
Fluoride	X

5.0 SITE PREPARATION FOR DRILLING

Each drilling site should be prepared for foot and vehicular traffic by the removal of all weeds (4' or greater) within a 25-ft radius of the drilling location. Areas used to traverse between drilling locations and the support area should be visually reviewed on foot by the Site Safety Coordinator to avoid or remove objects that may puncture the tires of the drill rig.

6.0 DETERMINATION OF WORK AREAS

G&M will define and identify the following areas at each drilling site and specify the equipment, operations, and personnel in the areas as defined below.

6.1 ZONE 1: EXCLUSION ZONE -- The exclusion zone is the zone where contamination exists or could occur (Figure 6.1-1). All people entering the exclusion zone will wear the prescribed level of protection. An entry and exit check point will be visually defined at the periphery of the exclusion zone to regulate the flow of personnel and equipment into and out of the zone.

Prohibitions in the contaminated area (Exclusion Zone) would include the following:

- o Beards and long sideburns;
- o Eating, smoking, chewing;
- o Personal articles, e.g., watches and rings;
- o Working when ill; and
- o Complete removal of respirator under Level C protection.

6.2 ZONE 2: CONTAMINATION REDUCTION ZONE -- The area between the exclusion zone and the support zone is the contamination reduction zone. This zone provides a transition between a contaminated area and the clean zone. Zone 2 serves as a buffer to further reduce the possibility of the clean zone becoming contaminated. It provides additional assurance that the physical transfer of contaminating substances on people, equipment, or in the air is limited through a combination of decontamination, distance between exclusion and support zones, air dilution, zone restrictions, and work functions. At the boundary between the exclusion and contamination reduction zones, decontamination stations will be established, as described in the decontamination procedures.

6.3 ZONE 3: SUPPORT ZONE -- This area is outside the zone of contamination. The support zone shall be marked and protected against contamination from the work site. The function of the area includes:

a. An entry area for personnel, material, and equipment.

b. An exit area for decontaminated personnel, materials, and equipment.

c. A storage area for clean safety and work equipment.

d. An area for rest breaks, the consumption of food and beverage, and all other activities.

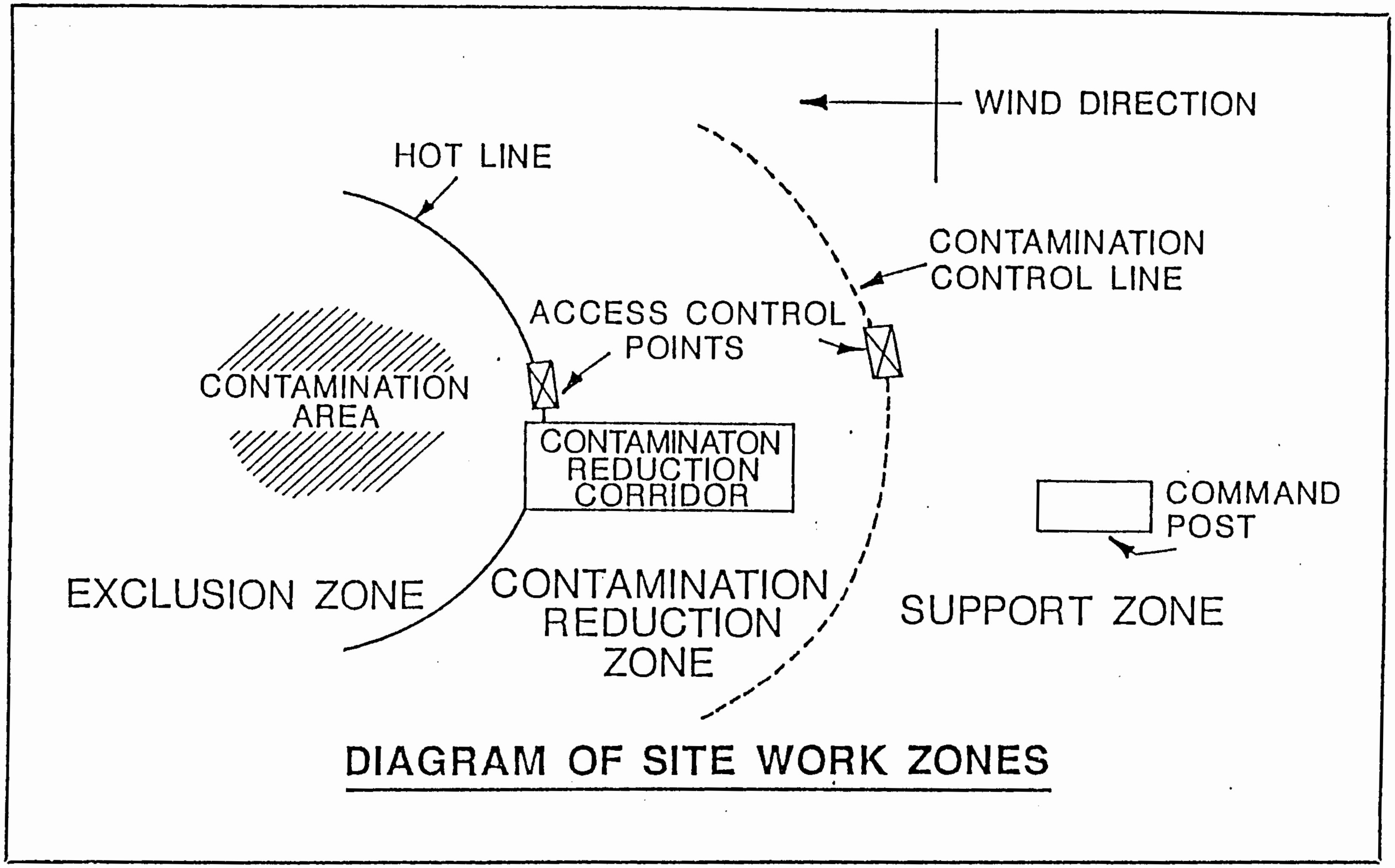

FIGURE 6.1-1. Diagram of Site Work Zones.

7.0 PERSONNEL PROTECTION PROGRAM

G&M has established and will maintain a Personnel Protection Program for all personnel working at the Site. G&M will provide safety and health training for all subcontractors, and service personnel assigned to the Site for the purpose of performing or supervising work, health and safety, security, administrative purposes, or for any other site investigation-related function. The level of protection required at each drilling or sampling location has been designated by the Site Safety Officer to be Level D. This determination is based upon a hazard evaluation of the Site and previously documented information (see 4.0 Potential Contamination Sources and Waste Characteristics). The hazards may vary as drilling progresses.

8.0 PERSONNEL PROTECTION ZONE REQUIREMENTS

Personnel protective equipment for the exclusion zone is based upon OSHA requirements for each drilling site. Protective gloves, boots, and suits will be of material resistant to acids and organic chemicals present. All respiratory protective equipment will be approved by the National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA).

All workers within the drilling site boundary (Zone A, Exclusion Zone) will require personnel protection at Level D with a contingency for Level C personnel protection should this be determined by the Site Safety Officer as a result of evaluation from instrument readings of on-site, air-monitoring data.

The intermittent evaluation of the breathing zone (every hour, maximum) will provide readings for organic vapors (TIP, Photovac, Inc, Photoionization Detector) hydrogen cyanide (Sensidyne/Gastec, Tube No. 12L 2.5-120 ppm), hydrogen fluoride (Sensidyne/Gastec, Tube No. 17 0.5-20 ppm) to support the appropriateness of the level of personnel protection.

The Level D protection will be upgraded if any of the following airborne concentrations are detected in the breathing zone:

MONITORING PARAMETERS	METHOD	MAXIMUM AIRBORNE CONCENTRATION AT LEVEL D	RANGE OF DETECTION
Organic Vapors	Photoionization Detector	10 ppm	0 - 100 ppm
Hydrogen Cyanide	Detector Tube	10 ppm	2.5 - 120 ppm
Hydrogen Fluoride	Detector Tube	3 ppm	0.5 - 20 ppm

If ambient conditions exceed any concentration (shown above) for 5 minutes, the level of personnel protection will be upgraded from Level D to Level C. The personnel protection level may be downgraded when all monitoring parameters remain below 1 ppm in the breathing zone for 10 minutes or more.

A summation of Level C and Level D personnel protection is summarized below:

- Level C Protection.

  a. Full-face piece, air-purifying, canister-equipped respirator.

  b. Tyvek chemical-resistant clothing, long sleeves, one or two pieces, requirement for hood to be determined.

  c. Gloves (chemical resistant).

  d. Steel toe and shank boots/shoes (safety or chemical-protective)

  e. Hard hat (face shield optional)

  f. Options as required.

     1) Coveralls (fire resistant)

     2) Inner chemical-resistant gloves

     3) Disposable outer boots (chemical-protective, heavy rubber vinyl disposables as appropriate)

- Level D Protection

  a. Coveralls (must be chemically resistant)

  b. Gloves with inner gloves

  c. Safety boots

  d. Goggles or safety glasses

  e. Hard hat

A complete description of the decontamination procedure is described below.

8.1 DECONTAMINATION PROCEDURES

8.1.1 Level C Decontamination

- Equipment Worn

  The full decontamination procedure outlined is for workers wearing Level C Protection (with taped joints between gloves, boots, and suit) consisting of:

  - One-piece, hooded, chemical-resistant splash suit;

- Canister or cartridge equipped, full or half-face mask;

- Hard Hat;

- Chemical-resistant, steel toe and shank boots; and

- Inner and outer gloves.

o <u>Procedure for Full Decontamination (See Figure 8.1.1-1)</u>

<u>Station 1:</u> Segregated Equipment Drop

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. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross-contamination.

Equipment: Various size containers
Plastic liners
Plastic drop cloths

<u>Station 2:</u> Outer Garment, boots and gloves, wash and rinse.

Scrub outer boots and glove with decon solution or detergent/water. Rinse gloves, boots and garment with hand pump spray bottle into plastic bucket.

Equipment: 2 containers (30-50 gallon)
hard pump spray device (garden sprayer)
Water
Detergent
Scrub brushes

<u>Station 3:</u> Outer boot and glove removal

Remove outer boots (if worn) and gloves with accompanying tape. Tape should be placed in a container with a plastic liner.

