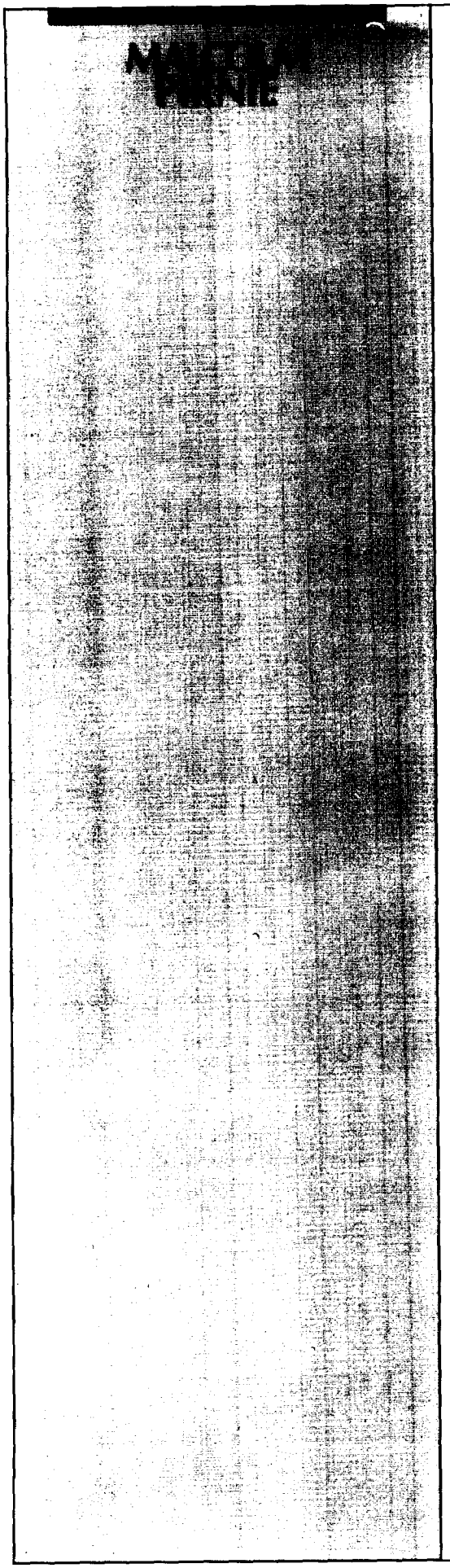


FINAL CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

Lemberger Landfill Closure System and Ground Water Treatment System

Prepared for:

Lemberger Site Remediation Group

Submitted By:

MALCOLM PIRNIE

Environmental Engineers, Scientists & Planners
5500 Wayzata Boulevard
Minneapolis, Minnesota 55416-1262

May 10, 1995
2049-006-200

RECYCLED PAPER

MALCOLM PIRNIE

115358

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

100 YEARS

May 10, 1995

Mr. Pablo Valentin
Remedial Project Manager
United States Environmental Protection Agency
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: Final Construction Quality Assurance Plan
Lemberger Landfill RD/RA - Operable Unit 1

Dear Mr. Valentin:

On behalf of the Lemberger Sites Remediation Group, please find enclosed two (2) copies of the Final Construction Quality Assurance Plan (CQAP) for Operable Unit 1 in accordance with the Final Work Plan and Consent Decree Scope of Work. Also, please find enclosed a response to your comments on the Draft CQAP.

The LSRG is planning to issue notice-to-proceed to the construction contractor on May 19, 1995. Therefore, your timely review and approval of the CQAP will avoid any further delays.

If you have any questions regarding the enclosed CQAP or our response to comments please contact me.

Very truly yours,

MALCOLM PIRNIE, INC.

William M. Mahlum, Jr., P.E.
Associate

Enclosure

c: D. Clark, Foley & Lardner, w/encl
LSRG Technical Committee, w/encl
J. Huffman, WDNR, w/encl
G. Edelstein, WDNR, w/encl (3 copies)
T. Ritter, w/ encl
R. Sosnowski, w/encl
J. Lee, w/encl
K. Davis, w/encl
R. Arko, w/o encl

2049-006-200/FCQAP.LET

5500 WAYZATA BOULEVARD MINNEAPOLIS, MN 55416-1262 612 591 1394 FAX 612-591 9881

Malcolm Pirnie, Inc. May 3, 1995

RESPONSE TO COMMENTS FROM USEPA ON THE DRAFT CQAP DATED FEBRUARY 14, 1995 LEMBERGER LANDFILL RD/RA -- OPERABLE UNIT 1

A draft Construction Quality Assurance Plan (CQAP) for Operable Unit 1 was submitted to the USEPA and WDNR for review and comment on February 14, 1995. The following CQAP comments (*in italics*) were received from the USEPA on April 26, 1995. Each comment has been numbered according to the April 26, 1995 letter (1C, 2C, ...). Malcolm Pirnie's response follows each comment (1R, 2R, ...).

1C. ***Section 5.1.1, Testing*** *- The plan indicates the general contractor be the party to select the soils testing firm. There is a potential for a conflict of interest in the general contractor also employing the testing lab that checks on the contractor's performance. A more conventional arrangement is for the owner or PRP group to supply testing services, both field and lab. The contractor will engage testing services of its own if there is a conflict with the test results, but the CQAP testing is under control of the engineer, not the contractor.*

1R. As identified in the approved Final Technical Specifications the contractor is required to engage services of a qualified (independent) testing laboratory. The laboratory has to be acceptable to the LSRG's Engineer (Malcolm Pirnie, Inc.). This arrangement allows the Engineer to review and approve laboratory qualifications in order to avoid conflict of interest issues. The specifications also require the Contractor to submit the results of the clay borrow source, sampling and testing program under the seal of an engineer registered in Wisconsin. Lift maps and backup information are also required for each lift of clay showing location, reference number, and sampling date for all tests. The Engineer's field personnel and USEPA's field personnel will be at the site to oversee construction activities, and as stated in the specifications, the Engineer will be determining field sample locations for critical construction activities.

2C. ***Section 5.1.1, seventh bullet point*** *- Acronym "ALSC" should be "AISC".*

2R. Acronym "ALSC" has been changed to "AISC".

3C. ***Section 5.1.2, item 1, footing subgrade*** *- The test to determine bearing capacity of footing subgrades is not listed in Section 5.1.1, and should be added if this test is indeed going to be required.*

3R. The test for footing subgrades is already listed under 5.1.1 of the CQAP (last entry ASTM D 698) as discussed in the Final Technical Specifications Section 02220, 3.3, H, 3.

4C. ***Section 5.2.1, first item 3*** - *Verify that either the modified or standard Proctor compaction tests are applicable for this project. One method or the other should be selected for the entire project, and this document refers only to standard Proctor elsewhere. Also, verify that the technical specifications refer to and require only standard Proctor.*

4R. Both modified and standard Proctor compaction tests are applicable for the project. The clay borrow source testing may use either method. The contractor is required to use the modified test for the clay barrier layer installation and the standard test for other layers.

5C. ***Section 5.2.2, 5.2.3, and 5.2.4*** - *Verify that the limitation to stop gradation analysis at the #200 sieve is appropriate, or document why it is appropriate to do so for this application. The volume of fines is of great interest in drainage and vent layers where the unrestricted flow of gas or fluids is the prime function of the material.*

5R. The limitation to stop gradation analysis at the #200 sieve is appropriate and in accordance with NR 516, Wis. Adm. Code. Resources on the physical and geotechnical properties of soil indicate that using sieves of numbers larger than #200 seems to be impractical, as soil can be sieved through this size mesh only with some difficulty. This mesh is fine enough to begin providing resistance to water flow nad the soil provides more resistance to passage through the mesh than does water. Additionally, the #200 sieve is the separation between gravel/sand and silt/clay for both the Unified (or AC) and ASTM systems.

6C. ***Section 5.2.3, Protective Cover Testing*** - *Thickness of both the sand drain over a capping layer and the protective soil should be controlled in the field by some sort of marker that rests on the capping layer. They could be cardboard tubes, plastic pipe, traffic cones, etc., as long as they are not the conventional wooded lath that must be driven into the cap to stand upright.*

We recommend that the specifications emphasize restricting the content of cobbles, boulders, sticks, roots, etc. in the cover material.

6R. We have modified the Specifications and Section 5.2.3 of the CQAP to include the following item:

"3. The Contractor shall perform hand-augering of each layer, at locations designated by the Engineer, to verify the depth of the layer. Auger hole locations shall be referenced to the same grid system as the topographic surveys. Auger holes in the clay layer shall be backfilled and tamped with bentonite. Auger holes in other materials shall be filled with materials meeting the specifications for that layer."

Additionally, the Specifications and CQAP have been revised to state that the Cover Soil Layer soil classification shall be in accordance with "General Fill meeting the requirements of Section 02220". (Free of rock or gravel larger than 3 inches, debris, waste, frozen materials, organic matter and other deleterious matter.)

7C. *Section 5.2.5, Clay Testing - LSRG should clarify if they want to contractor to only use standard Proctor or if modified Proctor is acceptable. LSRG should have the barrow source information before making decisions about the details of acceptable soil properties. We suggest that, with the heavier equipment we should expect a contractor to use, the modified Proctor specifications are more appropriate.*

Lift thickness should also be addressed. Section NR 516.05(1) (a), Wis. Adm. Code, indicates testing on one foot lifts, but the compaction procedures should require construction in lifts no thicker than 6 inches after compaction. regarding paragraph 3 in this section, lift surfaces should be scarified to assure bonding of lift to lift, regardless of weather or desiccation.

7R. See response to Comment No. 4 regarding the modified/standard Proctor tests.

The following paragraph items have been inserted after Section 5.2.5, item 5. of the CQAP on page 5-8.

"6. The first lift of the barrier layer shall be constructed using a 12-inch (before compaction) lift. The rest of the barrier layer shall be constructed in 6-inch maximum (after compaction) lifts, for a minimum thickness of 24 inches.

7. The top inch of each completed and approved lift shall also be scarified, unless otherwise directed by the Engineer, prior to placement of successive layers."

Existing paragraph items 6 and 7 on page 5-8 of the CQAP have been renumbered as 8 and 9 respectively. These changes have also been incorporated into the specifications.

8C. ***Section 5.2.6, Soils*** *- We note that if soils have to have a P200 fraction of >50%, then all SC soils are excluded, even if they happen to be advantageous.*

The specifications for other soils should limit gas venting and drain soil sands to SP materials. There should be limits on upper size of particles as well as limits on P200 foreign. As noted above, the specifications for cover soils should include controls on matter and cobbles and boulders.

8R. Section 5.2.6, Clay Barrier Layer Material, item 1 has been modified to delete the word "SC". This change has also been made to the Specifications.

Section 5.2.6, Foundation and Gas Control Layer and Drainage Layer Material, item 1 has been modified to delete the word "SW". The Cover Soil Layer Material has been separated from this grouping and a soil classification requirement has been eliminated in the Specifications.

9C. ***Section 5.4, Slurry Wall*** *- WDNR developed some specifications for the Flambeau Mine slurry wall, which are recommended here for quality control of field construction:*

a. Bentonite used in slurry cutoff wall construction shall be a pulverized commercial product with 50% or more passing the P200 sieve.

b. Water used for slurry mixing and makeup shall be tested at a rate of one test per 150 feet of wall length for TDS, hardness, COD, chlorides, field pH, and field conductivity.

c. Soils from the base of the trench shall be tested at 50 foot intervals for grain size analysis to the P200 sieve size, liquid limit, and plasticity index.

d. Bentonite and admixed soil shall be tested at a rate of one test per 150 feet of wall for grain size analysis.

e. Depth of the cutoff wall shall be recorded by physical soundings at 20 foot intervals.

9R. Section 5.4 of the CQAP discusses inspection and testing during slurry wall construction. The WDNR specifications for the Flambeau Mine slurry wall (items a. thru e.) can be cross-referenced to the materials in Part 2 - Products, Section 02234 of the Specifications. Part 2 - Products, Section 02234 of the approved Final Technical Specifications has not been revised to include the WDNR recommended

specifications, thus the CQAP has not been revised to include the recommended specifications.

10C. ***Section 5.4.2, item 3, third sentence*** *- Correct grammar.*

10R. The third sentence in Section 5.4.2, 3. has been revised to read " Trench continuity shall be assured by the movement of trench equipment...".

11C. ***Section 5.5 Geosynthetics*** *- The geosynthetics specifications appear to nondemanding and most applicable to silt fencing. If there are uses of geotextiles as filters or separators of soil layers, more specific requirements will have to be developed based on the geotextile properties necessary for the final design.*

11R. As stated in the second paragraph of Section 5.5.1 ("... comply with the average minimum values for the properties identified in paragraph 2.1.A of Section 02244 of the Specifications.") the geotextile filter fabric must comply with the detailed table presented in this section of the Specifications.

12C. ***Section 5.5.1, item 2*** *- Should this information be included in Section 5.5.2, with other geotextile information, since Section 5.5.1 seems to be general information about all geosynthetics? Further, are there no other geosynthetics on this project, such as geomembrane, geonet, or GCL? If so, add CQAP requirements on these other materials as well.*

12R. The information included in Section 5.5.1, 2. should remain in this section since it pertains to design information versus Section 5.5.2 (tests). Additionally, there are no other geosynthetics on this project.

13C. ***Section 5.6 and 5.7*** *- These sections are written as though items must be done by a subcontractor. Should this be rewritten to indicate that the Prime Contractor may complete these tasks, if qualified according to the specifications and this CQAP?*

13R. The first sentence in Section 5.6 of the CQAP has been revised to read "The Contractor or fencing subcontractor shall be experienced in the...". The word "Contractor" has been replaced by "Contractor/fencing subcontractor" through out Section 5.6.

The first sentence in Section 5.7 of the CQAP has been revised to read "The Contractor or landscape subcontractor shall be specialized in landscaping." The

word "Contractor" has been replaced by "Contractor/ landscape subcontractor" through out Section 5.7.

14C. ***Section 5.8, page 5-21, bottom bullet point*** *- ASCE 7-88 should be listed as newer edition, ASCE 7-92.*

14R. The bottom bullet point on page 5-21 (Section 5.8) has been revised to the newer addition ASCE 7-92. Note that the paragraph introducing the codes states "the latest editions of codes shall apply".

15C. ***Section 5.13.1, page 5-36, item 4.f*** *- It is suggested that the sentence be worded so the leakage shall "not exceed the" rate specified above.*

15R. Item 4.f of Section 5.13.1 has not been changed and leakage is required to be below the allowable leakage rates.

(second #15 comment)

15C. ***Section 7.2, Completion Report*** *- The remedial action implementation report should also include a construction documentation report meeting s. NR 724.13 and ch. NR 516, Wis. Adm. Code.*

15R. The remedial action Construction Completion Report will be prepared in accordance with the approved Final Work Plan dated March 23, 1993. NR 724.13 Wis. Adm. Code is not an ARAR for the site nor referenced in the Final Work Plan. Section 7.2 of the CQAP has not been changed to incorporate the "construction documentation report meeting s. NR 724.13 and ch. NR 516" statement.

Global
Environmental
Engineering Inc.

RECEIVED
MAY 10 1995
REMEDIAL & ENFORCEMENT
RESPONSE BRANCH

May 5, 1995

Mr. Pablo Valentin
U.S. Environmental Protection Agency
Region V, 5 HS-11
77 West Jackson Blvd.
Chicago IL 60604

Re: Hedblum Quarterly Monitoring Report
March 1995

Dear Mr. Valentin:

Enclosed for your review is a copy of the Quarterly Monitoring Report, for the Hedblum Industries Site in Oscoda Michigan.

If you have any questions please give us a call at 1(616) 947-1000.

Sincerely,

Global Environmental Engineering Inc.

Robert H. Douglass, P.E.
Project Manager

2640 Aero Park Dr. • Traverse City, MI 49686 • Bus: (616) 947-1000 • Fax: (616) 947-1044

CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN
FOR THE
LEMBERGER LANDFILL CLOSURE SYSTEM
AND GROUND WATER TREATMENT SYSTEM
OPERABLE UNIT 1

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1-1
2.0	RESPONSIBILITIES AND AUTHORITY	2-1
2.1	Regulatory Agencies	2-1
2.1.1	United States Environmental Protection Agency	2-1
2.1.2	Wisconsin Department of Natural Resources	2-1
2.2	Lemberger Sites Remediation Group	2-2
2.3	Engineer	2-2
2.4	Contractor	2-6
3.0	PERSONNEL QUALIFICATIONS	3-1
3.1	Engineer	3-1
3.2	Contractor	3-1
3.2.1	Resident Superintendent	3-2
3.2.2	Field Personnel and QA Technicians	3-2
3.2.3	Subcontractors	3-2
4.0	INSPECTION ACTIVITIES AND PROJECT MEETINGS	4-1
4.1	Inspection Activities	4-1
4.1.1	Preconstruction Inspection	4-1
4.1.2	Prefinal Inspection	4-1
4.1.3	Final Inspection	4-2
4.2	Project Meetings	4-3
4.2.1	Preconstruction Conference	4-3
4.2.2	Weekly Progress Meetings	4-4
4.2.3	Special QA/QC Meetings	4-5
5.0	CONSTRUCTION QA REQUIREMENTS	5-1
5.1	Excavation and Backfill	5-1
5.1.1	Testing and Permits	5-1
5.1.2	Field Quality Control	5-2

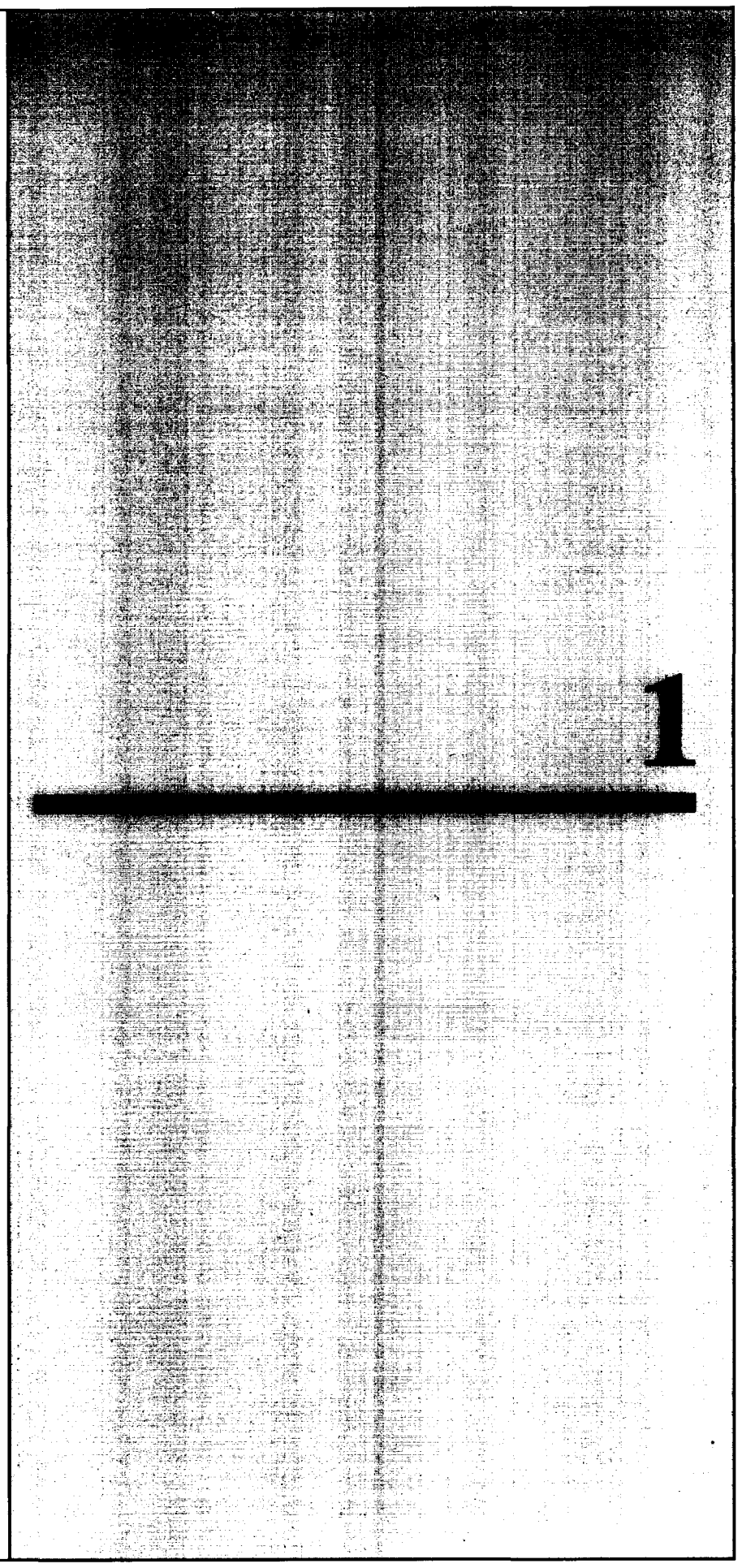
5.2 Borrow Sources and In-place Construction 5-3
5.2.1 Clay Borrow Source Testing 5-3
5.2.2 Foundation and Gas Control Layer 5-5
5.2.3 Testing for Protective Cover Soil 5-5
5.2.4 Testing for Drainage Layer Material 5-6
5.2.5 Construction Testing for Clay Barrier Layer 5-6
5.2.6 Soils 5-9
5.2.7 Crushed Stone and Gravel 5-11
5.2.8 Riprap 5-11
5.3 Relocation of Existing Soil and Solid Waste 5-11
5.3.1 Disposal of Existing Empty Drums, Drummed Wastes and other Wastes 5-12
5.3.2 Disposal of Excavated Solid Waste, Soils, and Water Removed by Dewatering Systems 5-12
5.3.3 Disposal of Purge and Development Water 5-13
5.3.4 Disposal of Other Waste 5-13
5.3.5 Loading and Transport of Waste 5-14
5.4 Soil/Bentonite Slurry Wall 5-14
5.4.1 General 5-14
5.4.2 Inspection and Testing during Slurry Wall Construction 5-15
5.5 Geosynthetics 5-16
5.5.1 General 5-16
5.5.2 Geotextile Filter Fabric Tests 5-16
5.6 Fencing 5-17
5.7 Landscaping 5-18
5.8 Installation of Structures and Structure Materials 5-19
5.8.1 Concrete Work 5-22
5.8.2 Reinforcement, Joints and Embedded Items 5-23
5.8.3 Grout 5-23
5.8.4 Structural Steel Erection 5-23
5.8.5 Steel Grating Installation 5-24
5.8.6 Anchorage Devices Installation 5-24
5.8.7 Interior Room Materials Installation 5-24
5.8.8 Painting 5-24
5.9 Well Installations and Appurtenances 5-25
5.9.1 Observation, Leachate Head Level and Monitoring Wells 5-25
5.9.2 Ground Water Extraction and Leachate Collection Wells 5-26
5.9.3 Abandonment of Wells and Borings 5-28
5.9.4 Sump and Sample Pumps 5-28
5.10 Air Stripping System 5-29
5.11 Metal Building System 5-32
5.12 Fiberglass Reinforced Polyester Tanks 5-33
5.13 Piping 5-35

5.13.1 Buried Piping Installation 5-35
5.13.2 Exposed Piping Installation 5-39
5.13.3 Thermoplastic Pipe and Accessories 5-41
5.14 Valves and Appurtenances 5-42
5.15 Plumbing 5-44
5.16 Heating, Ventilation and Air Conditioning 5-45
5.17 Electrical Work 5-46

6.0 SAMPLING, INSTALLATION DATA AND EQUIPMENT TESTING 6-1
6.1 Sampling and Testing 6-1
6.1.1 Samples 6-1
6.1.2 Testing Laboratory Services 6-2
6.2 Installation Data 6-4
6.3 Field Tests of Equipment 6-5

7.0 RECORD DOCUMENTS 7-1
7.1 Contractor 7-1
7.2 Engineer 7-3

MALCOLM PIRNIE



1

1

RECYCLED PAPER

1.0 INTRODUCTION

This Construction Quality Assurance (CQA) Plan has been prepared for the Lemberger Landfill RD/RA - Operable Unit 1 to comply with the provisions of the Consent Decree of June 15, 1992 between the Lemberger Site Remediation Group (LSRG) and the United States Environmental Protection Agency (USEPA). The CQA Plan has been prepared in accordance with the Final Work Plan dated March 23, 1993. The Final Work Plan was conditionally approved by the USEPA on May 4, 1993.