Equipment: 1 container (30-50 gallon)
Plastic liner
Bench

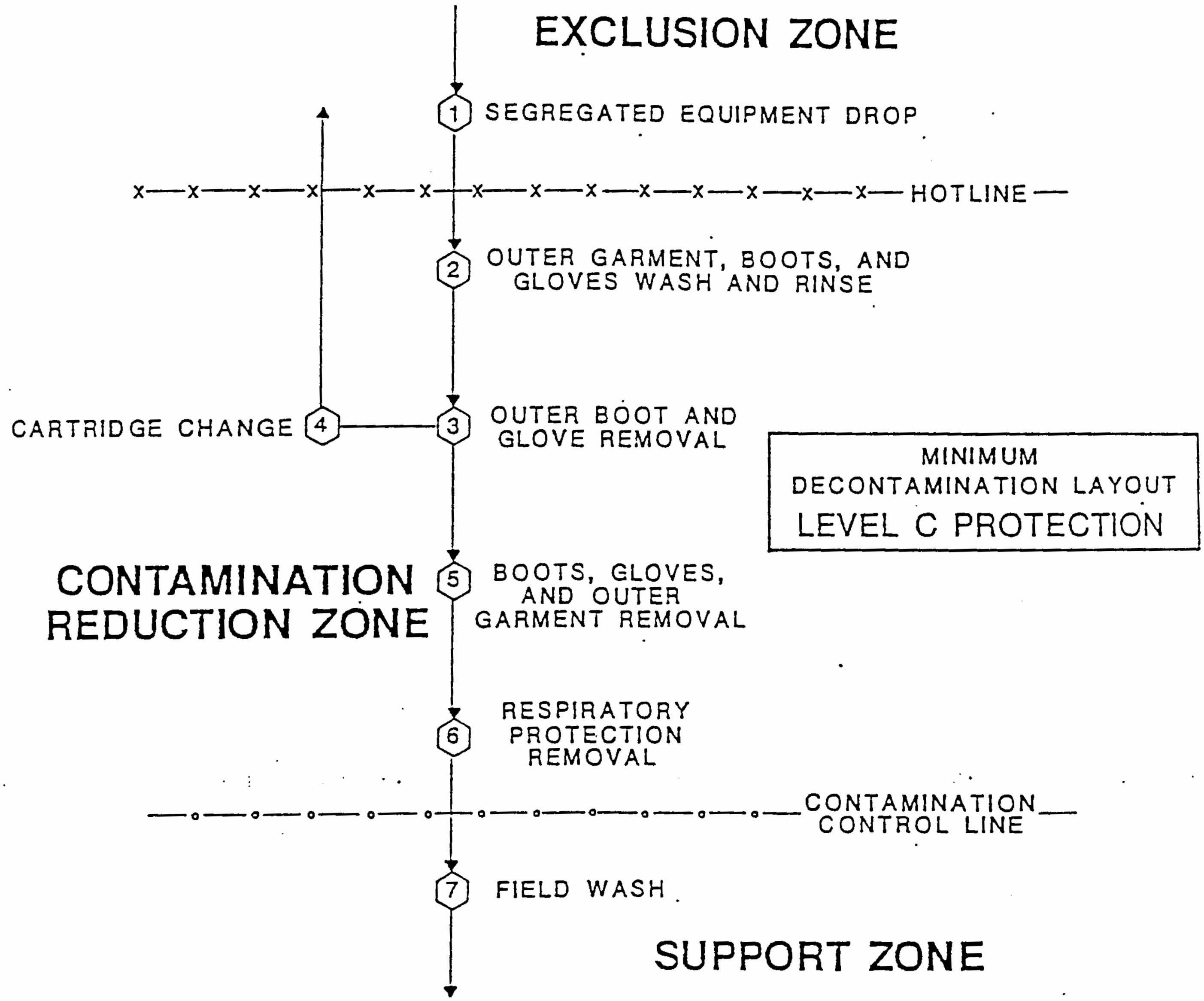

FIGURE 8.1.1-1. Minimum Decontamination Layout - Level C Protection.

Station 4: Canister Change

If a worker leaves the exclusion zone to change a canister on his/her respirator, this is the last step in the decontamination procedure. Once the worker's canister is exchanged, the outer gloves and boot covers are donned with joints taped. The worker may then return to the exclusion zone.

Equipment: Respirator canisters
Tape
Extra gloves
Boot covers (if worn)

Station 5: Boots, gloves and outer garment removal

Removal of boots, gloves (inner) and outer garment. The outer chemically resistant garment should be deposited in a plastic lined container.

Equipment: Container (30-50 gallon)
Bench or stool
Plastic liners

Station 6: Respiratory Protection Removal

Remove the face piece respirator, deposit used cartridges in a plastic lined container and wipe the face piece with clean water and paper towels.

Equipment: Container (30-50 gallon)
Plastic liners
Paper towels
Detergent solution
Rinse water

Station 7: Field Wash

Wash hands and face

Equipment: Water
Soap
Wash basins/buckets

8.1.2 Level D Decontamination

o Equipment Worn

The full decontamination procedure outlined is for workers wearing Level D protection consisting of:

- One piece chemical resistant splash suit;

- Hard Hat;

- Chemically-resistant steel toe and shank boots; and

- Inner and outer gloves.

o <u>Procedure for Decontamination (See Figure 8.1.2-1)</u>

<u>Station 1:</u> Segregated Equipment Drop

Deposit equipment used on-site (tools, sampling devices and containers, monitoring equipment, radios, clipboards) on a plastic drop cloth or in different container with plastic liners.

Equipment: Various size containers
Plastic liners

<u>Station 2:</u> Outer garment, boots and gloves, wash and rinse

Scrub outer boots and gloves with decon solution or detergent/water, rinse gloves, boots and garment with hand pump spray device.

Equipment: 2 containers (30-50 gallon)
Hard pump spray device
Water
Detergent
Scrub brushes

<u>Station 3:</u> Boot, gloves, and outer garment removal

Boots and outer gloves are removed and placed outside the decontamination zone. Inner gloves and Tyvek suit are deposited in separate containerss lined with plastic.

Equipment: Containers (30-50 gallon)
Plastic liners

<u>Station 4:</u> Field wash

Thoroughly wash hands and face. Shower as soon as possible.

Equipment: Water, wash basin/bucket, soap

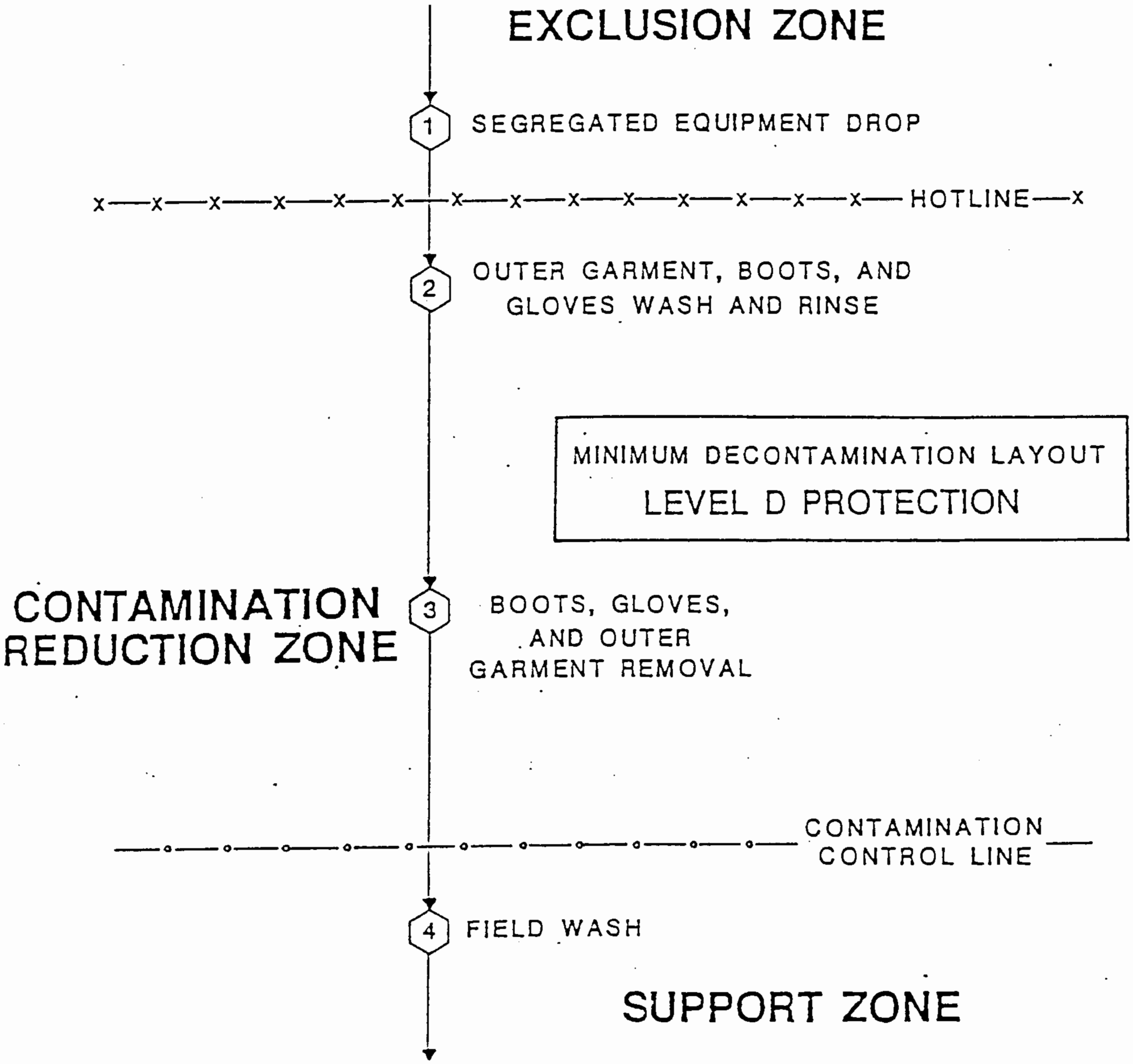

FIGURE 8.1.2-1. Minimum Decontamination Layout - Level D Protection.

9.0 PERMISSIBLE EXPOSURE LIMITS PROVISIONS

9.1 INHALATION

G&M shall limit employee or subcontractor exposure to airborne concentration of total ionizable pollutants, hydrogen cyanide and hydrogen fluoride throughout the course of the investigation. This level of protection shall be provided through the use of air monitoring equipment (as described above). In the event that the personnel protection level is upgraded from Level D to Level C, workers within the exclusion zone will be supplied with full-face respirators equipped with a Type N canister (MSA, protects against 2% acid gases, organic vapors, hydrogen fluoride). All canisters used at Level C personnel protection sites will be disposed after four hours of use and fresh canisters installed prior to work start.

A Photovac TIP will be calibrated prior to use each morning (isobutylene standard 100 ppm) to provide comparable readings during the day and a source of comparison during the investigation. Under no circumstances will site personnel enter the exclusion zone without the use of a respirator when Level C personnel protection is required.

A concentration level of 100 ppm total ionizable pollutants, 50 ppm hydrogen cyanide and 20 ppm hydrogen fluoride have been assigned to determine the need to provide a higher level of personnel protection at the Site (Level C to Level B). Complete removal of canister-equipped respirators within the exclusion zone, where required (Level C), is absolutely forbidden and may result in the dismissal of the employee from the project.

9.2 INITIAL MONITORING

All employees shall be assigned work functions within a singular personnel protective level zone. Assignments within the exclusion zone (work zone) will receive monitoring (one hour intervals) of the respiratory parameters described above. Visitors and employees in a service capacity that remain in the support zone will not receive periodic exposure monitoring, nor will they be required to wear level C or D personnel protection wear.

10.0 RESPIRATORY PROTECTION

G&M shall require that respirators (full-face) be used continuously, where appropriate, to reduce employee exposure to airborne substances.

10.1 RESPIRATORY SELECTION

G&M shall select and provide the appropriate type of canister-equipped respirator for all employees at the Site (see above). Prior to use of a respiratory protection device, G&M will provide a respiratory fit test to assure the proper use and fit of the device (see Training Program).

All subcontractors will provide respirators for their own employees from those approved by the National Institute for Occupational Safety and Health under provisions of 30 CFR Part II.

10.2 Visitor Protection

All visitors to the drilling sites shall be instructed to stay outside the work zone and remain with the support zone during the extent of their stay.

Visitors shall be cautioned to avoid skin contact with contaminated or suspected contaminated surfaces. During visitation, hand-to-mouth transfers should be reduced with special precautions not to eat, drink, smoke or chew gum or tobacco. The use of alcohol or medicine is prohibited.

Visitors requesting observation of the work zone (Zone A) must wear all appropriate personnel protective gear prior to entering the work zone. Should respiratory protective devices be necessary (Level C), visitors who wish to enter the work zone must produce evidence that they have had a complete physical examination and respiratory protection training within the past twelve months.

Visitor inspection of the work zone will be left to the discretion of the on-site safety coordinator.

11.0 SOIL AND GROUND-WATER SAMPLING

Soil samples will be collected during the course of the investigation as described in the RIFS Work Plan. Project personnel should take precaution to avoid dermal and inhalation exposure at all sample locations.

During sampling activities (soil and water), smoking, chewing or eating shall be prohibited. Air monitoring equipment, as described in the Permissible Exposure Limit Provisions, shall be used to determine airborne concentrations of volatile organics, hydrogen fluoride and hydrogen cyanide prior to sampling. Surgical gloves should be worn during all routine sampling tasks to avoid dermal contact.

12.0 NOTIFICATION OF EMERGENCIES

A written plan for emergency situations has been developed to address the immediate needs of on-site emergency activities (Figure 12.0-1). The plan describes the action that shall be implemented in the event of an emergency and a list of Emergency Information Telephone Numbers to assist during the event (Table 12.0-1).

An Emergency Report (Table 12.0-2) must be completed and submitted to the Site Health and Safety Officer.

12.1 ALERTING EMPLOYEES

Alarms: Where there is a possibility of employee exposure to physical harm, the potential for an explosive situation, or elevated levels of organic vapors, the on-site safety coordinator shall be responsible to alert all employees by voice or horn.

Evacuation: Employees not engaged in correcting the emergency shall be restricted from the drilling area and shall not be permitted to return until the emergency is abated.

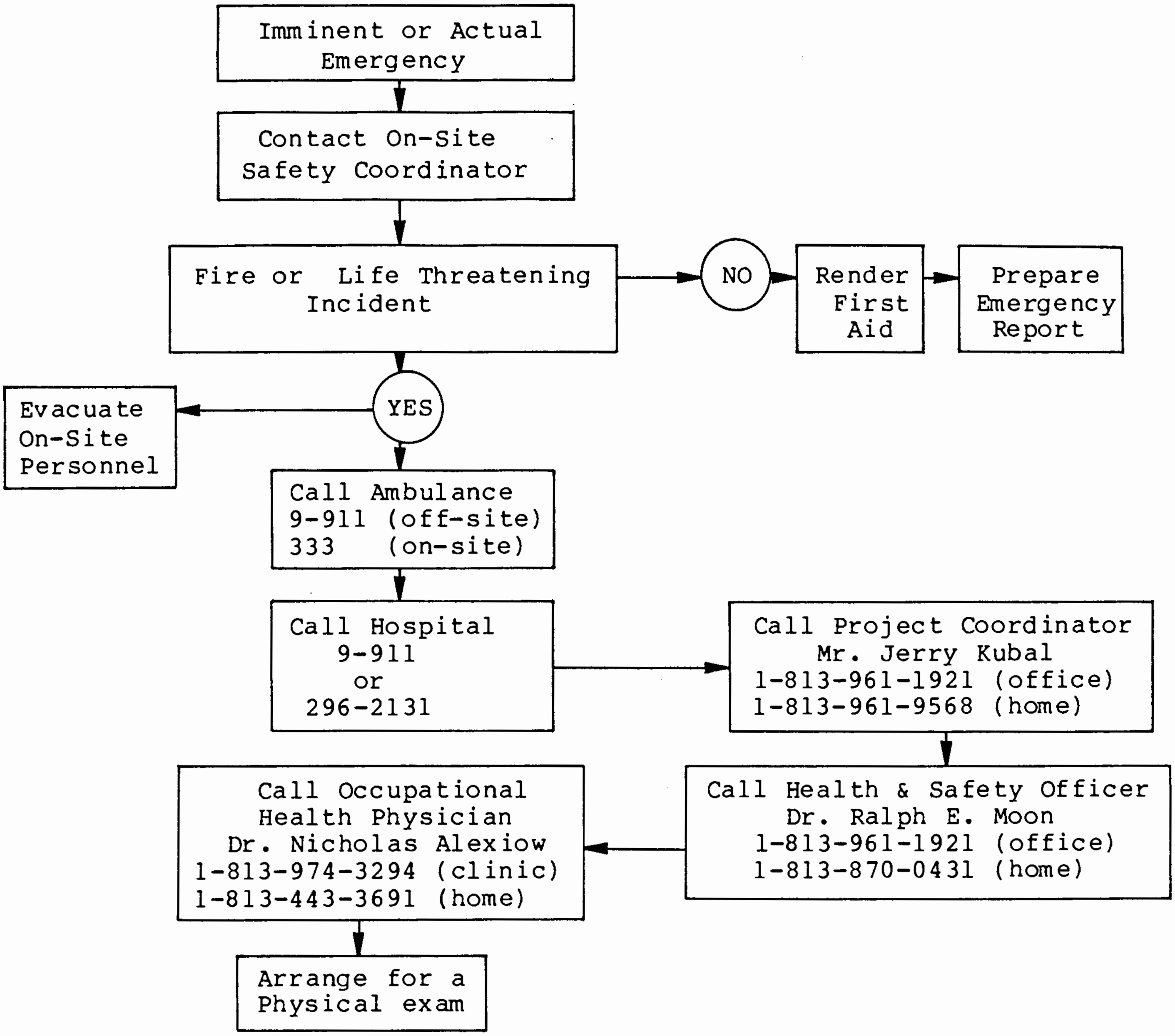

Figure 12.0-1. Emergency Action Plan

TABLE 12.0-1

EMERGENCY INFORMATION TELEPHONE NUMBERS

Martin Marietta: The Dalles On-Site

Emergency: 333
Security: 204
Operations Manager: 277/320 Mr. Jim Ramsey

The Dalles Off-Site:

Emergency: 911 - Fire, Police, Ambulance

Poison Control: 296-1111 (Mid-Columbia Medical Center)

Mid-Columbia Clinic: 296-2131

Wasco County Sheriff: 296-5454

The Dalles Police: 296-2233

Wasco County Fire Department:
Fire Only: 298-5579
Office: 296-9445
Ambulance: 296-9445

The Dalles Fire Department: 296-3264

The Dalles Ambulance: 296-2254

The Oregon State Police: 296-2161

TABLE 12.0-2

EMERGENCY REPORT

1. Date ______________________________

2. Time of Accident ______________________________

Climatic Conditions ______________________________

3. On-Site Coordinator ______________________________

4. Employee Injured ______________________________

5. Company Affiliation ______________________________

6. Social Security Number ______________________________

7. Insurance Company ______________________________

8. Number of Workers at Site ______________________________

Names of Workers	Company Affiliation
1. ______________	______________
2. ______________	______________
3. ______________	______________
4. ______________	______________
5. ______________	______________

9. Circumstances of the Injury/Emergency Action ______________________________

10. Emergency Actions Taken ______________________________

11. What first aid was provided? ______________________________

12. Was an emergency phone call made to the Project Safety Officer? __________ If so, time: __________

13. Ambulance Service Used ______________________________

14. Hospital Used ______________________________

15. Attending Physician ______________________________

16. Company Representatives Contacted ______________________________

17. Contractor Representatives Contacted ______________________________

13.0 EMERGENCY AND FIRST AID REQUIREMENTS

G&M will contact emergency medical care services at a nearby medical facility and establish emergency routes (Figure 13.0-1). In addition, the Site operates a first-aid facility for injuries not immediately threatening life.

In the event of any emergency which, in the opinion of the on-site Safety Coordinator, materially endangers life, property, or the environment, G&M will cease all drilling at the Site; take action to remove or minimize the cause of the emergency; render assistance to local authorities to remedy any impact on local residents or property.

Shower facilities and lockers are provided at the Site for all workers who wish to change clothes and shower before leaving the facility after each work day.

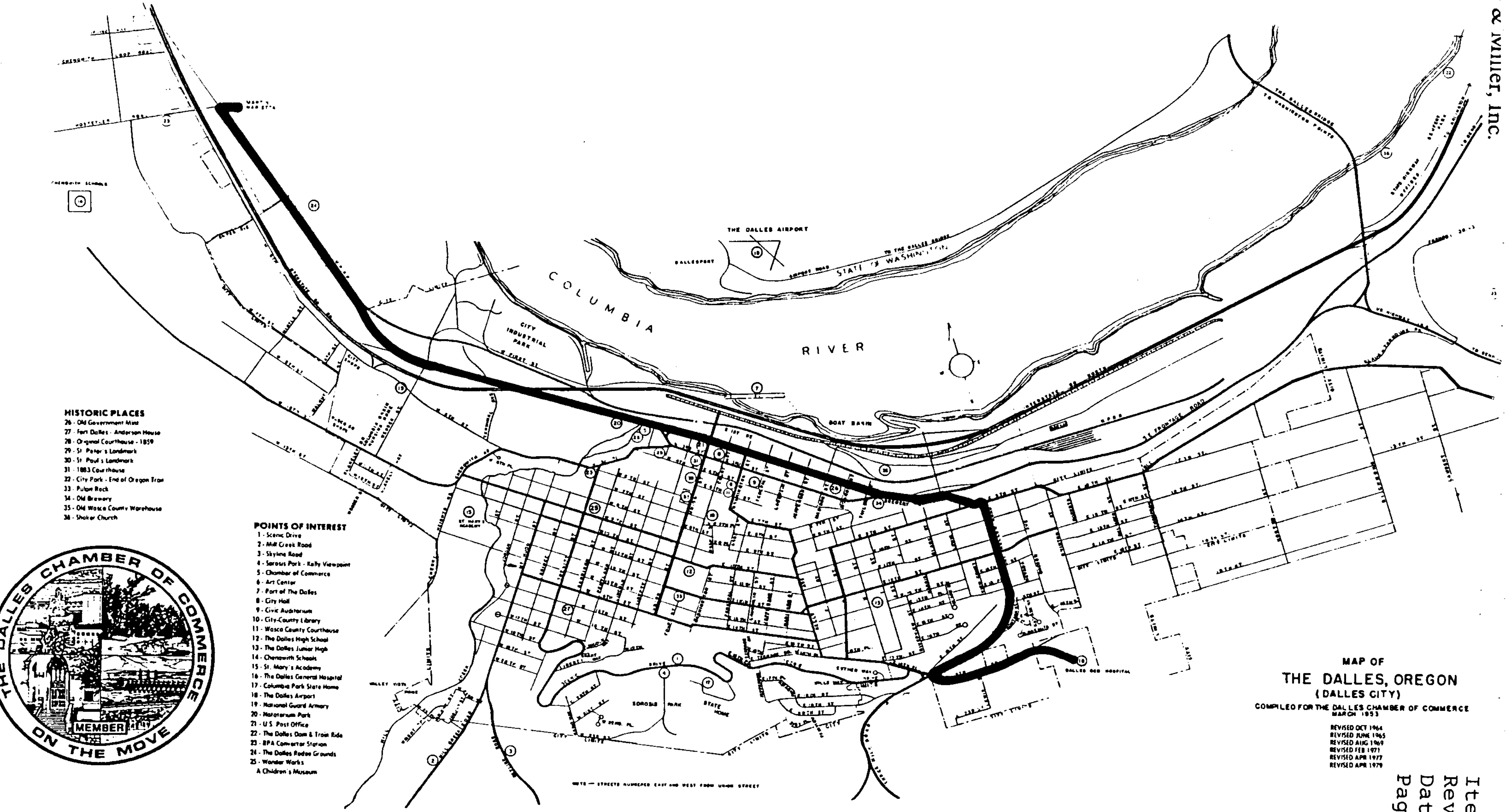

FIGURE 13.0-1. ROUTE TO HOSPITAL

APPENDIX C

APPENDIX C

DATA AND RECORDS MANAGEMENT PLAN
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
MARTIN MARIETTA REDUCTION FACILITY
THE DALLES, OREGON

TABLE OF CONTENTS

1.0 INTRODUCTION

It is anticipated that the Remedial Investigation/ Feasibility Study (RI/FS) for the MMRF will involve generating an extensive volume of information from State and Federal agencies, contractors, subcontractors, and other sources. The Data and Records Management Plan outlines the procedures that are to be used to maintain the quality and integrity of the data that will be collected. The protocols that have been outlined help ensure that the validity of the data and records are safeguarded for any future enforcement, legal, or cost recovery actions.