The purpose of the CQA Plan is to describe the planned and systematic actions to be undertaken in order to provide confidence that the Remedial Action construction activities will be accomplished satisfactorily and conform to the project requirements. The CQA Plan is to be implemented in conjunction with the Final Technical Specifications, where quality assurance procedures and sampling, testing and documentation protocols have been specified. The CQA Plan has been organized into the following sections:

Section 1.0 Introduction

Section 2.0 Responsibilities and Authority

Section 3.0 Personnel Qualifications

Section 4.0 Inspection Activities and Project Meetings

Section 5.0 Construction Certification Requirements

Section 6.0 Sampling, Installation Data and Equipment Testing

Section 7.0 Record Documents

After completing the Remedial Action construction activities, a Construction Completion Report will be prepared and submitted to the USEPA and Wisconsin Department of Natural Resources (WDNR). This report will document the conformance of construction methods and materials with the design standards, and plans and specifications. The report will identify modifications to the plans and specifications, including an explanation for such modifications. It will also include the results of the facility monitoring, indicating compliance with the performance criteria and an explanation of the operation and maintenance required for the facility.

MALCOLM PIRNIE

2

2

RECYCLED PAPER

2.0 RESPONSIBILITIES AND AUTHORITY

The principle organizations involved in the Remedial Action activities at the Lemberger Landfill - Operable Unit 1 include the USEPA, WDNR, LSRG, the Engineer and the Construction Contractor. This section provides a discussion on the responsibilities and authority for the involved parties during the Remedial Action activities. Figure 2-1 is an organizational chart of the personnel involved in this project. Figure 2-1 also includes arrows for identifying the lines of communication between the different organizations. Modifications to these lines of communication may be made during the implementation of the Remedial Action activities.

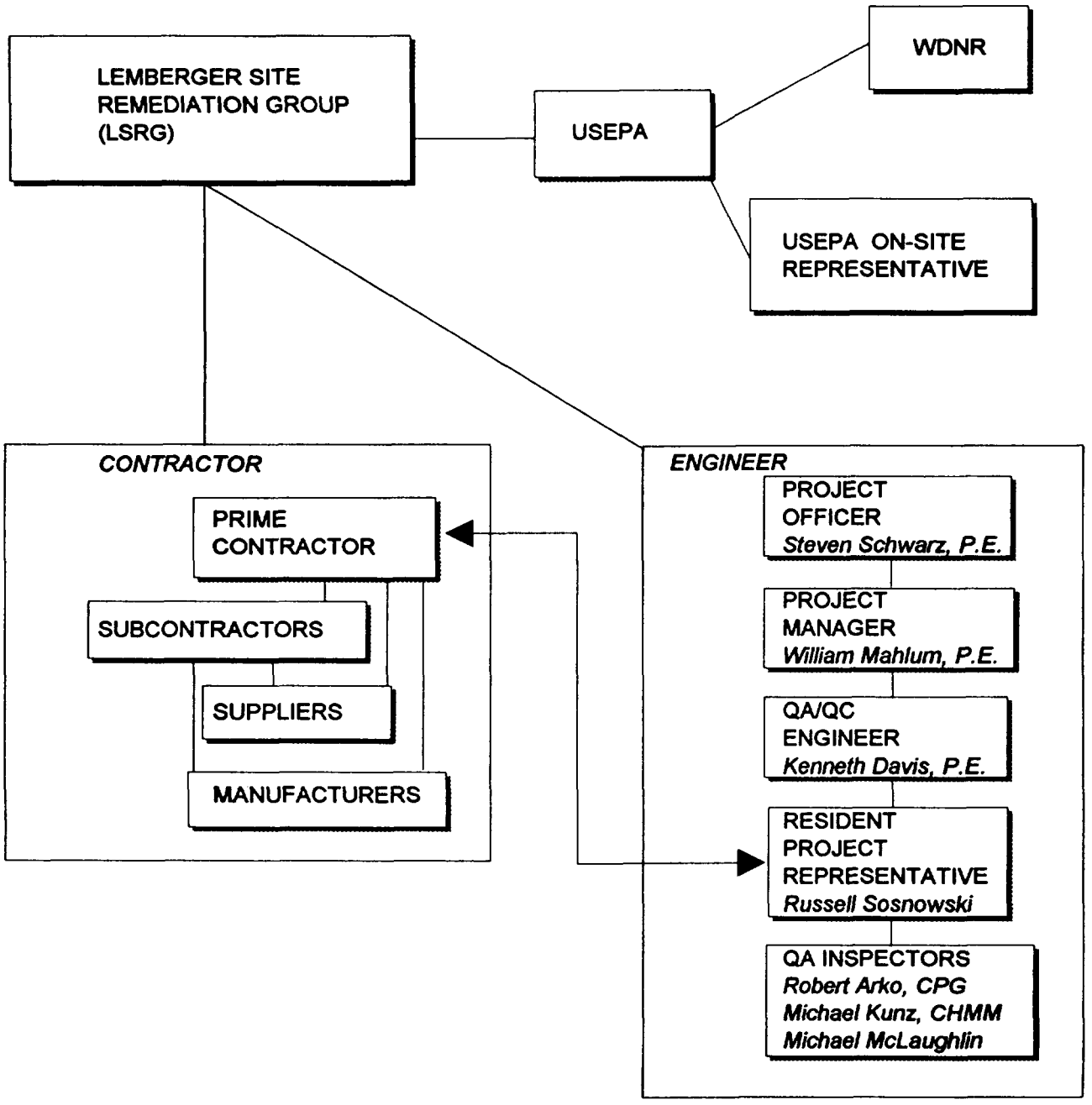
2.1 REGULATORY AGENCIES

2.1.1 USEPA

The USEPA shall review this CQA Plan and coordinate a response based on the review and the WNDR review. The USEPA shall also review and approve the construction and installation monitoring and QA/QC documentation prepared during or after the Lemberger Landfill - Operable Unit 1 Remedial Action activities are completed, to confirm that the approved CQA Plan was followed and the Remedial Action activities were conducted as required by the Consent Decree.

2.1.2 WDNR

The WDNR shall review this CQA Plan for compliance with the agency's regulations and to advise the USEPA of outstanding issues which need to be addressed.



MALCOLM PIRNIE

CQA PLAN ORGANIZATIONAL CHART

Lemberger Landfill Closure System and Ground Water Treatment System

Figure 2

2.2 LSRG

It is the responsibility of the LSRG (Owner), with its representative (Engineer), to prepare and implement the CQA Plan. The LSRG shall issue all communications to the Contractor through the Engineer.

The LSRG shall furnish data required by of the Owner under the Contract Documents. The LSRG shall provide lands and easements and engineering surveys to establish reference points as identified in the Construction Documents. Additionally, the LSRG will identify and make available to the Contractor copies of investigation reports and subsurface or site condition tests, or other reports utilized by the Engineer to prepare the Drawings and Specifications, which may affect performance of the work at the site. The LSRG has the right to request changes in the site work by executing Change Orders in accordance with the Contract Documents. The LSRG and Engineer will have the authority to accept or reject any design revisions and shop submittals presented by the Contractor.

2.3 ENGINEER

The Engineer (Malcolm Pirnie, Inc.) shall be the LSRG representative during the construction period. The Engineer will be responsible for the review of engineering designs, engineering changes, construction observation and quality assurance in accordance with the CQA Plan. All field and laboratory sampling and testing results and all QA/QC testing conducted by the Contractor and equipment manufacturers shall be submitted to the Engineer for review.

QA/QC personnel within the Engineer's organization and assigned to this project will include a Project Officer, Project Manager, QA/QC Engineer, Resident Project Representative (RPR), QA Inspectors and any necessary support engineering and field observation personnel.

Specific QA/QC responsibilities of the Project Officer shall include:

- Implementing technical quality assurance monitoring procedures for the construction contractor's work.
- Certifications to the best of the Engineer's knowledge, information and belief, that the construction was completed in conformance with the approved construction Drawings and Specifications.
- Support the Project Manager, QA/QC Engineer and RPR in meetings with the USEPA, WDNR and Contractor, as necessary.
- Assign the Engineer's resources to the project.

Specific QA/QC responsibilities of the Project Manager shall include:

- Review design criteria, drawings and specification modifications for completeness and interpretation of construction modification requirements so that the CQA Plan can be implemented.
- Support the QA/QC Engineer and RPR in meetings with the USEPA, WDNR and Contractor, as necessary.
- Consult with the QA/QC Engineer and RPR on field problems, clarifications, interpretations and corrective measures.
- Schedule and coordination of field QA/QC activities.

Specific QA/QC responsibilities of the QA/QC Engineer include:

- Direct and support the QA field personnel in performing observations and documentation.
- Support the RPR in meetings with the USEPA, WDNR and Contractor, as necessary.
- Consult with the RPR and QA Inspectors on field problems and corrective measures.
- Inform Project Manager of problems or deficiencies at the site.
- Visit the site on a regular basis to review the adequacy of completed work.

Specific responsibilities of a Resident Project Representative (RPR) will include:

- Conduct progress meetings with the Contractor and attend project-related meetings and conferences.
- Primary interface with the Contractor serving as the Owner's liaison with the Contractor.
- Perform on-site observations of the work in progress to assess to the best of his/her knowledge, information and belief, compliance with the Design Criteria, Drawings and Specifications.
- Record date of receipt of Shop Drawings and Samples and receive Samples for examination.
- Verify field and laboratory sampling and tests to determine that the materials at the site meet design requirements as indicated in the Specifications.
- Verify that tests, equipment and system startups and operating and maintenance training are conducted in accordance with the Contract Documents.
- Verify to the best of his/her knowledge, information and belief, that the equipment used in the field testing meets the test requirements and that the tests are conducted in accordance with the Specifications.
- Report the results of field QA activities, including work that is not of acceptable quality or that fails to meet the specified Design Criteria or Specifications.
- Verify to the best of his/her knowledge, information and belief, that the raw data collected by the Contractor are properly recorded, validated, reduced, summarized and interpreted.
- Verify to the best of his/her knowledge, information and belief, that all failed areas of work are redone and brought into compliance with the Drawings and Specifications.
- Accompany visiting inspectors representing public or other agencies having jurisdiction over the project.

- Respond to clarifications and interpretations of the Contract Documents, when needed and consider and evaluate Contractor's suggestions for modifications to the Drawings and Specifications.
- Review applications for payment with the Contractor for compliance with the established procedures.

Specific responsibilities of the QA Inspectors will include:

- Support the RPR in performing observations and documentation.
- Perform on-site observations of the work in progress to assess to the best of their knowledge, information and belief, compliance with the Design Criteria, Drawings and Specifications.
- Verify field and laboratory sampling and tests to determine that the materials at the site meet design requirements as indicated in the Specifications.
- Verify to the best of their knowledge, information and belief, that the equipment used in the field testing meets the test requirements and that the tests are conducted in accordance with the Specifications.
- Report the results of field QA activities, including work that is not of acceptable quality or that fails to meet the specified Design Criteria or Specifications.
- Verify to the best of their knowledge, information and belief, that the raw data collected by the Contractor are properly recorded, validated, reduced, summarized and interpreted.
- Verify to the best of their knowledge, information and belief, that all failed areas of work are redone and brought into compliance with the Drawings and Specifications.

2.4 CONTRACTOR

The Contractor shall be responsible for complete compliance, supervision and direction of operations and those of subcontractors employed by the Contractor to perform the work in accordance with the Design Criteria, Drawings and Specifications. More specifically, the Contractor shall be responsible for the following provisions:

- The Contractor shall be responsible for the means, methods, techniques, sequences and procedures for the construction activities and maintain at all times a competent resident superintendent and qualified field and QA/QC personnel during the work.
- The Contractor shall provide all materials, equipment, qualified labor, transportation, construction equipment and machinery, tools, appliances and all other facilities and incidentals for the execution, testing, initial operation and completion of the work. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable manufacturer, fabricator, supplier or distributor, except as otherwise provided in the Specifications.
- The Contractor shall not make substitutions for materials and equipment having a specified manufacturer, fabricator, supplier or distributor and the words no substitutions permitted in the Drawings and Specifications. For other specified materials or equipment, other manufacturers, fabricators, suppliers or distributors may be accepted by the Engineer if sufficient information is submitted by the Contractor to allow the Engineer to determine the product is equivalent to the Drawings and Specifications. The substitution requests can only be made by the Contractor and require a written application in accordance with the Contract Documents.
- The Contractor shall receive approval from the Owner or Engineer for subcontractors prior to sending a Notice of Award. The Contractor shall be fully responsible for the subcontractors and if there is reasonable objection to

the subcontractor by the Owner or Engineer, the Contractor will submit an acceptable substitute. All work conducted by a subcontractor will be pursuant to an appropriate binding agreement between the Contractor and the subcontractor.

- The Contractor shall obtain and pay for all construction permits and licenses, unless otherwise indicated. The Contractor shall pay for all governmental charges and inspection fees associated with the work and pay for all utility services necessary for completing the work.
- The Contractor shall confine construction equipment, materials and operations of personnel to the permitted areas. The Contractor shall keep the premises free from accumulations of waste materials and debris and shall remove all waste materials and surplus supplies at the completion of the work.
- The Contractor shall maintain one record copy of all Specifications, Drawings, Addenda, Modifications, Show Drawings and Samples at the site and annotated to show changes during the construction process. These records shall be submitted to the Engineer at the completion of the work.
- The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work and provide the necessary protection to prevent damage, injury, or loss to persons, properties, materials and equipment on the site or affected by the work conducted at the site. The Contractor shall designate a qualified and experienced safety representative at the site responsible for the prevention of accidents and maintaining and supervising safety precautions and programs. The Contractor shall maintain a hazardous communication program including but not limited to material safety data sheets or hazardous communication information in accordance with laws, ordinances, and regulations. In emergency instances the Contractor shall act to prevent damage, injury or loss and shall give prompt notice to the Engineer of any significant changes or deviations to the work.

- After checking and verifying all field measurements, the Contractor shall submit copies of all stamped and approved Shop Drawings and Samples for review and approval by the Engineer. The Contractor shall identify in writing all deviations that the Shop Drawings and Samples may have from the requirements of the Contract Documents. Where a Shop Drawing or Sample is required by the Specifications, no related work shall be commenced until the submittal has been reviewed and approved by the Engineer.

MALCOLM
PIRNIE

3

3

RECYCLED PAPER

DOROTHY PRICE

3-8340

663-9415. G-0397

Mary Thomas

3.0 PERSONNEL QUALIFICATIONS

3.1 ENGINEER

The Engineer (Malcolm Pirnie, Inc.) will be licensed to practice engineering in the State of Wisconsin and authorized to represent the LSRG in the execution of the work covered herein. The Engineer will review and approve Shop Drawings and Samples for conformance with the design of the project and for compliance with information provided in the Contract Documents. The Engineer's QA/QC field personnel will observe the construction activities for compliance and general conformance with the Design Criteria, Drawings and Specifications.

The Engineer will designate a Resident Project Representative to observe the performance of work for the project. The Resident Project Representative will be familiar with the site and all aspects of the site activities for the project. The Resident Project Representative will be the initial interpreter of the acceptability, execution and progress of the work and will maintain regular communications with the Project Manager and QA/QC Engineer for the project. Additionally, the Resident Project Representative will be assisted by QA Inspectors to observe the performance of work for specific site activities. QA Inspectors may include engineers, hydrogeologists and scientists. The Resident Project Representative shall be properly trained for the field activities being conducted at the site. Training will include the OSHA eight hour supervisor's course and Malcolm Pirnie's construction oriented Safety Awareness Training. The QA inspectors will have the training appropriate to their activities on-site. Resumes for the Malcolm Pirnie CQA personnel are included at the end of this section.

3.2 CONTRACTOR

The Contractor will be experienced in the supervision and direction of the work and have the skills and expertise to competently and efficiently perform the necessary work in accordance with the Contract Documents. The Contractor shall provide competent, suitably qualified personnel and subcontractors to perform the work and implement the work by proper means, methods, techniques, sequences and procedures. Qualifications for the Contractor are included in the Bidders Qualification Statement, as part of the Contract Documents.

3.2.1 Resident Superintendent

The Contractor shall designate a competent, experienced Resident Superintendent for the supervision and direction of the work. The Contractor shall maintain a Resident Superintendent at the site, at all times during the site work. The Resident Superintendent will be the Contractor's representative and shall have the authority to act on behalf of the Contractor. The Resident Superintendent shall be properly trained and knowledgeable in the field activities being conducted at the site.

3.2.2 Field Personnel and QA Technicians

The Contractor shall provide competent and experienced field personnel and QA technicians to perform the work in accordance with the Contract Documents. Field and QA personnel will be properly trained and knowledgeable in specific tasks and responsibilities, as identified and required in the Specifications. If or when required, the Contractor shall provide training certifications for the field and QA personnel.

3.2.3 Subcontractors

The Contractor shall employ and provide competent and experienced subcontractors, including person or organization furnishing principle items of materials or equipment, to perform work in accordance with the Contract Documents. The subcontractors will be

properly trained and knowledgeable in the specific areas and responsibilities, as identified and required in the Specifications. If or when required, the Contractor shall provide subcontractor certification or license information and personnel qualifications.

STEPHEN C. SCHWARZ
Vice President & Director, Solid Waste Programs

EDUCATION

BCE (Civil Engineering) 1967; City College of New York
MSE (Sanitary Engineering) 1968; Manhattan College

REGISTRATION

Professional Engineer
Diplomate: American Academy of Environmental Engineers

RECOGNITION

Vice-Chairman, ASCE Committee on Resource and Energy Recovery
Chairman, ASCE Ad Hoc Committee on Dioxin and Resource Recovery
Chairman, AAEE Solid Waste Management Subcommittee
Member, Solid Waste Combustion Institute Technical Advisory Committee
Member, SWANA Waste-to-Energy Subcommittee

SOCIETIES

Fellow, American Society of Civil Engineers
Solid Waste Processing Division, ASME
American Public Works Association, Institute for Solid Wastes
New York State Association for Solid Waste Management
Solid Waste Association of North America

SUMMARY OF EXPERIENCE

Mr. Schwarz has been involved in the professional practice of environmental engineering since 1967. A Diplomate of the American Academy of Environmental Engineers, he has been responsible for the effective administration, management, design, and implementation of a wide range of recycling, landfill, composting, planning, and waste-to-energy projects. As Director of Solid Waste Programs, he is responsible for the technical quality of all solid waste projects performed at Malcolm Pirnie. He is a recognized national expert in solid waste management, as well as a published author and lecturer in the field.

DETAILED EXPERIENCE

1968 to Date — Malcolm Pirnie, Inc.

Over more than 25 years, Mr. Schwarz has directed a wide variety of important, innovative and, on occasion, award-winning projects. Examples include:

- For Lee County FL: As project officer, overall responsibility for Malcolm Pirnie's final permitting, construction monitoring, and administrative services performed for the County's 1,200-tpd resource recovery project. Provided expert assistance during Florida Power Plant Site Certification Review Process.

(continued)

DETAILED EXPERIENCE (Continued)

1968 to Date Malcolm Pirnie, Inc. (continued)

- For Westchester County NY: Planning and development of a countywide solid waste management system. The centerpiece of this program, the 2250-ton per day (tpd) Peekskill refuse-to-power facility, went into operation in 1984, and was at that time the largest such facility in the U.S. A second major component, the Sprout Brook residue disposal facility (the first lined leachate collection residue landfill in the U.S.), went into operation in 1985. The system also includes transfer stations and a materials recovery facility (MRF), designed by Malcolm Pirnie, to process and beneficiate 350-tpd of source-separated materials.

- For the City of Bangkok, Thailand: Responsible for the development of a Solid Waste Master Plan for a metropolitan area with a population of 6,500,000, including collection, recycling, and disposal. This program included the development of a 1,000-tpd MSW composting facility and two new landfills (350 and 150 acres). A major goal of the program was the replacement of scavenging operations at the face of the landfill with an enclosed recycling facility.

- For Broward County FL: Responsible for the initial planning and development of a countywide solid waste management program, including two waste-to-energy facilities totaling 4,500 tpd in capacity. Both facilities have been in operation since 1991. This program is believed to be the largest of its kind ever undertaken in North America, with a total cost exceeding $700 million, and in 1991 was the recipient of the Grant Conceptor Award from the Florida Chapter of the ACEC.

- For Islip NY: Responsible for the design and construction of a 23-acre "piggy-back" landfill (meaning a new, lined, leachate-collecting landfill on top of an existing older landfill). Believed to be the first of its type in the U.S., this project was the recipient of the 1989 award for Engineering Excellence from the New York Association of Consulting Engineers.

- For the York County Solid Waste and Refuse Authority, York County PA: Directed the planning, development, and construction of a 1,350-tpd refuse-to-energy facility. This facility began commercial operation in 1990 and was, at the time, the largest O'Connor Rotary Combustor type facility in the world. In 1992, this program was awarded the Consulting Engineers Council of Pennsylvania 1992 Honor Award for Engineering Excellence in Consulting Services, Research and Studies. Work for this client also included closure and capping of two cells of the Hopewell Township Landfill, preparation of a permit application to PADER and, after regulatory approval, directed the detailed design and construction observation of the 23-acre capping project. Also directed the preparation of the construction certification report for submission to PADER.

- For Tompkins County NY: Directed the development of a 350-tpd recycling and solid waste center. The facility combines a transfer station and a materials recovery facility into a single operation. This facility is one of the first municipally sponsored projects where extraction of recyclables from the mixed waste stream is accomplished. Also directed the closure of a 32-acre landfill pursuant to the New York State 6 NYCRR Part 360 requirements.

(continued)

DETAILED EXPERIENCE (Continued)

1968 to Date — Malcolm Pirnie, Inc. (continued)

- For Southampton NY: Directed the permitting, design, and construction monitoring of a new landfill (Cell No. 3) and the closure of two existing landfills (Cell Nos. 1 and 2). The new landfill is the only remaining permitted landfill on Long Island for mixed solid waste. Because Long Island depends on a single, sole-source aquifer for virtually all its drinking water, successful permitting of the new landfill was a significant accomplishment.

- For the Coastal Regional Solid Waste Management Authority, NC: Responsible for the planning, financing, design, and construction of various solid waste projects, including a 20-acre regional Subtitle D landfill with composite liners, leachate collection, leachate recirculation, and a transfer station system to serve the three-county partnership. Those systems are fully permitted and in operation.

PUBLICATIONS AND PRESENTATIONS

Author and speaker on resource recovery and solid waste management. Co-author of *Recovery of Energy from Solid Waste*, Noyes Data Corp., 1983

Co-author of *Recycling: State of the Art*, Recycling Today, May 1988.

Schwarz, S.C., 1981. "Resource Recovery and Solid Waste Management," presented at the University of Alabama Seminar, March.

Schwarz, S.C., 1985. "Fast-Track Resource Recovery Procurement - Bergen County, New Jersey - A Case History," presented at the 7th National Conference on Waste Management in Canada, November.

Schwarz, S.C. and Bolton, R.E., 1982. "An Analysis of Resource Recovery Facility Costs," presented at the ASCE National Conference on Environmental Engineering, Minneapolis MN, July.

Schwarz, S.C. and Macy, M.S., 1985. "Solid Waste Management: A Focus on Resource Recovery," presented at the Ohio County Commissioners & Engineers Winter Conference, November.

Schwarz, S.C. and Shelstad, M.J., 1987. "Waste Disposal Issues Surveyed," American City & County, pp. 42-48, February.

Schwarz, S.C., Hess, S.K., Clayton, J.K., Bhatt, H.G. and Starobin, N.I., 1988. "Recycling: The State of the Art," *Recycling Today*, July, August, October.