The plan is divided into the following sections:

- Procedures and guidelines for data mangement;
- Documentation of field and laboratory activities;
- Data and records management requirements for the remedial responses; and
- Technical progress reports.

2.0 DATA MANAGEMENT PROCEDURES AND GUIDELINES

The MMRF project will require the administration of both on-site and central project files. The data and records management system will provide adequate control and retention of all project-related information. Record control will include receipt from external sources, transmittal, transfer to storage, and indication of record status. Retention will include receipt at storage areas, indexing, filing, storage, maintenance, and retrieval.

2.1 Records Control

Data and records management for the MMRF site involves controlling the flow of information to and from Geraghty & Miller, Inc. (G&M). All project-related materials which are incoming in the form of correspondence, sketches, logs, authorization, or other information shall be routed to the Project Coordinator after the original is marked with the date received and the project number by a member of the Project Staff or a secretary assigned this duty. The Project Coordinator will then determine which personnel should review the incoming materials and will route the materials as appropriate.

As soon as practical, all incoming originals of correspondence, etc. will be placed in the project central file. If the correspondence is required for reference by project personnel, a copy should be made rather than holding the original. All records shall be legible and easily identifiable. In addition, field records and records being sent between G&M and subcontractor offices will be adequately protected from damage and loss during transfer.

Examples of the types of documents that will be transferred to the project central files are:

- o Field records and checkprints;
- o Laboratory test data and checkprints;
- o Numerical calculations and checkprints;
- o Reports and other data transmittals;
- o Copies of proposals;

- o Purchase orders for project services, and contractors;

- o Correspondence, including incoming and outgoing letters, memorandums, and telephone records;

- o Photographs and other imagery; and

- o Documentation and verification of computer programs.

Records submitted to the project central file, with the exception of correspondence, should be bound, placed in folders or binders, or otherwise secured for filing.

Project-related materials sent outside G&M, including correspondence, reports, and drawing will be appropriately reviewed, approved, and if necessary signed prior to transmittal. Outgoing correspondence will, as a minimum, be signed by the Project Coordinator or a key level individual assigned the responsibility by the Project Coordinator. If joint signatures are needed, the originator of the correspondence, when different than management, may also sign. Quality assurance correspondence shall be signed by the Quality Assurance Officer, or a key level individual assigned the responsibility by the Quality Assurance Officer.

All outgoing project correspondence and reports should be read by the Project Coordinator prior to mailing. The office copy of all project correspondence should bear routing information.

To facilitate communications, weekly progress meetings or conference calls will be held with the Project Manager and key project members in attendance. Meeting notes will be subsequently issued to appropriate staff members.

2.2 Record Status

To prevent the inadvertent use of obsolete or superceded project-related information, all individuals on the Project and Laboratory staffs will be responsible for reporting such information to the Project Coordinator and/or Laboratory Directors, as appropriate, will notify the Project and Laboratory Staffs and the Quality Assurance Officer of the resulting status change in project documents, such as drawings and project procedures. Notification to staff personnel of status changes in quality-assurance procedures will be the responsibility of the Quality Assurance Officer.

In general, outdated drawing and other documents shall be marked "Void". However, the Project Coordinator may request that the copies be destroyed. It is recommended that one copy of all void documents be maintained for the project files with the reasons for and date voiding clearly indicated.

To denote calculations, drawings, and other material which have not been checked, or which do not contribute to final project information; these documents shall be marked "Draft."

2.3 Record Retention

Information related to the project will be retained by G&M. Designated personnel will assure that incoming records have proper identification for filing, are legible, and are in suitable condition for storage. Indexing and filing of records will be performed only by the Data and Records Manager or personnel designated by him.

For the project central file, the individual file folders will be divided into appropriate categories based on content, and filed sequentially within each category. Table 1 lists the typical project central file categories, and examples of the contents for each category.

For the original drawing, drawing checkprint, and quality assurance files, all material shall be filed only by project number. Computer files of generic program documentation and verification shall be organized by program name.

Record storage will be performed in two phases:

- o Storage during and immediately following the project;
- o Permanent storage of records directly related to the project.

Both phases will use storage facilities that provide a suitable environment to minimize deterioration or damage, and that prevents loss. The facilities will, where possible, have controlled access and will provide protection from excess moisture and temperature extremes. Records will be secured in steel file cabinets labeled with the project number.

TABLE 1

Organization of Project Central Files
Martin Marietta Reduction Facility
The Dalles, Oregon

CATEGORY	CONTENT EXAMPLES
Discover/Scoping	Correspondence, initial investigation reports, preliminary assessment reports, site inspection reports, hazardous waste site ranking system evaluations, sampling and analysis data.
Site Characterization	Correspondence, draft and final copies of work plans for remedial investigation/feasibility study, draft and final copies of remedial investigation/feasibility study reports, health and safety plan, quality assurance project plan, data management plan.
Remedial Implementation	Remedial design reports, permits, contractor work plans and progress reports, Corps of Engineers agreements, reports, and correspondence.
EPA/DEQ Coordination	Correspondence, consent order changes/-interpretation, interagency agreements, memorandum of understanding with state.
Community Relations	Correspondence, meeting summaries, press releases, news clippings.
Imagery	Photographs, illustrations, and other graphics.
Enforcement	Status reports, cross reference to any confidential enforcement files and person to contact, correspondence, and administrative.
Contracts	Site-specific contracts, procurement packages, contract status notifications, lists of contractors and subcontractors.
Technical Progress	Monthly technical progress reports.
Financial Transactions	Monthly financial progress reports, cumulative project cost reports, audit reports, and contractor cost reports.

For the project central file used during and immediately following the project, and for the permanent project storage file, sign-out sheets will be maintained so that a record of files removed is available.

Permanent storage of project-related material will be in an approved single source facility, with duplicate records being stored in a separate location. All materials from the project central file, original drawing file, and quality assurance file shall be stored.

All storage systems will provide for the prompt retrieval of information for reference or use outside the storage areas. Project records will be accessible by Martin Marietta Corporation, and as necessary, the DEQ, for the life of the records.

2.4 On-Site Control

A file, similar to the project central file, will be established and maintained by the field personnel under the direction of the on-site manager. Upon completion of the field program, the on-site file will be transferred to, and integrated with, the office project files.

3.0 FIELD/LABORATORY DOCUMENTATION

3.1 Project/Field Log Books

All field measurements and observations will be recorded in project log books, field data records, or similar types of records-keeping books. Field measurements will include pH, temperature, conductivity, water flow, and various air quality parameters. All data will be recorded directly and should be legible. All entries will be signed and dated. If, for any reason, entries must be changed, the change will not obscure the original entry. The reason for the change will be stated, and the change and explanation will be signed and dated at the time the change is made. Field data records will be organized into standard formats whenever possible, and kept in permanent files.

All field investigations and testing will be documented in a daily log of project activities, including identifying the sampling personnel. Copies of the daily log entries will be sent to the Project Coordinator approximately once a week. If the logs are not submitted as required, it is the responsibility of the Project Coordinator to contact the field personnel. All field records shall be collected and maintained by the On-Site Manager until completion of the field program. During the performance of a field program, it is anticipated that copies of the field records will be sent on a weekly basis to the Project Coordinator. These copies can provide adequate documentation of work activities should the originals be destroyed, lost, or stolen.

3.2 Sample Tags

Each field sample will be identified by a sample tag which is filled out using water resistant ink. Included on the tag (usually supplied by the laboratory) are the sample identification number, date, time and location of sample collection, designation of the sample (grab, pumped, or composite), the type of sample and preservative, any pertinent remarks, and the signature of the sampler.

This information will be recorded in the bound log book along with any in-situ measurement data and field observations. After collection and identification, the sample will be indicated for and maintained under the Chain-of-Custody procedures outlined below. If the sample collected is to be split with Federal or State agencies, then the appropriate sample receiver will be indicated on the split sample tag which is affixed on the container containing the split sample aliquot.

3.3 Sample Data Sheets and Logs

Laboratory testing programs will utilize prepared forms to systematically and uniformly document administrative and technical information. These forms shall be prepared prior to initiating the testing programs. Chemical analysis documentation and soil sample test forms shall be completed during the testing and subsequent data reduction. All requested information shall be addressed. This information shall include, as appropriate:

- o Project name and number;
- o Identification of test personnel;
- o Testing date;
- o Identification of calibrated equipment used (test equipment list giving equipment name and identification number);
- o Identification of and descriptions of sample(s) tested;
- o Test results in the form of tables and curves; and
- o Unusual conditions encountered.

3.4 Chain-of-Custody Records and Seals

Documenting proper sample custody is an important part of field and laboratory operations when samples are needed for enforcement actions or litigation. Chain-of-custody procedures will document sample possession from the time of collection to disposal, in accordance with the guidelines established in the EPA Safety Manual for Hazardous Waste Site Investigations (September, 1980). In order to document sample custody, the following chain-of-custody procedures will be followed.

The field samples to be collected can be classified into two categories: (a) in-situ measurements, and (b) laboratory analyses.

A. In-situ measurements are those measurements made immediately after the sample has been collected. The data will be recorded directly in bound log books with sequentially numbered pages, along with identifying information on sampling conditions and location. In-situ measurements include the following: pH, temperature, conductivity, flow measurements, and continuous air monitoring.

B. Laboratory Measurements - Samples collected and preserved in the field, to be shipped to the appropriate laboratory for chemical analysis. Identifying information on sampling conditions and location will be recorded as indicated above together with a record of the required analysis for each of the samples collected.

3.4.1 Sample Custody in the Field

The following general guidelines will be used to document, establishing and maintaining custody of field samples:

- Sample tags will be completed for each sample, using waterproof ink, making use that the tags are legible and affixed firmly on the sample container;
- All information will be recorded in the field in bound notebooks with sequentially numbered pages, using the sample identification numbers from the tags as references;
- A chain-of-custody record (Figure 7.1-1 of the QAPP) will be initiated in the field for every sample or set of samples that are being shipped to the same laboratory. A copy of this record will accompany the sample.

Prior to sampling, all personnel involved will have received copies of the chain-of-custody procedure. A briefing for these personnel will be held and documented in conjuncton with the Health and Safety training program. The chain-of-custody procedure will be covered.

3.4.2 Sample Transfer and Shipment

The following guidelines will be followed in transferring and shipping samples:

- o When transferring possession of samples, the individual relinquishing the sample and the new custodian will sign the record and denote the date and time. A copy of the signed record will be made by the previous custodian and sent to the receiving laboratory to allow tracking of sample possession. All change of custody of samples must be a person-to-person exchange of custody documents and samples; and

- o The following documentation will supplement the chain-of-custody records:

  - Field log book, which will be filed upon completion in the project files,
  - Sample tags on each sample,
  - Sample seal on each sample, and
  - Photographic records, wherever practical and the extent economically feasible.