Kapner, M. and Schwarz, S.C., 1988. "A Guide to Air Pollution Control Equipment," *Waste Alternatives*, September.

Schwarz, S.C., 1990. "Incineration: A Burning Issue," presented at the 27th Annual Public Affairs Symposium at Dickinson College, February.

(continued)

PUBLICATIONS AND PRESENTATIONS (Continued)

Schwarz, S.C., 1991. "A Discussion of Technical Options for Managing Solid Waste in New York," presented at the Fundamentals of New York Environmental Law Compliance Course, Albany NY, March.

Schwarz, S.C. and P. Frillici, 1991. "BACT, MACT, and the ACT: What's Going On?," *Waste Age*, November.

WILLIAM M. MAHLUM, JR.
Senior Project Engineer

EDUCATION

BS (Mechanical Engineering) 1984; University of Wisconsin, Madison
Additional Course Work: Thermal Power Systems 1987; Massachusetts Institute of Technology

REGISTRATION

Professional Engineer

SOCIETIES

American Society of Mechanical Engineers
Air & Waste Management Association
Solid Waste Composting Council

SUMMARY OF EXPERIENCE

Mr. Mahlum has experience in all phases of municipal solid waste planning and project development including technology assessment; composting and resource recovery feasibility studies; landfill design review and procurement; modeling and evaluation of resource recovery plant performance; air quality permitting; contract negotiations; design; specifications; and construction monitoring. His experience also includes the design and analysis of municipal water distribution and hot water district heating systems.

DETAILED EXPERIENCE

1988 to Date — Malcolm Pirnie, Inc.

As Project Engineer and Senior Project Engineer:

- Prepared a technical evaluation of a proposed composite lined ash landfill for Blue Earth County, MN. This evaluation included: a review of the proposed design considering site-specific conditions; review of permit related documents; responses to technical issues raised by concerned citizens; and recommendations for improvement in the design.

- Served as Project Engineer on the Dakota County Resource Recovery Project for Dakota County, MN. Responsible for assisting in the planning and development of environmental permit applications. This included a technical review of a proposed Thermal DeNO$_x$ system to control nitrogen oxide emissions and an ash issue report for the Dakota County Board of Commissioners. Developed an ash recycling/disposal RFP for services from full-service vendors. Conducted a front-end process feasibility study which analyzed the technical feasibility, economics, and worker safety impacts of recovering hazardous and recyclable materials from mixed waste before incineration. Conducted a technical review of a proposed ash landfill that may receive ash from the Dakota County Resource Recovery Facility.

(continued)

DETAILED EXPERIENCE (Continued)

1988 to Date — Malcolm Pirnie, Inc. (continued)

- Developed 20 year projections of solid waste and incinerator ash landfill capacity needs for the greater New York City area which included New York City, Long Island, Rockland County, and Westchester County in New York State and nine counties in the State of New Jersey.

- Served as Project Leader for consulting services provided to Pierce County, WI on a 50 ton-per- day mixed municipal solid waste compost facility. Conducted a design review of a facility proposed by a full-service vendor. Developed performance specifications and acceptance test procedures for the County's construction and operating contract with the vendor.

- Served as independent engineer during acceptance testing of the Hennepin Energy Resource Company's resource recovery facility. This facility has a unique Thermal $DeNO_x$ system designed to control nitrogen oxide emissions.

- Prepared a waste-to-energy facility feasibility study for the City of Canton, OH. This experience included development of a conceptual design, estimates of performance, and an evaluation of the economics of four project alternatives including co-firing sewage sludge and municipal solid waste.

- Served as Project Engineer on a 100 to 125 ton per day mixed municipal solid waste compost facility feasibility study for Albert Lea, MN. This study included waste from Mower and Freeborn Counties.

1984 to 1988 — Metcalf & Eddy, Inc.

As Senior Engineer:

- Prepared detailed specifications for refuse-fired steam generator units on seven resource recovery projects.

- Developed computer models to predict resource recovery plant performance. These programs modeled combustion calculations, energy balances, steam turbine cycle performance, annual plant availability, and plant throughput capability.

- Prepared technical proposals to design, construct, own, and operate resource recovery facilities ranging in size from 86 to 1440 tons per day (tpd). Proposals involved predicting and specifying vendor performance, equipment layout and design, and preparation of accompanying text.

- Participated in the procurement process for a 644-tpd resource recovery project for Charleston County, SC, which involved developing a request for proposals from full-service operators; evaluating and selecting a full-service operator; and negotiating with two electric utilities for the purchase of co-generated power under FERC and PURPA on behalf of the County.

(continued)

DETAILED EXPERIENCE (Continued)

1984 to 1988 Metcalf & Eddy, Inc. (continued)

- Prepared a Prevention of Significant Deterioration Application for a new 400-tpd resource recovery facility in Warren County, NJ. Analyzed Best Available Control Technology and evaluated air quality modeling of project emissions from this new source.

- Prepared a feasibility study on a resource recovery facility burning municipal solid waste and wood chips to co-generate electricity and heat for a district heating system in the City of Lewiston, ME.

- Conducted a feasibility study on the economics of a hot water district heating system for the Harbor Point housing redevelopment project in Boston, MA.

- Prepared a planning report on the transfer and haul of municipal solid waste from 14 communities on Cape Cod to the SEAMASS resource recovery facility for the Massachusetts Bureau of Solid Waste Disposal.

- Conducted a study of solid waste transfer station alternatives for the Town of Wellfleet, MA. Provided an economic evaluation of a regional transfer station compared to a transfer station serving only Wellfleet. Developed performance specifications to construct and operate a transfer station for the Town.

- Developed a municipal water distribution master plan for the Portland Water District. Modeled the existing and proposed expansion of the Portland Water District to the year 2010. Sized six pumping stations, eight tanks, and transmission piping required to meet future system demands.

- Participated in the design of the largest hot water district heating system in the United States in St. Paul, MN.

PUBLICATIONS AND PRESENTATIONS

Bishop, S.L. and W.M. Mahlum. "Dynamic Modeling of the Portland Water District Distribution System," presented at the Seminar on Water Distribution System -Analysis and Design, sponsored by the Department of Engineering Professional Development, University of Wisconsin-Madison, held in Portland, Maine in November, 1988.

Mahlum, W.M., R. Tabors, and R. Toland, 1985. "Advantages of a Central Plant vs. Distributed Boiler Design, Harbor Point: A Case Study," presented at the International District Heating and Cooling Association's Annual Meeting, June, 1985.

KENNETH A. DAVIS
Senior Project Engineer

EDUCATION

AAS (Civil Technology) 1975; Mohawk Valley Community College
BCE (Civil Engineering) 1978; Rochester Institute of Technology
Health and Safety Operations at Hazardous Materials Sites, 40-Hour Course
Health and Safety Supervisory training, 8-hour course

REGISTRATION

Professional Engineer
Certified Nuclear Moisture-Density Gauge Operator

SOCIETIES

American Society for Testing and Materials

SUMMARY OF EXPERIENCE

Mr. Davis has 17 years of experience in solid waste and environmental engineering. His solid waste project work has included waste management studies, design of transfer stations, and landfill siting, design, and closure. Mr. Davis has extensive knowledge of the regulatory and technical requirements for landfill design, construction, and operation. He has worked on landfill projects across the United States, the Republic of Korea, and the Kingdom of Thailand.

DETAILED EXPERIENCE

1986 to Date — Malcolm Pirnie, Inc.

As Senior Project Engineer Mr. Davis has direct responsibility for the siting, design, construction, operation and/or closure of a number of landfill for both municipal and private clients. These projects include (in reverse chronological order):

- Performing technical reviews for various Malcolm Pirnie projects around the country.
- Performing technical oversight for the United States Environmental Protection Agency (USEPA) on a landfill closure (a USEPA Natioal Priorities List site) in Syossett NY.
- Provided master planning and preliminary design on two landfills in Thailand.
- Providing operation aid for the North Sea Landfill which included preparation of monthly and annual reports to the New York State Department of Environmental Conservation (NYSDEC) for compliance with the Town's Permit to Operate.
- Closure design and contract document preparation for the closure for Cell No. 1 (a USEPA National Priorities List site) at the North Sea Landfill, Town of Southampton NY.
- Design, contract document preparation and construction administration of a gas collection and disposal system for Cells No. 2 and No. 3 at the North Sea Landfill, Town of Southampton NY.

(continued)

DETAILED EXPERIENCE (Continued)

1986 to Date — Malcolm Pirnie, Inc. (continued)

- Closure design, contract document preparation, construction administration and quality assurance/quality control of the closure for Cell No. 2 at the North Sea Landfill, Town of Southampton NY.
- Construction administration and quality assurance/quality control during construction of the Cell No. 3 liners, leachate management and perimeter gas monitoring system for all of the landfilled areas of the North Sea Landfill, Town of Southampton NY.
- Construction administration and quality assurance/quality control during construction of Lagoon No. 2 of the Sprout Brook ash residue disposal facility in Westchester County NY.
- Landfill siting study and the Edgeboro Landfill evaluation for the Middlesex County Utilities Authority and subsequent engineering design of the vertical and horizontal expansion of the 315-acre Edgeboro Landfill in Middlesex County NJ.
- Conceptual design for the vertical "piggyback" expansion of the Oaks Landfill in Montgomery County MD.
- Design and preparation of plans, specifications and engineering reports for a vertical "piggyback" expansion/closure of a landfill in Islip NY.

1981-1986 — Elson T. Killam Associates, Inc.

As Senior Engineer:

- Prepared landfill design (with double geomembrane and liner) and permit application for the City of Linden NJ.
- Participated in and responsible for the landfill evaluation portion of a solid waste management study for the Cities of Sewon and Ulson, Republic of Korea, which required three months' residency in Korea.
- Designed solid waste transfer stations for various clients in New Jersey.
- Responsible for wastewater transmission and treatment design and various construction management projects.

1978-1981 — Barton & Loguidice, P.C.

As Engineer: Responsible for design and project coordination of solid waste management, sewer infiltration/inflow, and water distribution projects.

1976-1978 — Lozier Engineers, Inc.

As Engineer: As part of an educational co-op program, served as researcher and wrote manuals for operation and maintenance of secondary and tertiary wastewater treatment plants, field technician on I/I studies, and structural design technician.

(continued)

PUBLICATIONS

Davis, K.A., Druback, G.W., Tieman, G.E. and Weidner, C.H., 1988. "Islip, New York: Designing a Municipal Landfill Vertical Expansion or "Piggyback," presented at Waste Tech 88, National Solid Wastes Management Association, Boston MA.

(continued)

RUSSELL S. SOSNOWSKI
Project Engineer

EDUCATION

AAS (Civil Engineering Technology) 1978; State University of New York at Sullivan
Continuing Education:
Civil Engineering 1984; New York Polytechnic University
Civil Engineering 1989; New York Polytechnic University

REGISTRATION

Certified Troxler Nuclear Moisture-Density Gauge Operator
Health and Safety Operations at Hazardous Materials Sites, 40-Hour Course

SOCIETIES

American Society of Civil Engineers
American Society for Testing and Materials

SUMMARY OF EXPERIENCE

Mr. Sosnowski has 12 years of experience in the solid waste field, specifically in landfill design and construction as well as geotechnical engineering. He has supervised and inspected construction of landfills, landfill closure, and disposal lagoons, and has developed and implemented multiple quality assurance/quality control programs.

DETAILED EXPERIENCE

1989 to Date — Malcolm Pirnie, Inc.

- Managed the construction monitoring and quality assurance/quality control (QA/QC) program during the construction of the new Cell No. 3 expansion at the North Sea Landfill in the Town of Southampton NY. The 6.5-acre landfill has a high-density polyethylene (HDPE) geosynthetic and low-permeability soil composite liner, leachate collection and detection systems, leachate pump station, and an aboveground leachate storage tank.

- Managed the construction monitoring and QA/QC program during construction of the bilevel recycling center at the North Sea Landfill in the Town of Southampton NY. The facility has a seven-bay bilevel dropoff which features separate residential and private hauler dropoff areas for the Town's mandatory recycling program.

- Managed the construction monitoring and QA/QC program during the Cell No. 2 closure construction at the North Sea Landfill in the Town of Southampton NY. The 16-acre landfill has a HDPE geosynthetic cap liner including protective erosion control revetment, drainage layers and structures, gas venting and monitoring systems, ground water monitoring wells, and a leachate well pump station.