3.4.3 Laboratory Custody Procedures

The following general guidelines should be used by the laboratory sample custodian in maintaining the chain-of-custody once the samples have been received in the laboratory;

- o The samples received by the laboratory will be cross-checked to verify that the information on the sample tags matches that on the chain-of-custody record included with the shipment;

- o If all data and samples are correct, and there has been no tampering with the custody seals, the "received by laboratory" box is signed and dated;

- o The samples will be distributed to the appropriate analysts, with names of individuals who receive samples to be recorded in internal laboratory records; and

- o Upon sample destruction or disposal, the custodian responsible for the disposal will complete the chain-of-custody record, file a copy, and send a copy to the Project Coordinator for recordkeeping. All samples not consumed during analysis shall be kept for three months.

3.5 Receipt of Sample Forms

The sampling personnel shall complete a record of each group of samples shipped to the laboratory. Laboratory personnel shall compare this record against the samples received. Any samples that are damaged in shipment should be noted. If samples are improperly or incorrectly identified, they will be set aside prior to testing until sufficient information is supplied by project personnel.

3.6 Laboratory Log Books

All laboratory data will be recorded in bound books with sequentially numbered pages. The data entered in the book will be validated daily by having the analyst date and sign each analysis on the day completed. The use of bound notebooks is essential, as the recording in the notebook is the prime disposition of the data until a report is issued.

3.7 Laboratory Data, Calculations, and Graphs

The reduction of laboratory data from the raw instrument readings to a final value for the concentration of the determined parameter generally occurs in one of three methods:

- o Manual computation of results directly on the data sheet or on calculation pages attached to the data sheets;
- o Input of raw data for computer processing; and
- o Direct acquisition and processing of raw data by a computer.

If data are manually processed by an analyst, all steps in the computation be provided including equations used and the source of the input parameters such as response factors, dilution factors, and calibration constants. If calculations are not performed directly on the data sheet, calculations should be shown in full and attached to the data sheets. The analyst will sign their full signature and date in ink each page of calculations.

For data that are input by an analyst and processed using a computer, a copy of the input shall be kept and identified with the project number and other information as needed. The samples analyzed shall be clearly noted and the input signed and dated by the analyst.

If the data are directly acquired from instrumentation and processed, the analyst will verify that the following are correct: (a) project and sample numbers, (b) calibration constants and response factors, (c) output parameters such as units, and (d) numerical values used for detection limits if a value is reported as less than. The analyst will sign and date the resulting output.

4.0 REMEDIAL RESPONSE DATA MANAGEMENT REQUIREMENTS

The following sections outline data management guidelines and procedures that apply to RI activities described in the Work Plan for the MMRF site. These include:

- o Scoping;
- o Site Characterization and Sampling; and
- o Health/Safety Programs.

Procedures for the disposition of data and any special data handling are presented in this section.

4.1 Scoping

Scoping is the initial step in the remedial response. The existing data gathered and assessed during the scoping process define the subsequent task. Among the reports that will be produced to document the scoping task are:

- o Site background, including a description of the problem;
- o Site chronology;
- o Site map;
- o Sampling plan and map; and
- o Final work plans.

It is anticipated that this process will generate an extensive volume of information in preparing the above-listed reports. This information will be filed so that it is readily available to support the conclusions of the feasibility study. The system that will be used to file this information is outlined below:

- o Correspondence;
- o Initial Investigation Reports;
- o Preliminary Assessment Report;
- o Site Inspection Report;

- Hazardous Ranking System Evaluation; and
- Sampling and Analysis Data.

The rationale and results of the scoping process and other RI tasks will be documented. The documentation and filing system that will be used are covered in Section 5.0 of this plan.

4.2 Site Characterization and Sampling

Site characterization and sampling are conducted to verify existing data and to fill data gaps for subsequent and concurrent RI work. Documentation and record-keeping procedures are most important during site characterization and sampling because these steps produce the basic data used in making all subsequent decisions, including remedial technology selection. The outline of the file structure for site characterization and sampling is given below:

- Correspondence;
- Draft/Final work plans for RI/FS;
  (Detailed work plans will be used to maintain timing and scheduling requirements for field work, laboratories, holding times, and timely data turn around.)
- Draft/Final RI/FS Reports, including:
  a) Site Description,
  b) Contamination Assessment,
  c) Environmental Assessment,
  d) Public Health Assessment,
  e) Endangerment Assessment, and
  f) Remedial Design Reports;
- Quality Assurance Project Plan;
- Data Management Plan
  (This document includes security systems designed to ensure that the records cannot be tampered with or accidentally lost or damaged.)
- Permits; and
- Contractor Work Plans and Specifications.

4.3 Health and Safety Programs

A Health and Safety (H&S) Plan has been developed for the MMRF site. The purpose of the H&S plan is to address the health and safety concerns of implementing the remedial investigation. The plan will be revised as necessary to address the health and safety needs during installation of ground-water monitoring wells at the site following the preliminary investigation. The H&S Plan generally includes the following items:

- A statement of responsibility;
- Medical surveillance;
- A personnel protection program;
- A management plan that defines responsibilities and authorities for health and safety functions;
- Exposure monitoring and standard operating procedures (SOP);
- Safety equipment required on-site;
- Emergency situations; and
- Recordkeeping.

The H&S Plan documentation that will be carried out during the course of the remedial investigation includes:

- Physician's reports;
- Site-specific health and safety plan;
- Personnel monitoring results;
- Incident and nonconformity reports;
- Safety Officer's log;
- On-Site Manager's activity log; and
- Personnel Training documentation

Data on the health and safety programs will be stored for a long period of time, due to the unusually long lag time between exposure to hazardous substances and developing symptoms of disease. Data is usually stored for more than 30 years in order to document previous exposure to hazardous materials. These data could help determine if the employee's poor health in later years is related to some kind of exposure.

4.4 Institutional Issues

Remedial activities at the MMRF site involve institutional requirements, including:

- Coordination with EPA, other Federal agencies, and the Oregon Department of Environmental Quality (DEQ); and
- Community Relations planning.

As described in the Consent Order for the MMRF RI/FS, the development and implementation of the Community Relations Plan has been identified as one of the tasks to be performed independently by the EPA. Geraghty & Miller, Inc., will support the EPA in this effort as required (meetings, presentations on project status, findings, etc.). The types of documents that will be stored in the project files include:

- Correspondence;
- Community Relations Plan outline;
- Meeting summaries; and
- Press releases and news clippings.

5.0 TECHNICAL PROGRESS REPORTS

5.1 Monthly Technical Progress Reports

Evaluating the progress made during a remedial investigation depends on the availability of appropriate financial and project tracking data. In the MMRF site Work Plan, the work plan is broken into a series of tasks, including schedules associated with each task.

Project tracking reports will be used for tracking technical progress. A modified format for monthly technical progress reports developed by EPA is included as Table 5.1-1. This is the format that will generally be followed in tracking technical progress during the remedial investigation and feasibility study. The Monthly Technical Progress Report will be submitted within 15 calendar days after the end of each reporting period.

TABLE 5.1-1
Sample Status Report Format
Monthly Work Assignment Technical Status Report

WORK ASSIGNMENT NUMBER:

SITE NAME/ACTIVITY:

PREPARED BY:

DATE:

PERIOD (Month, Year):

COPIES:

1. Progress Made This Reporting Period - Description of progress made during the reporting period, including problem areas encountered and recommendations.

2. Problems Resolved - Results obtained relating to previously identified problem areas.

3. Anticipated Problem Areas and Recommended Solutions - Anticipated problems and recommendations including technical, costs, and scheduling implications for resolution. Actual or projected overruns should be discussed here.

4. Deliverables Submitted - Deliverables completed and anticipated, including deliverables to be submitted, dates of anticipated submittals, and reasons if due dates have been (or need to be) revised.

5. Upcoming Events/Activities Planned - Important upcoming dates, meetings, hearings, etc. Major tasks to be performed within the next reporting period, identification of decision points.

6. Key Personnel Changes - Any changes in key personnel assigned to the work.

7. Percent Complete - Level of technical completion achieved, reported as percent complete for each task and as a single number for the total work assignment.

8. Schedule - Agreed-upon date that deliverables are due and actual date deliverables were or are planned to be submitted. Any delay should be explained.

APPENDIX D

APPENDIX D

Resumes of Key Personnel

JERRY E. KUBAL

Associate
Manager, Tampa Office
Member of the firm since 1981

CREDENTIALS/REGISTRATION

B.S., Geology, University of Florida, 1970
M.S., Environmental Engineering, University of Florida, 1973

PROFESSIONAL AFFILIATIONS

American Institute of Professional Geologists (CPGS #6161)
National Water Well Association
Florida Water Well Association
American Water Resources Association
Southeastern Geological Society
Technical Association of the Pulp and Paper Industry (TAPPI)
Nonmember advisor to the American Society of Civil Engineers Ground Water Committee, Irrigation and Drainage Division.

FIELDS OF SPECIALIZATION

- Investigation and evaluation of ground-water contamination incidents
- Expert testimony at regulatory and judicial proceedings.
- Development and management of ground-water resources
- Investigation of hydrogeologic suitability of solid-waste disposal sites

EXPERIENCE SUMMARY

Mr. Kubal is an environmental engineer with more than fifteen years' experience in planning and managing complex ground-water contamination investigations in the southeast and western United States. Typical projects have involved proper siting of solid-waste disposal facilities, assessments of ground-water contamination, and development of remedial programs, many at Superfund sites. Mr. Kubal has lectured extensively, has served as an expert witness in regulatory and judicial proceedings, and prior to joining Geraghty & Miller, Inc., was Director of the Water Resources Department of the St. Johns River Water Management District and Acting Director of the Alachua County Pollution Control District, both in Florida.

KEY PROJECTS

- Project manager in charge of data collection and ground-water quality monitoring at the Taylor Road Landfill in Hillsborough County, Florida (Superfund site). Also served as technical expert for Hillsborough County during depositions and settlement negotiations with the U.S. Justice Department and the EPA.

- Project manager on an investigation of ground- and surface-water conditions and recommended remedial action at a battery disposal site in Tampa, Hillsborough County, Florida, including presentation of expert witness testimony at trial (Superfund site).

- Project manager for a preliminary hydrogeologic and ground-water quality assessment at the specialty chemicals site of Montco Research Products, Hollister, Putnam County, Florida, including presentation of expert witness testimony at trial (Superfund site).

- Project Manager to oversee and review work performed by the State of Florida Contractor at the City Industries (Forsyth Road) site in Winter Park, Orange County, Florida (Superfund site). Served as technical expert and consultant to the technical steering committee composed of potential responsible parties (PRP's).

- Project Manager on an investigation of ground-water contamination from an abandoned drum storage/disposal area at the Vroom site in Loughman, Polk County, Florida (Superfund site). Reviewed work performed by the State of Florida and their contractor and provided expert witness testimony during depositions.

- Project Manager to oversee and review work performed by an EPA contractor at the Zellwood Contamination Site in Zellwood, Orange County, Florida (Superfund site). Served as technical expert and consultant to the potential responsible parties (PRP's).

- Project Manager assisting in the preparation and implementation of a closure plan for a surface impoundment, and a ground-water quality assessment plan, for an industrial client in Goldendale, Washington.

- Project Manager on an evaluation of hydrogeologic conditions and recommended ground-water monitoring program and interim remedial action plan for an industrial client in Denver, Colorado.

- Project manager for the installation of monitor wells around active and abandoned hazardous-waste disposal sites for an industrial client in Orlando, Orange County, Florida, including the design and installation of recovery-well systems and preparation of ground-water quality assessment plans and contamination assessment plans. Also served an technical expert during settlement negotiations with the State of Florida.