(continued)

DETAILED EXPERIENCE (Continued)

1989 to Date — Malcolm Pirnie, Inc. (continued)

- Managed the construction monitoring and QA/QC program during construction of the new Cell A3 ash monofill expansion at the York County Sanitary Landfill in Stewartstown, York County PA. The 7.5 acre landfill was constructed with a HDPE geosynthetic and low-permeability soil composite liner and primary leachate drainage and collection system.

- Managed the construction monitoring and QA/QC program during the construction for Cells A1 and A2 landfill closure and overtopping construction at the York County Sanitary Landfill in Stewartstown PA. The 23-acre landfill final cover system was constructed with a low-permeability soil layer and PVC flexible membrane cap liner, drainage layers and structures, and gas venting and monitoring system. The 5.3-acre landfill overtopping area interfacing existing Cells A2 and A3 for additional ash residue capacity has a geosynthetic geogrid reinforcement system, HDPE geosynthetic and low-permeability soil composite liner, and primary leachate drainage system.

- Managed the construction monitoring and QA/AC program as Assistant Resident Engineer during the on-going construction of the Cell 1, 2, and 3 double liner system at the Edgeboro Landfill in East Brunswick NJ. The 55-acre landfill expansion was constructed with a HDPE geosynthetic and low permeability soil composite liner and primary leachate drainage and collection system.

1986-1989 — Henningson, Durham & Richardson, P.C.

As Senior Technician: Provided assistance and support on solid waste projects including landfills, transfer stations, resource recovery facilities and material recovery facilities.

1979-1986 — Wehran Engineering, P.C.

As Technician/Designer: Provided assistance and support in the field of land disposal engineering and geotechnical engineering. Assisted in the design, engineering and construction of sanitary landfills, hazardous waste secure landfills, liquid waste storage lagoons, remediation of abandoned hazardous waste sites, including soils related field and laboratory testing. Field project responsibilities included construction supervision, inspection, project coordination, planning, scheduling, quality assurance and quality control. Construction experience includes the construction of earthen impoundment structures for waste containment, including impermeable soil capping and lining controlled fill construction, bulk excavation and extraction of materials, road construction, installation of synthetic materials, leachate collection and withdrawal systems, soil drainage systems, surface drainage structures, subsurface clay and slurry soil-bentonite cutoff wall barriers in soil and rock, and construction documentation. Office responsibilities included the design and engineering of excavation, operational and final grading drawings; leachate collection, surface drainage systems; preparation of cost estimates, engineering reports, specifications and drawings.

ROBERT W. ARKO
Senior Project Hydrogeologist

EDUCATION

BS (Geology) 1971; University of Minnesota
Graduate Studies (Engineering Geology) 1972-73; Oklahoma State University

REGISTRATIONS AND CERTIFICATIONS

Registered Professional Geologist: Oregon
Certified Professional Geological Scientist: AIPG

SUMMARY OF EXPERIENCE

Mr. Arko has over 20 years professional experience in ground water, hazardous materials and environmental investigations ranging from field implementation to project management. He has particular expertise in the development of specialized hydraulic testing methods and equipment.

DETAILED EXPERIENCE

1988 to Date — Malcolm Pirnie, Inc.

As Senior Hydrogeologist:

- Project Manager for field investigations and remedial design at the Bob's Marathon LUST site, Grand Ledge, MI (MUSTFAA).
- Project Manager for field investigations and remedial design at the Wash King Laundry ground water contamination site, Baldwin, MI (Superfund and MI Act 307 site).
- Project Manager for field investigations at the Osceola Refinery soil and ground water contamination site, West Branch, MI (MI 307 site, heavy industry).
- Project Manager for field investigations at the Manistee Drop Forge ground water and surface water contamination site, Filer City, MI (MI 307 site, heavy industry).
- Project Manager for field investigations at the Conrail Yard (and surrounding area) soil and ground water contamination site, Grand Rapids, MI (MI 307 site, heavy and light industry).
- Ground water modeling, extraction well network design and bid document preparation, at the Lemberger sites - industrial and municipal landfills, Whitelaw, WI.
- Design and specification preparation for ground water extraction wells at Long Prairie, MN Superfund site (Superfund, MN Multi-Site).
- Preparation of a source inventory, complex PRP and operation history, and RI work plan for the IDC site, Ellsworth, MI (MI 307 site, heavy industry).

(continued)

DETAILED EXPERIENCE (Continued)

1988 to Date Malcolm Pirnie, Inc. (continued)

- Supervision of stratified ground water sampling team.
- Supervision/training of field teams for pumping tests and slug tests.
- Represented site owners during sampling split with USEPA FIT team at Copiah County Landfill Site, MS (potential Superfund).
- Task Leader for Oak Grove Sanitary Landfill Remedial Investigation (Superfund, MN Multi-Site).
- Technical Leader for a hydrogeologic investigation of an organic/inorganic chemical manufacturing plant (client confidential, heavy industry).
- Project Leader for hydrogeologic investigations at potential sites for a resource recovery facility (incinerator) proposed in Dakota County, MN.
- Project Leader for Adrian, MN Site Remedial Investigation Report (Superfund, MN Multi-Site).
- Developed work plan and QAPP consistent with EPA Guidance for LaGrande RI/FS (MN Multi-Site).
- Developed Work Plan consistent with EPA Guidelines for Ritari RI/FS (MN Multi-Site).
- Technical resource, use of Lotus 1-2-3.

1984 to 1988 IT Corporation

As Senior Project Geologist:

- Project Manager for the Adrian, MN site remedial investigation (Superfund, MN Multi-Site).
- Project Manager for the Atwater, MN site remedial investigation (MN Multi-Site).
- Project Manager for the Syntex (Springfield, MO) site investigation; field experience with dioxin investigation; Karst hydrogeology (heavy industry).
- Project Leader for the New Lyme Landfill, OH site remedial investigation (Superfund).
- Conducted pump tests at the Stringfellow (Glen Avon, CA) site (Superfund).
- Hydraulic testing of low permeability rock; soil sampling in Level B, Front Street Trust (Kansas City, KS) site.

(continued)

DETAILED EXPERIENCE (Continued)

1984 to 1988 — IT Corporation (continued)

- Development of testing tool and procedures for hydraulic testing of low permeability rock; soil sampling in Level B, Panoche Landfill (Solano County, CA) site.
- Development of testing tool and procedures for hydraulic testing of high permeability sands, Adrian site remedial investigation.
- Project Leader for PCB contamination investigation, Rosemount Research Center, MN.
- Quality Assurance Officer, regional office.

1979 to 1984 — D'Appolonia Waste Management Services, Inc. (acquired by IT Corporation, 1984)

As Senior Project Geologist:

- Project Leader for the New Lyme Landfill, OH site remedial investigation (Superfund).

As Project Geologist:

- Project Leader for the Berlin and Farro (Schwartz Creek, MI) Hydrogeology Investigation (Superfund).
- Principal investigator for Paducah Gaseous Diffusion Plant (Paducah, KY) investigation of ground water contamination from low level radioactive disposal sites.

As Assistant Project Geologist:

- Project Leader for investigation of ground water contamination at a chemidal manufacturing plant, Follansbee, WV (Superfund, heavy industry).
- Designed and installed monitoring wells with multiple pump/packer systems, Hooker Chemical Co. Vault Site, Montague, MI.

As Geologist:

- Conducted hydraulic testing of very low permeability rocks for potential nuclear waste repository, Manitoba, Canada.
- Debugged computer code for reduction of data from hydraulic testing of low permeability salt beds, Waste Isolation Pilot Project.

(continued)

DETAILED EXPERIENCE (Continued)

1974 to 1979 National Biocentric, Inc.

As Geologist:

- Project Manager for Environmental Impact Statements, Environmental Assessments, and Siting Studies for power plants, transportation pipelines, and waste sewers.

1973 to 1974 Dames and Moore

As Geologist:

- Offshore drilling for foundation conditions at the Trident Nuclear Submarine Facility, Bangor, WA.
- Field investigations of hydrogeology for nuclear power plant siting studies.

1972 to 1973 Consulting Engineers Diversified, Inc.

- Assistant drill rig operator.

PUBLICATIONS AND PRESENTATIONS

Kadwell, R.J., Cundiff, R.J., Arko, R.W. and Wolbert, D.L., 1978. "A Hydrologic and Chemical Assessment of an Existing Sanitary Landfill," Proceedings, 4th Joint Conferences on Sensing of Environmental Pollutants, American Chemical Society, Washington, DC.

MICHAEL R. KUNZ
Project Environmental Scientist

EDUCATION

BS (Geology) 1986; University of Minnesota, Duluth
Undergraduate Studies 1982-1983; University of Birmingham, England
Specialized Training: Health and Safety Operations at Hazardous Materials Sites 1988; Site Managers Health and Safety Course 1989; Health and Safety Refresher Courses 1989 through 1994; Certified Hazardous Materials Manager (CHMM) 1993

SOCIETIES

Academy of Certified Hazardous Materials Managers
Minnesota Groundwater Association

SUMMARY OF EXPERIENCE

Mr. Kunz is experienced in environmental and industrial/hazardous waste investigations ranging from project design and implementation to project management. Mr. Kunz has participated in a variety of projects throughout the United States. Areas of specialization include: environmental assessments, regulatory compliance; development of environmental strategies; project coordination and management; on-site investigations; hazardous waste site investigations; feasibility studies and remediation conducted under Superfund; contamination assessment and technical report development; and client, regulatory and subcontractor liaison. Mr. Kunz is experienced in the coordination and implementation of comprehensive solid waste management plans. His fields of specialization include solid waste facility siting, permitting, regulatory/environmental assessment, and operations including recycling, composting, resource recovery and landfill investigations. Additionally, Mr. Kunz is experienced in conducting archaeological investigations, developing project proposals, developing budgets, and conducting and managing multi-disciplinary projects.

DETAILED EXPERIENCE

1987 to Date — Malcolm Pirnie, Inc.

As Environmental Scientist and Project Environmental Scientist:

- Project Manager for a multi-service contract with the USDA Forest Service. Responsible for both technical and administrative activities for hazardous waste, solid waste and water related projects and investigations.

- Project Manager for updating USDA Forest Service Water and Wastewater construction certification materials including a self-study course (SSC), reference specifications and drawings, and certification exam. Upon completion of the update soft metrics will be incorporated into the water and wastewater materials.

- Conducted a remedial investigation at the Superior National Forest, Tofte Ranger Station to identify the extent of petroleum contamination in soil, ground water and surface water of a leaky fuel oil underground storage tank.

(continued)

DETAILED EXPERIENCE (Continued)

1987 to Date Malcolm Pirnie, Inc. (continued)

- Conducted remedial design/remedial action (RD/RA) activities for a Wisconsin Superfund site including groundwater investigations (well installations, pump test, groundwater sampling and contaminant assessment), Branch River investigations (water quality and sediment assessment), and oversight of drum excavation remediation program.

- Conducted an economic analysis of aggregate resources in the Minneapolis St. Paul metropolitan area for Edward Kraemer & Sons, Inc.

- Conducted technical and administrative functions for RI/FS Superfund projects under a Multi-Site Contract with the Minnesota Pollution Control Agency (MPCA). Technical involvement included conducting site investigations and assessment of findings, preparation and assistance with work plans, quality assurance project plans, health and safety plans, RI and FS reports, and client questions and requests. Administrative support included monitoring project budgets and schedules, preparation of monthly progress reports and invoices, and client contact.

- Project Geologist and assisted Project Archaeologists with a Phase 3 Data Recovery of archaeological sites 13LE110 and 117, U.S. Highway 61 Bypass, Lee County, IA, and with a cultural resources management investigation (Phase 1 archaeological survey) of residuals management facilities properties, Newport News, VA.

- Project Leader for the MacGillis and Gibbs (Superfund Site) Feasibility Study. Project included a test-burn of contaminated soils and debris from a wood processing/treatment facility, a soil boring investigation to characterize site conditions and escalate remedial action for contaminated material, preparation of FS report and project management.

- Project Leader for the LaGrande Sanitary Landfill (Superfund site) Feasibility Study. Developed and evaluated remedial alternatives and cost estimates, and prepared FS report of findings.

- Developed and prepared sections of the St. Louis River/Interlake site, Oak Grove Groundwater, St. Paul Park Groundwater, and Long Prairie Groundwater Feasibility Studies (State and NPL Superfund, MN Multi-Site). Assisted in technology research and review process, cost estimates and report preparation.

- Conducted a hydrogeologic investigation for Tarmac Mid-Atlantic, Inc. at an underground storage tank (UST) site in Richmond, VA. Subsurface exploration included soil borings, soil sampling/headspace analyses, and monitoring and recovery well installations.

- Prepared project work plans, conducted environmental/hydrogeologic investigations and evaluated remedial alternatives for LPST/PSTR sites for the Texas Water Commission (TWC) in the State of Texas. Project tasks include: site characterization, subsurface exploration including soil borings and sampling, monitoring well installation and groundwater sampling slug tests, and contamination assessment, evaluation of remedial alternatives and cost estimates and report preparations.

(continued)

DETAILED EXPERIENCE (Continued)

1987 to Date — Malcolm Pirnie, Inc. (continued)

- Site Leader for a remedial investigation at the Cameron Meadows Gas Processing Facility Site, Cameron, LA. Project included a soil and hydrogeologic investigation, assessment of findings, and report preparation.
- Conducted a hydrogeologic investigation for the Albany Landfill Expansion Project, Albany, NY. Subsurface exploration included soil borings, soil sampling and monitoring well installations.
- Project Leader and on-site representative for the Illinois Environmental Protection Agency at its Paxton Avenue Lagoons Remediation Site in Chicago, IL. Project included soil incineration at a hazardous waste site and development of project budget and administration.
- Prepared a preliminary siting assessment for an Ohio Waste-To-Energy Facility Feasibility Study.
- Task Leader for Interlake Phase II Remedial Investigation (Superfund, MN Multi-Site). Coordinated and conducted field investigation activities, sampling and analytical programs. Prepared cost budgets and schedules, and implemented QA/QC control. Addressed client questions and requests on both a technical and administrative basis. Coordinated and developed Interlake RI Report for the MPCA/USEPA.
- Involved in various aspects of the Dakota County Resource Recovery Project including solid waste facility siting investigations, subsurface/hydrogeologic explorations, Environmental Impact Statement (EIS), permitting, research on waste management alternatives, preliminary recycling studies, subcontractor services, and project progress/budget reports.
- Conducted a comprehensive Refined Site Screening Analysis (field work, research, mapping, and report) for site selection of a resource recovery facility in Dakota County, MN. Developed Amendment No. 1 to the site screening analysis.

1986 to 1987 — Olmsted County, Minnesota

As Environmental Technician:

- Conducted regulatory liaison work with local, county and state agencies for Olmsted County Solid Waste Management Alternatives including; recycling, composting, resource recovery and landfill.
- Managed Olmsted County recycling and composting programs including implementation of recycling redemption center and compost site, Minnesota Waste Management Board reports, publicity/advertisement, recycling incentive and curbside collection programs.
- Assisted in landfill closure plans and new landfill siting investigations including: field investigations, public meetings, and development of a dye-trace study for USEPA Superfund site.

(continued)

DETAILED EXPERIENCE (Continued)

1986 to 1987 — Olmsted County, Minnesota (continued)

- Developed and presented public education programs addressing resource recovery, recycling, composting and waste abatement. Implemented an environmental education program in schools.

PRESENTATIONS AND PUBLICATIONS

"Enhancement of Volatile Organic Extraction in Soil at an Industrial Site", Michael R. Kunz, presented at Minnesota Pollution Control Agency Innovative Technologies Seminar, December, 1991.

MIKE MCLAUGHLIN
Project Engineer

EDUCATION

BS (Civil Engineering) 1985; North Dakota State University
Graduate Studies (Environmental Engineering) 1991; North Dakota State University
Specialized Training: Hazardous Waste Operations & Emergency Response 1994

REGISTRATIONS

Engineer-in-Training

SOCIETIES

Associate Member - American Society of Civil Engineers
National Society of Professional Engineers

SUMMARY OF EXPERIENCE

Mr. McLaughlin has experience in civil and environmental engineering including project management on projects for utility, governmental, and industrial clients. He has participated as a manager, design engineer, and field engineer.

DETAILED EXPERIENCE

1994 to Date — Malcolm Pirnie, Inc.

As Engineer:

- Preparation of final drawings, specifications, design reports, and O&M plan for a Superfund site located in Wisconsin.
- Preparation of landfill cover drawings for the Laurel and Hattiesburg landfills in Mississippi.
- Updated USDA Forest Service Water and Wastewater construction certification materials including a self-study course, reference specifications and drawings, and certification exam.
- Prepared drawings for a remedial investigation at the Superior National Forest, Tofte Ranger Station.

1993 to 1994 — Ulteig Engineers, Inc.

- Inspected the installation of a 24" water main through an oil refinery in Mandan, ND.
- Inspected the replacement of sanitary sewers in Minot ND.
- Designed upgrades to a major sanitary lift station and the water treatment facility in Minot, ND.

(continued)

DETAILED EXPERIENCE (Continued)

1988 to 1991 Minnegasco

- As Metering and Regulation Engineer, overall responsibility for maintaining code compliance for meters and pressure regulators. Developed new technologies and equipment for use in the natural gas distribution system.
- As System Design Manager, supervised design staff of 15. Analyzed design projects in accordance with Minnegasco procedures, developed departmental budgets, and evaluated performance of staff.
- As Remote Meter Reading Project Manager, managed the implementation of a new meter reading system. Developed new procedures and wrote several PC programs to evaluate implementation of this new system.
- As Design Engineer, analyzed, designed, estimated, and monitored design projects in conjunction with construction projects.
- As Corrosion Engineer, developed practices and procedures to protect the natural gas distribution system from deteriorating, trained technicians and inspectors in "basic" corrosion practices.

1985 to 1988 Northern Illinois Gas Company

- As Pressure Supervisor, supervised field operations staff of 8 in a small field office. Areas of supervision included locators, leak detection, pressure regulation, tapping and stopping, and fleet operations. Evaluated system integrity to maintain adequate gas supply to customers.
- As Pressure Engineer, provided technical assistance for pressure regulation and system integrity. Supervised staff of 8 in a large field office.
- As Design Engineer, analyzed, designed, and estimated projects in conjunction with road construction, infrastructure problems, or distribution system enhancements.

1983 to 1984 North Dakota State Highway Department

- Cooperative Education Program. Responsible for installation of storm sewer, water main, and sanitary sewers on a railroad underpass project in Fargo, ND.

MALCOLM PIRNIE

4

4

RECYCLED PAPER

4.0 INSPECTION ACTIVITIES AND PROJECT MEETINGS

4.1 INSPECTION ACTIVITIES

The CQA Plan includes discussions on the observations and tests that will be used to monitor the construction and/or installations of the components of the Remedial Actions. Inspections shall verify compliance with the construction and environmental requirements associated with the project. Inspections shall also ensure compliance with all health and safety procedures. In addition to the oversight inspections, three inspection activities have been identified for the project as discussed below.

4.1.1 Preconstruction Inspection

A Preconstruction Inspection shall be conducted along with the preconstruction conference to review methods for documenting and reporting inspection data; review methods for distributing and storing documents and reports; and review work area security and safety protocol. Additionally, attendees will discuss any appropriate modifications of the Construction Quality Assurance Plan to make certain that site-specific considerations are addressed and conduct a Site walk-around to verify that the design criteria, plans, and specifications are understood and to review material and equipment storage locations.

The preconstruction inspection shall be documented by the Engineer and a memorandum summarizing the meeting shall be transmitted to all parties. The preconstruction inspection is discussed further in Section 4.2.1 of this document.

4.1.2 Prefinal Inspection

Upon preliminary project construction completion, USEPA shall be notified for the purposes of conducting a prefinal inspection. The prefinal inspection shall consist of a walk-through inspection of the Site by the USEPA. The inspection is to determine whether the project is complete and consistent with the contract documents and the USEPA approved Remedial Action. Any outstanding construction items discovered during the inspection shall

be identified and documented in a Prefinal Inspection Report. Additionally, retesting will be completed where deficiencies are revealed. Outstanding construction items, actions required to resolve items, completion date for these items, and date for final inspection shall be outlined in the Prefinal Inspection Report. The Prefinal Inspection Report shall be structured to include the following items:

- Documentation of all Contractor's, subcontractors' and manufacturers' test results and submittals.
- Documentation of all laboratory and field testing conducted on all materials.
- Documentation of all failed test results, with a detailed description of the methods and procedures used to correct the improperly installed or defective material.
- Statements of all retesting performed on any problem areas.
- As-built drawings noting the location and identification of all construction activities and any deviation from the approved engineering plans.
- A narrative providing an overview of the reports generated by the Engineer and of the daily reports of project activity prepared by the Contractor.
- A series of color photographs of major project features.

4.1.3 Final Inspection

Upon completion of any outstanding construction items, USEPA shall be notified for the purposes of conducting a final inspection. The final inspection shall consist of a walk-through inspection of the project Site by USEPA. The Prefinal Inspection Report will be used as a checklist with the final inspection focusing on the outstanding construction items identified in the prefinal inspection. Confirmation shall be made that outstanding items have been resolved.

4.2 PROJECT MEETINGS

4.2.1 Preconstruction Conference

A Preconstruction Conference will be held after execution of the Agreement and before construction is started at the site. The Engineer will establish the date, time and location of the meeting in accordance with the General Conditions. The Engineer shall prepare an agenda, preside at the meeting, and prepare and distribute a transcript of proceedings to all parties. The Contractor shall provide data required, contribute appropriate items for discussion, and be prepared to discuss all items on agenda. The following parties are required to attend the Preconstruction Conference:

- Contractor and major Subcontractors.
- Owner's representative.
- Engineer.
- Representatives of governmental agencies having any degree of control or responsibility, if available.

The Preconstruction Conference agenda will include, but will not necessarily be limited to, the following:

- Designation of responsible personnel.
- Subcontractors.
- Coordination with other contractors.
- Progress schedule.
- Processing of Shop Drawings.
- Schedule of Shop Drawing submittals.
- Processing of Field Orders and Change Orders.
- Requirements for copies of Contract Documents.
- Insurance in force.
- Schedule of values.
- Processing of progress payments.

- Use of premises.
- Contractor (s) responsibility for safety and first aid procedures.
- Security.
- Housekeeping.
- Field Offices.
- Record Drawings.

4.2.2 Weekly Progress Meetings

Weekly progress meetings shall be held to review the progress of the project and discuss project issues, observations and planned activities. The Engineer shall prepare an agenda, preside at the meeting, and prepare and distribute a memorandum summarizing the proceedings to all parties. The Contractor shall provide data required, contribute appropriate items for discussion, and be prepared to discuss all items on agenda. When needed for the discussion of a particular agenda item, the Contractor shall require representatives of the subcontractors, manufacturers or suppliers to attend the meeting. The following parties are required to attend the weekly progress meetings:

- Contractor
- Subcontractors, as necessary
- Engineer
- Owner's representative, if required
- Others as appropriate

The weekly progress meeting agenda will include, but will not be necessarily limited to the following:

- Transcript of the previous meeting
- Progress since last meeting
- Planned progress for next period
- Problems, conflicts and observations
- Change Orders

- Status of Shop Drawings
- Quality standards and controls
- Schedules, including off-site fabrication and delivery schedules; corrective measures, if required
- Coordination between parties
- Safety concerns
- Other business

4.2.3 Special QA/QC Meetings

Special meetings shall be held if or when a major QA/QC problem or deficiency is present or likely to occur. At a minimum, the meeting shall be attended by the Contractor, and any subcontractors involved with the QA/QC concern and the Engineer. The purpose of these meetings will be to define and resolve the QA/QC problem or concern. The Engineer will prepare a meeting summary and distribute them to the parties.