- Project manager for a preliminary hydrogeologic and ground-water quality assessment of the Blackman-Uhler Plant Site, Spartanburg, South Carolina, and the Augusta Chemical Company, Augusta, Georgia, including preparation of ground-water quality assessment plans and Part B permit applications for the two facilities.

- Project manager on an evaluation of hydrogeologic conditions and recommended ground-water monitoring program at hazardous-waste disposal sites for an industrial client in Lewisport, Kentucky.

- Project manager for an evaluation of ground-water quality conditions related to a gasoline leak and its impact on the water-supply wells for the City of Belleview, Marion County, Florida.

- Project manager for a hydrogeologic investigation of the Buckeye Cellulose Chip Mill, Carrabelle, Franklin County, Florida, evaluating the ultimate fate and deposition of pentachlorophenols in soils and adjacent ground waters.

- Project manager responsible for the installation of deep observation wells and recovery wells at the Savannah River Plant in Aiken, South Carolina for E. I. duPont deNemours and Company, Inc.

- Project manager on a hydrogeologic survey of potential sanitary landfill sites in Beaufort and Jasper Counties, SC.

- Project manager for a preliminary hydrogeologic investigation at the Gulf Oil Chemicals Company Explosives Plant, Brooksville, Hernando County, Florida.

- Project manager for a hydrogeologic investigation of and monitor-well installation at the FPL Sanford Power Plant, Volusia County, Florida.

- Project manager for a hydrogeologic investigation and ground-water monitoring plan for the Georgia-Pacific Corporation, Palatka Mill, Putnam County, Florida.

- Project manager for a hydrogeologic evaluation of ground water availability in the Silver Springs Shores area of Marion County, Florida for General Development Corporation.

DAVID J. JESSUP

Senior Engineer
Member of the firm since 1985

CREDENTIALS/REGISTRATION

B.S. Civil Engineering, Purdue University, 1975
M.S. Environmental Engineering, University of Tennessee, 1977
P.E., Louisiana, 1982

PROFESSIONAL AFFILIATIONS

American Society of Civil Engineers
American Water Resources Association
Louisiana Engineering Society
Chi Epsilon

FIELDS OF SPECIALIZATION

- Hazardous Waste Remedial Action Design and Implementation
- Landfarm Facility Design
- Hazardous/Solid Waste Permit Applications
- Wastewater Treatment

EXPERIENCE SUMMARY

Mr. Jessup is a Senior Engineer in Geraghty & Miller's, Baton Rouge, Louisiana, office. In this capacity, Mr. Jessup is responsible for managing remedial action programs, designing wastewater treatment systems and for directing the engineering aspects of Baton Rouge projects.

Prior to joining Geraghty & Miller, Inc., Mr. Jessup held the position of project manager/engineer with IT Corporation and Black & Veatch. Responsibilities included development of feasibility assessments, permits, closure plans, and designs for solid, hazardous and special waste facilities, associated responsibilities consisted of delisting of suspected hazardous wastes, development of quality assurance and health and safety programs, waste segregation studies, automated surface water monitoring and sampling, carbon adsorption pilot tests, volume reduction and solidification studies.

Mr. Jessup also has experience in industrial and municipal wastewater treatment. He is familar with biological and various chemical treatment systems. Responsibilities in the area of wastewater treatment consisted of designing biological and chemical/physical systems, wastewater segragation studies, surface water quantity and quality monitoring, facility planning and sewer rehabilitation projects.

KEY PROJECTS

- Project Manager for the Old Inger Superfund Site, Phase III Engineering Design. This project is the first superfund site in the nation to demonstrate land treatment technology as a method for disposal of hazardous oily wastes. Management duties consisted of coordinating activities between the Louisiana DEQ Project Officer, EPA Region 6 Technical and RCRA staff and sub-contractors. Project duties consisted of developing the Quality Assurance Project Plan, Health and Safety Plan and technical elements of the Work Scope. The Work Scope consisted of conceptual design/waste removal sequencing, water treatment design, laboratory waste degradation kinetics, field plot demonstration study and final design.

- Remedial Investigation, Puerto Rico. Performed sampling investigation for closed PVC manufacturer under a compliance order from EPA Region 2. Waste management units consisted of an incinerator, neutralization impoundment, tanks and container storage. Laboratory results determined non-detectable concentrations of hazardous waste present in the soil or water.

- Louisiana Part II Preparation. Developed responses to Chapters 4, 16, and 18 of the Louisiana Hazardous Waste Regulations. Waste management units consisted of a neutralization impoundment, two waste impoundments and a landfill. Management duties required supervision of technical staff in the preparation of responses and development of required figures and illustrations.

- Industrial Hazardous Waste Sludge Dewatering and Disposal Study. Provided dewatering and disposal alternatives for cooling water blowdown sludge. Study included evaluation of dewatering equipment, preliminary design of online system, sludge pond dewatering and disposal alternatives.

- Hazardous Waste Management Plan for NAS Pensacola, Florida. Conducted hazardous material/hazardous waste survey for facility and developed comprehensive management plan, including innovative waste generation abatement techniques and in depth RCRA permit Part B compliance survey.

- Closure Plans. Developed innovative closure plans for three south Louisiana commercial oil field waste disposal facilities required to meet Louisiana Office of Conservation Statewide Order 29-B requirements. All closure plans have been accepted and are currently pending implementation.

- Landfarm Facility Design. Project consist of designing a landfarm disposal facility for class II industrial waste; specifically waste drilling muds which are currently being disposed of in impoundments. Design must meet Office of Conservation regulations designated in Statewide Order 29-B. An ancillary objective was to treat impoundment waters and negotiate a discharge petition.

- Activated Carbon Pilot Plant Study. Conducted a pilot plant study for treatment of dilute hazardous organic wastewaters utilizing activated carbon treatment. Objectives were to determine treatability of waste stream, carbon loading/usage rates, and an economic evaluation which included a comparison to existing waste disposal methods. On-site regeneration using steam and methanol/steam were conducted as part of the economic evaluation.

- Water Quality Stimulation, NAS New Orleans, Belle Chasse, Louisiana. Participated in AUTOQUAL model application project for the ICWW-Algiers Route to determine wasteload application. Conducted two independent intensive water quality surveys for model calibration/verification. Reviewed and summarized hydrologic/hydraulic data pertaining to tidal hydraulics, lock operation and pumped urban drainage discharges. Executed calibrated model for various flow conditions to predict water quality changes due to proposed discharge.

Richard C. Smalley

Staff Scientist
Member of the firm since 1985

CREDENTIALS/REGISTRATION

B.S., Geosciences, The Pennsylvania State University, 1979
M.S., Geosciences, University of Arizona, 1983

PROFESSIONAL QUALIFICATIONS

Society of Petroleum Engineers of the American Institute of Mining and Metallurgical Engineers
Mining and Metallurgical Engineers
American Institute of Professional Geologists (certification pending)

Fields of Specialization

- Stable and Radioisotope Geochemistry
- Ground-Water Contamination Assessments
- Remedial Action Plan Design for Contamination Abatement
- Underground Injection Wells
- Fracture Flow in Sedimentary Rocks

EXPERIENCE SUMMARY

As a staff scientist for Geraghty and Miller, Inc., Mr. Smalley is responsible for managing and directing hydrogeological investigations. He has conducted field studies of aquifer properties, directed monitor-well installation, and coordinated water-quality and soil boring sampling programs.

Mr. Smalley was previously employed by the Kentucky Geological Survey as a principal investigator in underground injection control. In this research project, Mr. Smalley defined the hydrogeology of all major water-flooded strata in Kentucky, determined pressure response, area of influence of wells injecting into each of these formations, and the maximum pressure gradients for maintenance of cap-rock integrity. His duties also encompassed analysis of fracture flow in the hydrogeologic systems in the Eastern Kentucky Coal Field.

While employed with Malcolm Pirnie, Inc., Mr. Smalley participated in water-supply studies and landfill sitings. He assisted in developing water supplies for municipalities in industrialized New Jersey, Fairlawn and Pequannock Townships, in Glendale and Mesa, Arizona and other areas of the arid southwest. All studies entailed extensive record collection and analyses. The Fairlawn study also employed aerial photo techniques through which a yield two to four times the average yield for the area was obtained. These water wells yielded excellent quality despite their location in a highly developed urban area. Well sites in the southwest were chosen to avoid the presence of the pesticide dibromochloropropane. Mr. Smalley evaluated the regional geology of sites in Florida, Virginia, Arizona, and New York which were being considered for landfill facilities.

While employed with Malcolm Pirnie, Mr. Smalley participated in numerous hazardous-waste site evaluations, including the following:

- Evaluation of magnitude and extent of contamination at a major chemical-company facility in Woburn, Massachusetts; involved were diverse chemical groups such as solvents and plasticizers.

- Evaluation of contamination and design of abatement scheme for acid-metal waste dump at a munitions factory in Connecticut. This study required delineation of sources of contamination in a highly industrialized area.

- Definition of sources and mechanisms by which municipal well fields in an industrialized area of Rhode Island were contaminated. Successfully refuted claims made by a regulatory-agency contractor regarding one of the two fields and achieved a savings of three to five million dollars for an industrial client. Designed and implemented remedial action at the other well field including pumping and treating with packed tower aeration.

- Study of extent and mode of migration of volatile organic contaminants in thick unsaturated zone at Indian Bend Site, Phoenix, Arizona; purpose was to assess potential danger to municipal water supply. Conducted a similar study near the International Airport, Tucson, Arizona.

- Assessment of contamination by plasticizers and water-soluble oils at a site on the banks of a major waterway dividing two northeastern states. Designed methods to eliminate discharge of contaminants to the river.

- Studies of contamination at sites planned for large structures in the Bronx and midtown Manhattan, New York.

- Evaluations of ground-water impacts in rural portions of Nantucket Island, Massachusetts, and the Adirondacks, New York. The Nantucket Island project identified ways to meet increasing electrical needs while minimizing potential impact on the island's beaches and sole-source aquifer. The Adirondack study evaluated leakage of gasoline from an underground storage tank and identified alternate horizons for obtaining potable water while remedial actions were pursued on the gasoline-contaminated horizon.

- Two projects involving specific pesticides. One was a toxicological and water-resources impact study for an industrial client who was developing a new pesticide and applying for a license to use it. The other involved a wall-paper manufacturer who had landfilled scraps which contained a mold inhibitor. This was a complex problem because solvents, deposited at the dump by other industries, influenced the mobility of the pesticide used on the wall paper.

- An investigation of residual contaminants in the area of Love Canal, New York. This was an extensive, interdisciplinary effort designed for assessing the rehabitability of the Love Canal area by humans.

- During the summer of 1980, Mr. Smalley worked with Penn Environmental Division of NUS Corporation. He assisted in the evaluation of a site proposed for disposal of neutralized acid-waste sludges. This project included surface-water monitoring and the siting and installation of monitoring wells; such tasks were complicated because the area had been mined by surface and underground methods. He also assisted in the evaluation of an uncontrolled pesticide and chemical-waste disposal site near Deerfield, Ohio.

- During the summer of 1979, Mr. Smalley conducted a field exploration program for base and precious metals in the Piedmont Province of North and South Carolina for Asarco, Inc. His duties included extensive stream sediment sampling and geologic mapping.

- Mr. Smalley's masters thesis project was a regional study and effort to develop new techniques to assess the geothermal resource potential of low to moderate temperature (30° to 50° C) ground waters in the basin and range province of the western United States. This study surveyed the hydrogeology of a 30- by 70-mile basin in southeastern Arizona and used stable isotope measurements to determine the source area of the ground waters and geothermal waters, used radio isotope measurements to determine the residence time of the waters, and fluid-rock interaction phenomena to assess deep geothermal-reservoir properties.

PUBLICATIONS:

- Long, Austin, Richard C. Smalley, and A. Muller, 1982. "Application of Environmental Isotopes to the Safford (Arizona) Valley Ground-Water System: A Basin of Multiple Water Sources and Uses." 1982 International Radiocarbon Conference, Seattle, Washington.

- Smalley, Richard C. and Austin Long, 1983. "An Isotopic and Geochemical Study of the Hydrogeologic and Geothermal Systems in the Safford Basin, Arizona." 1983 Annual Meeting of the Rocky Mountain and Cordillerian Sections of the Geological Society of America.

- Smalley, Richard C. and William Zimmerman, 1984. "Application of Detailed Analysis of Geologic Structures to Problems in Coal Hydrogeology." Proc. 1984 National Symposium on Surface Mining, Hydrology, Sedimentation, and Reclamation, University of Kentucky, Lexington, Kentucky.

- Smalley, Richard C. and James S. Dinger, (in preparation). "Area of Review and Pressure Buildup Assessment for Injection Wells Used in Petroleum Production." To be released as a publication of the Kentucky Geological Survey in 1985.

RALPH E. MOON

Staff Scientist
Member of the Firm Since 1984

CREDENTIALS/REGISTRATION

B.S. Biology, Western Michigan University, 1972
M.S. Botany, University of South Florida, 1975
Ph.D. Biology, University of South Florida, 1980
Post Doctoral Fellowship, University of South Florida, Department of Chemistry, 1981.
Certified Hazardous Materials Manager, Master Level, 1985

PROFESSIONAL AFFILIATIONS

Sigma Xi
Chemical and Environmental Management Service (CHEMS) Board of Directors, University of South Florida
American Chemical Society
Institute of Hazardous Materials Management

FIELDS OF SPECIALIZATION

- Investigation and evaluation of ground-water contamination incidents
- Ground-water chemistry
- Expert testimony at regulatory proceedings
- Analytical organic chemistry

EXPERIENCE SUMMARY

Prior to joining Geraghty & Miller, Inc., Dr. Moon served as district hydrologist for the Florida Department of Environmental Regulation (FDER), Southwest District. In this position, Dr. Moon was responsible for the review of all district ground-water monitoring plans submitted by facilities that generated hazardous, processing, and municipal wastes. As the district hydrologist, Dr. Moon was instrumental in calling attention to the State the environmental risks imposed by waste oil businesses and their potential to obscure the transport of hazardous waste.

Prior to his District Hydrologist's position, Dr. Moon served as a hazardous-waste compliance officer inspecting numerous industrial facilities for compliance under the Resource Conservation and Recovery Act (RCRA). Compliance inspections required a thorough knowledge of hazardous waste compatibility, occupational health criteria, and detailed understanding of both State and Federal environmental laws.

During his employment with the Florida Department of Environmental Regulation, Dr. Moon was a visiting professor at the University of South Florida's School of Public Health and directed a graduate course on the Regulation of Environmental and Occupational Health Laws.

Since 1983, Dr. Moon has served on the Board of Directors of the Chemical and Environmental Management Center in the Department of Chemistry at the University of South Florida. In this capacity, he continues to direct basic research by graduate students on issues which relate environmental problems to epidemiological, toxicological, pesticide and biochemical research.

KEY PROFESSIONAL ACTIVITIES

Chemical and Environmental Management Service (CHEMS), University of South Florida, Department of Chemistry. Since 1981, Dr. Moon has served as the Assistant Director and later on the Board of Directors of the CHEMS Center. The CHEMS Center is a multi-disciplinary environmental research team providing research, and public information on environmental hazards and occupational exposures.

SELECTED PUBLICATIONS

W. R. Fagerberg, R. E. Moon, E. Truby. Studies on Sargasum III. A quantitative ultrastructural and correlated physiological study of the blade and stipe organs of Sargassum filipendula. Protooplasma, 99(247-261), 1979.

R. E. Moon, T. N. Krumrei, and D. F. Martin. An investigation of compounds cytolytic toward the red tide organism, Ptychodiscus brevis (Davis) Steidinger, from Florida marine sediments. Microbios Letters 10, 115-119, 1980.

C. J. Dawes, N. F. Stanley, R. E. Moon. Physiological and biochemical studies on the iota-carrageenan producing red algo Eucheuma uncinatum Setchell and Gardner from the Gulf of California. Botanica Marina, 20(437-442), 1977.

R. E. Moon and D. F. Martin. Effects of 2- and 4-hydroxybiphenyl on culures of the red tide organism Ptychodiscus brevis. J. of Environmental Science and Health. A16(4), 381-386, 1981

R. E. Moon and D. F. Martin. Assay of diverse biological activities of material elaborated by a marine blue-green alga, Gomphosphaeria aponina. Microbios letters 18, 103-110, 1981.

R. E. Moon. Point Source Discharge in the Tampa Bay Area. Bay Area Scientific Information Symposium, Plenum Press, New York, 1982.

R. E. Moon and D. F. Martin. Studies on Utilization of Stack Gas. I. Preliminary Experiments. J. of Environmental Science and Health, A18(1), 19-28, 1983.

R. E. Moon. Domestic Sewage and Tampa Bay, the Overflow, May-June Issue, 22-23, 1983.

R. E. Moon. Bid Requirements are needed for Used Oil Dealers, The Florida Specifier, Vol. 5, No. 11, October 1984.

R. E. Moon and D. F. Martin. Study of Allelopathic Substances from a Marine Alga.
American Chemical Society (ACS)
Symposium Series Vol. 268, pp. 371-380, 1984.

Ralph E. Moon. Ground Water Monitoring in Florida--Living with Hydrologic and Regulative Peculiarities. National Water Well Association. Fifth Symposiunm and Exposition on Aquifer Restoration and Ground-Water Monitoring, 1985.

R. E. Moon and C. D. Henry. Field Methods - Drilling Techniques, Well Placement, Equipment and Worker Safety at a Pesticide Ground Water Investigation Site. American Chemical Society. Symposium Series (submitted), 1985.

SELECTED PAPERS PRESENTED

Study of Allelopathic Substances from a Marine Alga
Symposium on "The Chemistry of Allelopathy," Pesticide Division of the American Chemical Society, St. Louis, Missouri, April 8-13, 1984.

Ground Water Monitoring, Florida Association for Water Quality Control, Daytona Beach, Florida, May 20-22, 1984.

Waste Oil Generation and Use in the Tampa Bay Area
Florida Association of Governmental Purchasing Offices, 17th Annual Seminar and Workshop, Clearwater, Florida, May 21-25, 1984.

Analytical Data and Its Importance in Hydrological Studies, Florida Society of Environmental Analysis, October 20, 1984, Keynote Speaker.

Hazardous Waste Transport, American Society of Safety Engineers, Guest speaker, December 3, 1984.

Geochemistry and Ground-Water Monitoring, South Carolina Chamber of Commerce. Columbia, South Carolina, January 29, 1985.

Geochemistry and Ground-Water Monitoring, North Carolina Textile Association, Raleigh, North Carolina, January 30, 1985.

Field Methods-Drilling Techniques, Well Placement, Equipment, American Chemical Society, Division of Pesticide Chemistry, Miami, Florida, April 28-May 3, 1985, Invited speaker.

Ground-Water Monitoring in Florida--Living with Hydrologic and Regulative Peculiarities, Fifth Symposium and Exposition on Aquifer Restoration and Ground-Water Monitoring, Columbus, Ohio, May 21-24, 1985.

Health and Safety Plans, Quality Assurance, Quality Control Plans for Hydrogeological Investigations, Geraghty & Miller, Inc., Seminar, October 7, 1985, Orlando, Florida.

Hazardous Waste Management, Geraghty & Miller, Inc., Seminar, October 7 and 12, 1985, Orlando, Florida, and Baton Rouge, Louisiana.

Ground-Water Geochemistry, Geraghty & Miller, Inc., Seminar, October 12, 1985, Baton Rouge, Louisiana.

DAVID L. SMITH

Scientist
Member of the firm since January 1984

CREDENTIALS/REGISTRATION

B.A. Geology, University of South Florida, 1981
Graduate-level course work, hydrogeology

PROFESSIONAL QUALIFICATIONS

American Institute of Mining, Metallurgical and Petroleum Engineers
American Institute of Professional Geologists, Associate Affiliate
Georgia Geological Society
South Carolina Geological Society

FIELDS OF SPECIALIZATION

- Hydrogeological Investigations
- Environmental Impact of Surface Mining
- Impact of Underground Mining on Ground-Water Quality
- Geophysics

EXPERIENCE SUMMARY

As a staff scientist for Geraghty & Miller, Inc., Mr. Smith is responsible for managing and directing hydrogeological investigations. He has conducted field studies of aquifer properties, directed monitor-well installation and soil borings, and coordinated water-quality sampling programs.

Mr. Smith has considerable experience mapping the Piedmont and Coastal Plain geologic provinces of North and South Carolina and has conducted regional ground-water studies in these areas. He is knowledgeable of Coastal Plain stratigraphy and the interpretation of geophysical logs of these sediments.

Mr. Smith was previously employed by Kenwill, Inc., of Maryville, Tennessee, as a ground-water geologist. Mr. Smith was responsible for investigating the hydrogeologic environments of sites within the Valley and Ridge, Blue Ridge, and Piedmont geologic provinces. Mr. Smith was the chief hydrogeologist for determining the flow-system characteristics of Blount County Landfill. He completed many evaluations of the impact of surface mining on the hydrogeeologic regime and took part in a study of the effect of underground mining on the quality and yields of wells in the vicinity of the mine. He was responsible for locating and supervising the installation of monitoring and domestic wells. He directed the sampling of surface and ground water, soil, overburden, stream sediments, auger boring cuttings, hard rock and soft sediment cores and coal.

KEY PROJECTS

- Field manager for the installation of 21 monitor wells at the Savannah River Plant, Aiken, SC.
- Hydrogeologic consultant for the interpretation of the local ground-water environment of the CMP pits, Savannah River Plant, Aiken, SC.
- Coordinator of quarterly ground-water sampling program for 122 wells in the A-M area, Savannah River Plant, SC.
- Hydrogeologic consultant for the ground-water modeling of the A-M area, Savannah River Plant, Aiken, SC.
- Project manager for the installation of 64 monitoring wells at the Savannah River Plant, Aiken, SC.
- Project manager for the installation and testing of eight recovery wells at the Savannah River Plant, Aiken, SC.
- Project manager for the installation and testing of pilot production well at the Savannah River Plant, Aiken, SC.

LORETTA V. GRABOWSKI

Hazardous Waste Specialist
Martin Marietta Environmental Systems

CREDENTIALS/REGISTRATIONS

B.S., Chemistry, University of Florida, 1979
M.B.A., Business Administration, Florida Institute of Technology, 1983
Environmental Studies Certificate, University of Florida, 1979
National Spill Control School, Hazardous Waste Handling, Corpus Christi State University, 1984

PROFESSIONAL AFFILIATIONS

American Society for Testing & Materials, Member, Section D-34 on Waste Disposal
Society of Women Engineers, Member

FIELDS OF SPECIALIZATION

- Management of hazardous-waste operations, including identifications of waste-generating processes, on-site coordination of chemical spills, and development of programs
- Presentation of Contamination Control Training Programs
- Coordination of hazardous-waste storage facilities to meet engineering integrity of EPA

EXPERIENCE SUMMARY

Ms. Grabowski is the manager of the Contamination Control Program for the Vandenberg Shuttle Launch at the Martin Marietta facility on the Vandenberg AFB in California. She prepared the Shuttle Program Contamination Control Plan and the GSS Fluids & Fluid Systems Contamination Control Plan which included the coordination of the Air Force, contractors, and MMC personnel to ensure the plans cover all contamination control activities from design, procurement, installation, test maintenance, and repair of support equipment/systems, and shuttle facilities.

Prior to joining Martin Marietta, Ms. Grabowski was employed by EG&G, Inc., at the Kennedy Space Center in Florida. There she was responsible for environmental engineering integrity of EPA permitted hazardous-waste storage facilities to provide technical assistance to ensure conformity, design control, and performance of proposed storage facilities, systems, and equpment. Duties included the planning and coordination of off-site contract support management, development of KSC hazardous-waste management system for the Shuttle Program, and performance of feasibility studies for the recovery of precious metals and solvents.

KEY PROJECTS

- Manager of hazardous-waste operations at the Martin Marietta launch site during construction and installation of the GSS. This task involved identifying all waste-generating processes, projecting generation rates, schedules and volumes, selecting and scheduling appropriate disposal or recycling contractors and implementing on-site management control to assure compliance with Air Force directives.

- Presented a one-time SPCC training course for Martin Marietta on-site operations and management personnel. Acted as the on-scene coordinator for chemical spills at the site. Developed the hazardous-waste program for Vandenberg Shuttle Launch and Landing Site. Provided technical/management integration of operational and support requirements. Maintained an awareness of regulatory changes, interpretations, and legal decisions affecting hazardous-waste technology in order to comply with EPA, state, county, and Air Force regulations.

LEONARD H. BONGERS
Manager, Corporate Waste Management
Environmental Systems

Education

M.S., Plant and Microbial Physiology, University of Wageningen, Netherlands, 1953
Ph.D., Plant and Microbial Physiology, University of Wageningen, Netherlands, 1956

Fields of Competence and Experience

Management and treatment of hazardous wastes and wastewater; acute and chronic bioassay tests for understanding systems, developing compliance documentation, and interpreting U.S. Environmental Protection Agency regulations; water quality monitoring methodologies

Professional Background

Dr. Bongers is a principal scientist with 25 years experience in project management and research. At Martin Marietta Environmental Systems (formerly Environmental Center), he is responsible for all activities of the Martin Marietta Corporation related to the Toxic Substances Control Act, Clean Water Act, and Resource Conservation and Recovery Act (RCRA). He has been program director and principal investigator of programs for evaluating the environmental impact of various industrial activities, funded by the U.S. Environmental Protection Agency; U.S. Department of the Defense; U.S. Department of Energy; and the U.S. Department of the Interior.

Dr. Bongers has considerable experience in all phases of liquid and hazardous waste management. He has been involved in the development and the application of effluent limitation guidelines and standards for several industrial categories, including the analysis of the engineering and regulatory aspects of the treatment technologies enforced under these regulations. In addition to regulatory analysis, waste characterization, personnel training and risk analysis, he was involved in the tracking of hazardous wastes from the point of generation, through storage and transportation, to ultimate disposal. Such management requires a high degree of familiarity with RCRA reporting and permitting requirements at both federal and state levels; he has worked with all EPA regional offices and several corresponding state offices.

In addition, he is directly concerned with the conservation and recovery of resources and energy from solid wastes. He is currently managing Corporate programs to incinerate hazardous organic wastes in cement kilns. These programs include measurement of fuel composition and trace hydrocarbons in stack gases. He also directs field and laboratory program to manage and treat industrial wastewater.

Dr Bongers did his early research on algal physiology at the University of Wageningen. There, he analyzed kinetic aspects of nitrate and ammonia assimilation and interdependencies of carbon and nitrogen assimilation. He also define physiological conditions most suitable to balanced growth and development. This work was continued when he came to Martin Marietta Corporation (1959) where he also initiated investigations on the kinetics of hydrogen bacteria in continuous culture. Using intact cells as well as sub-cellular systems, he characterized energy generation and the use of autotrophic regenerative systems.

Professional Societies

American Association for the Advancement of Science
American Institute of Biological Sciences
American Society of Microbiology
Society for Industrial Microbiology
American Chemical Society

Cruise Experience

Dr. Bongers has participated in numerous offshore, estuarine, and freshwater cruises.

Patents

Process and product patent to use cement kiln dust for sludge dewatering (patent pending; applied October 1980).

Presentations

Dr. Bongers has made presentations at meetings of all the above listed societies.

Bongers, L.H., W.F. Furth, A.J. Lippson, and H.J. Obremski. 1972. An aquatic program strategy. Prepared by Martin Marietta Corporation for Maryland Department of Natural Resources, Power Plant Siting Program. Ref. No. PPSP-MP-1.

Bongers, L.H., and M. Khattak. 1972. Sand and gravel overlay for control of mercury in sediments. Prepared for U.S. Environmental Protection Agency. Water Pollution Control Research Series, Project No. 16080 HVA.

Bongers, L.H. 1973. Assessing the impact of power plants on Maryland's waterways. Record of the Maryland Power Plant Siting Act 2:1-4. Maryland Department of Natural Resources.

Polgar, T.T., L.H. Bongers, and G.M. Krainak. 1975. Assessment of nearfield manifestations of power-plant-induced effects on zooplankton. Prepared by Martin Marietta Environmental Technology Center for Maryland Department of Natural Resources, Power Plant Siting Program. Ref. No. MT-75-5.

Zankel, K.L., L.H. Bongers, and W.A. Richkus.. 1975. Acoustic measurement of fish densities at the Morgantown Steam Electric Station. Prepared by Martin Marietta Environmental Technology Center for Maryland Department of Natural Resources, Power Plant Siting Program. Ref. No. MT-75-4.

Zankel, K.L., L.H. Bongers, T.T. Polgar, W.A. Richkus, and R.E. Thorne. 1975. Size and distribution of the 1974 striped bass spawning stock in the Potomac River. Prepared by Martin Marietta Environmental Technology Center for Maryland Department of Natural Resources, Power Plant Siting Program. Ref. No. PRFP-75-1.

Bongers, L.H., T.T. Polgar, A.J. Lippson, G.M. Krainak, R.L. Moran, A.F. Holland, and W.A. Richkus. 1975. The impact of the Morgantown power plant on the Potomac estuary: An interpretive summary of the 1972-1973 investigations. Prepared by Martin Marietta Environmental Technology Center for Maryland Department of Natural Resources, Power Plant Siting Program. Ref. No. PPSP-MP-15.

Polgar, T.T., L.H. Bongers, and G.M. Krainak. 1976. Assessment of power plant effects on zooplankton in the nearfield. In: Proceedings of the Second Thermal Ecology Symposium, pp. 358-367. G.W. Esch and R.W. McFarlene, eds. ERDA Symposium Series 40, Technical Information Center, ERDA.

Bongers, L.H., D.T. Burton, and T. O'Connor. 1977. Bromine chloride -- An alternative to chlorine fouling control in condenser cooling systems. Prepared by Martin Marietta Environmental Center for the U.S. Environmental Protection Agency. Rep. No. EPA 600/7-77-053.

Bongers, L.H., B. Bradley, D.T. Burton, A.F. Holland, and H. Liden. 1977. Biotoxicity of bromine chloride and chlorine-treated power plant condenser cooling water effluent. Prepared by Martin Marietta Environmental Technology Center for Ethyl Corporation and Great Lakes Chemical Corporation.

Bongers, L., W. Richkus, J. Arlauskas, and M. Haire. 1978. Mixing zone characterization and impact evaluation of the Manistee Refractories Division wastewater discharge. Prepared by Martin Marietta Environmental Center for Martin Marietta Chemicals.

Bongers, L.H., D.T. Burton, and T. O'Connor. 1978. Bromine chloride -- a biofouling control agent for cooling water treatment. In: Water Chlorination Environmental Impact and Health Effects, Vol. 2, R.L. Jolley, et al., eds. Ann Arbor, MI: Ann Arbor Scientific Publications.

Bongers, L.H., D.T. Burton, and B.P. Bradley. 1978. Procedure for estimating biocide dosages for biofouling control in estuarine once-through cooling systems. Presented before the Division of Environmental Chemistry, American Chemical Society, Anaheim, CA.

Bongers, L., and J. Arlauskas. 1979. Molasses feed test. Prepared by Martin Marietta Environmental Center for Martin Marietta Chemicals.

Bongers, L., and J. Arlauskas. 1979. Performance analysis of Sodyeco's wastewater treatment plant. Prepared by Martin Marietta Environmental Center for Martin Marietta Chemicals.

Bongers, L.H., and L. Hanson. 1979. Biotoxicity evaluation of the Manistee Refractories Division wastewater. Report to Martin Marietta Chemicals, Refractories Division.

Liden, L.H., D.T. Burton, L.H. Bongers, and A.F. Holland. 1979. Effects of chlorobrominated and chlorinated cooling waters on estuarine food-chain organisms. J. Water Pollut. Control Fed. 52:173-182.

Arlauskas, J., L. Bongers, and M. Wills. 1980. Sludge conditioning by cement kiln dust at the Kennebec Sanitary Treatment Plant, Waterville, Maine. Prepared by Martin Marietta Corporation, Baltimore, MD, for Martin Marietta Cement.

Martin Marietta Environmental Center (J. Arlauskas and L. Bongers). 1980. Management of spent hot mill emulsion-Ultrafiltration and treatment of oily concentrate. Prepared for Martin Marietta Aluminum.

Arlauskas, J., and L. Bongers. 1980. Oil recovery from spent hot mill emulsion by ultrafiltration treatment - An alternative to disposal, Report I. Prepared by Martin Marietta Environmental Center for Martin Marietta Aluminum.

Bongers, L. 1980. Application for non-inclusion of iron cyanide-bearing waste sludge generated by Martin Marietta Aluminum Inc., Lewisport, KY, in the Kentucky Hazardous Waste System. Prepared by Martin Marietta Environmental Center for Martin Marietta Aluminum.

Arlauskas, J., L. Bongers, and M. Wills. 1981. Sludge conditioning by cement kiln dust at the Blue Plains Advanced Wastewater Treatment Plant in Washington, D.C. Prepared by Martin Marietta Environmental Center for Martin Marietta Cement.

Arlauskas, J., L. Bongers, L. Rouch, and R. Ross. 1982. Analysis for RDX contamination in water from Bledsoe Well. Prepared by Martin Marietta Environmental Center for Martin Marietta Aluminum Sales, Inc., Milan, Tennessee.

Bongers, L. 1982. Reclaimed fuels and industrial wastes for cement kilns. Prepared by Martin Marietta Environmental Center for Martin Marietta Cement.

Arlauskas J., and L. Bongers. 1983-1984 (I-IV). Quarterly groundwater sampling results for Martin Marietta Aluminum facilities. Prepared by Martin Marietta Environmental Center.

Arlauskas J., L. Bongers, J. Vollmerhausen, and L. Quinn. 1983 (I and II). Analysis for volatile organics and other constituents in groundwater and effluent. Prepared by Martin Marietta Environmental Center for Martin Marietta Aerospace.

L. Bongers

Articola, Bongers, and Chuang. 1984. Resource Conservation and Recovery Act Delisting Procedures Applicable to Wastes Produced at K-25. Prepared for Martin Marietta Energy Systems by Martin Marietta Environmental Systems.