MALCOLM PIRNIE

5

5

RECYCLED PAPER

5.0 CONSTRUCTION QA REQUIREMENTS

The Remedial Action activities at the Lemberger Landfill Site requires observation, inspection and testing procedures to ensure that all work and specified materials and equipment are in conformance with the design criteria identified in the Drawings and Specifications. As a result, the following sections describe the quality assurance procedures and observations required, as a minimum, for completion of the individual tasks incorporated into this project. The project involves numerous tests and documentation to determine the adequacy of each element of the work being conducted. The project Specifications further identify submittal requirements for compliance with the Construction Documents and are to be used along with this CQA Plan.

5.1 EXCAVATION AND BACKFILL

5.1.1 Testing and Permits

The Contractor shall engage the services of a qualified testing laboratory to make tests and determine acceptability of the fill or material as listed below. Laboratory shall be acceptable to Engineer.

The Contractor shall conduct the following required tests:

- Select Fill Samples: Gradation ASTM D 422.
- Compacted Select Fill: Compaction, ASTM D 1556 and ASTM D 1557, and ASTMD 2922.

All field density and moisture measurements shall be conducted using a Troxler nuclear density gauge.

The Contractor shall obtain all necessary permits and licenses required to complete the Remedial Action activities in accordance with the Drawings and Specifications. Additionally, the Contractor shall obtain permits as required by local, state and federal agencies for discharging water from excavations. The excavation work shall be performed in compliance with applicable requirements of governing authorities having jurisdiction.

The Contractor shall comply with applicable provisions and recommendations of the following reference standards except as otherwise shown or specified.

- ASTM A36 for Structural Steel.
- ASTM D 422, Method for Particle-Size Analysis of Soils.
- ASTM D 1556, Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
- ASTM D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
- ASTM D 2922, Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- OSHA Standard, Title 29, Code of Federal Regulations, Part 1926, Section .650 (Subpart P - Excavations).
- AISC Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.
- ASTM D 2487, Classification of Soils for Engineering Purposes.
- ASTM D 698, Test Method of Laboratory Compaction Characteristics of Soil Using Standard Effort.

5.1.2 Field Quality Control

For quality control testing during construction, the Contractor's testing service must inspect and certify in writing, signed by a professional engineer, to the Engineer that subgrades and fill layers were tested before construction work is performed thereon and meet the requirements of the Contract Documents. Tests of subgrades and fill layers shall be taken as follows:

1. Footing Subgrade: For each stratum of soil on which footings will be placed, the Contractor shall conduct at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested stratum, when acceptable to Engineer.

2. Paved Areas and Building Slab Subgrade: The Contractor shall make at least one field density test of subgrade for every 1000 square feet of paved area or building slab, but in no case less than 3 tests. In each compacted fill layer, the Contractor shall make one field density test for every 2000 square feet of overlaying building slab or paved area, but in no case less than 3 tests.

3. Foundation Wall Backfill: The Contractor shall take at least 2 field density tests, at locations and elevations as directed, but in no case less than one test per wall elevations.

If testing laboratory reports or inspections show subgrade or fills that are below specified density, the Contractor shall provide additional compaction and testing.

5.2 BORROW SOURCES AND IN-PLACE CONSTRUCTION

5.2.1 Clay Borrow Source Testing

The Contractor's testing laboratory shall perform the following sample collection and testing program and submit results, under the seal of a professional engineer registered in Wisconsin, directly to the Engineer for approval.

The required minimum sampling and testing shall be conducted to satisfy the requirements of NR 512 as follows:

1. Ten test pits or borings for the first 5 or less acres and one test pit or boring for each additional one or less acre shall be excavated or drilled on a uniform grid pattern across each proposed borrow source to document the depth, lateral extent and uniformity of acceptable material. The WDNR recommends using test pits as the method of borrow source investigation. Logs identifying the geologic origin, testing results, USCS classification and a visual description of each major soil unit encountered shall be included.

2. A minimum of 2 representative samples from each test pit or boring shall be collected and tested in the laboratory for grain size distribution to the 0.002 millimeter particle size and Atterberg limits.

3 A minimum of 5 representative samples for the first 10 or less acres and one additional sample for each additional 5 or less acres shall be tested for the relationship of water content to dry density using either the modified or standard Proctor method. Each Proctor curve shall be developed with a minimum of 5 points.

4. A minimum of 20% of the samples used to develop the Proctor curves shall be used to evaluate the relationship between compaction and hydraulic conductivity. This shall be accomplished by testing the sample corresponding to each point established on the chosen Proctor curves for hydraulic conductivity.

5 All samples shall be classified according to the unified soil classification system.

The following data information shall be submitted to the Engineer for review and approval:

1. The calculated volume of acceptable material based on the information obtained from the test pits or borings.
2. Property boundaries and test pit/boring locations shall be shown on a topographic map with a scale of one inch = 500 feet. The mapped area shall extend a minimum of 500 feet beyond the proposed borrow source.
3. An isopach map showing the thickness of acceptable material.
4. A description of the methods to be used for separating the acceptable material from any unacceptable material.
5. A proposal for maintaining drainage, sedimentation control and proper abandonment of the property.
6. All data obtained from the testing program.

5.2.2 Foundation and Gas Control Layer

The Contractor's authorized testing laboratory shall perform the following tests for foundation and the gas control layer and submit test results directly to the Engineer for approval. The material for the Foundation and Gas Control Layer shall be obtained by the Contractor from off-site sources.

The required minimum testing is as follows:

1. Perform grain size distribution analysis to the #200 sieve for each 1,000 cubic yards of material placed or at the request of the Engineer.
2. Perform one remolded laboratory hydraulic conductivity test for each 2,500 cubic yards of material placed. The samples shall be tested at 95% of Standard Proctor maximum density. The moisture content and density of each sample shall be recorded.

5.2.3 Testing for Protective Cover Soil

Materials for the protective cover soil shall be obtained by the Contractor from off-site sources. The Contractor's authorized testing laboratory shall perform the following tests:

1. One grain size distribution analysis to the #200 sieve for each 5,000 cubic yards of material placed.
2. The Contractor shall perform hand-augering of each layer, at locations designated by the Engineer, to verify the depth of the layer. Auger hole locations shall be referenced to the same grid system as the topographic surveys. Auger holes in the clay layer shall be backfilled and tamped with bentonite. Auger holes in other materials shall be filled with materials meeting the specifications for that layer.

5.2.4 Testing for Drainage Layer Material

Materials for the drainage layer shall be obtained by the Contractor from off-site sources. The Contractor's authorized testing laboratory shall perform tests and submit test results directly to the Engineer for approval. The minimum required testing is as follows:

1. Perform grain size distribution analysis to the #200 sieve for each 1,000 cubic yards of material placed or at the request of the Engineer.
2. Perform one remolded laboratory hydraulic conductivity test for each 2,500 cubic yards of material placed. The samples shall be tested at 95% of Standard Proctor maximum density. The moisture content and density of each sample shall be recorded.

5.2.5 Construction Testing for Clay Barrier Layer

The Contractor shall perform the following construction testing for the clay barrier layer.

1. Perform in-place soil density testing to determine the degree of compaction of the clay barrier layer. A minimum of five (5) density and moisture tests using a nuclear densitometer shall be performed on a 100-foot grid pattern per acre per lift of completed barrier layer. A minimum of 2 density and moisture content tests for each lift of completed barrier layer placed shall be performed to fully define the degree of soil compaction obtained in confined areas where equipment movement is hindered or hand compaction is necessary. The grid pattern shall be offset on each subsequent lift of completed barrier layer. The exact location of the moisture-density tests will be determined by the Engineer. The testing laboratory shall reference the location of all nuclear densitometer tests to the existing horizontal grid system. The soil shall be compacted to not less than 90% of the Modified Proctor maximum density. If the specified density is not obtained, the Contractor shall perform whatever work is required to provide the specified density. This work shall include recompaction and/or complete removal of unacceptable fill areas and

recompaction until the specified density is achieved. All additional excavation and compaction work shall be performed by the Contractor at no additional cost to the Owner until the specified degree of compaction is obtained.

2. One moisture-density curve shall be developed for every 5,000 cubic yards or less of clay placed and for each major soil type utilized. At least 5 points shall be established on each curve. A representative sample for every 5,000 cubic yards or less of clay placed shall be analyzed for grain size distribution through the .002 millimeter particle size and for Atterberg limits. If apparent changes in soil quality are observed during clay placement, a one-point Proctor analysis shall be utilized to verify the applicability of previously analyzed moisture-density curves.

3. Perform one (1) additional moisture content test per acre of the previous lift before placement of additional lifts. The Contractor shall obtain the approval of the Engineer for the moisture content of the soil for the previous lift before proceeding with placement of additional lifts. Moisture control shall be as specified in Paragraph 3.3.I of the Specifications. If evidence of desiccation (drying) cracks is noted, the affected area shall be scarified to the depth of the cracks, moistened to specified moisture content, recompacted and retested to meet all requirements of the specifications.

4. A minimum of one undisturbed sample for each acre or less for each lift of clay placement shall be retrieved and analyzed by the Contractor's testing laboratory for Atterberg limits, grain size distribution through the .002 millimeter particle size, moisture content and dry density. Laboratory hydraulic conductivity tests using the falling head method shall be performed on every third undisturbed sample. The Contractor's testing laboratory shall be responsible for collecting the Shelby-Tube sample necessary for the performance of the hydraulic conductivity (permeability) test. The exact location of the hydraulic conductivity tests will be determined by the Engineer. The testing laboratory shall reference the location of all hydraulic conductivity

tests to the existing horizontal grid system. The maximum allowable in-place soil permeability for the barrier layer shall be 1.0×10^{-7} cm/sec.

5. All holes made by the nuclear probe and Shelby tube samples shall be backfilled with granular bentonite and hand tamped as directed by the Engineer.
6. The first lift of the barrier layer shall be constructed using a 12-inch (before compaction) lift. The rest of the barrier layer shall be constructed in 6-inch maximum (after compaction) lifts, for a minimum thickness of 24 inches.
7. The top inch of each completed and approved lift shall also be scarified, unless otherwise directed by the Engineer, prior to placement of successive layers.
8. Soils testing of material shall be performed in accordance with the following references:
    a. ASTM D 421, Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants.
    b. ASTM D 422, Particle-Size Analysis of Soils.
    c. ASTM D 2922-81, Standard Test Methods for Soil and Soil Aggregates In-Place by Nuclear Methods (for shallow depths).
    d. ASTM D 1557, Moisture-Density Relations of Soils, Using 10 lb. hammer and 18-inch Drop.
    e. ASTM D 2216, Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil Aggregate Mixtures.
    f. ASTM D 4318, Liquid Limit, Plastic Unit, and Plasticity Index of soils.
    g. ASTM D3017, Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods.
    h. ASTM D2434, Test Method for Permeability of Granular Soils.
    i. ASTM 5084 Test Method for Permeability of Saturated soils.
    j. Boutwell Test for Field Permeability.

9. The Contractor shall be responsible for performing any corrective work required by the Engineer as a result of failed quality assurance tests as described in this section.

5.2.6 Soils

All soil material used associated with the borrow sources and in-place construction activities shall be natural soil, free from excessive moisture or frost. The Contractor shall remove all stumps, roots, muck, marl and stones exceeding 2-inches in greatest dimension prior to placement. Stones smaller than 2-inches in diameter shall be kept apart and not permitted to accumulate in groups. The Contractor shall not use frozen material.

The following soil material requirements apply to specific final cover construction activities:

Clay Barrier Layer Material:

1. Soil Classification: CL or CH soil based on Unified Soil Classification System.
2. Recompacted Permeability:
   a. Less than or equal to 1.0×10^{-7} cm/sec.
   b. The permeability tests results shall include an assessment of whether the field construction procedures specified are able to achieve the specified permeability.
3. Atterberg Limits
   a. Plasticity Index: 15% or greater, or an alternative value determined on a source-by-source basis by the Engineer, in which case subsequent approval by the USEPA and WDNR is required. The alternative value shall in no case be less than 12% on average for all samples and less than 10% for individual samples for clay placed as part of the final cover construction and documented in accordance with ch. NR 516, Wis. Adm. Code.

b. Liquid Limit: 30% or greater or an alternative value determined on a source-by-source basis by the Engineer, in which case subsequent approval by the USEPA and WDNR is required. The alternative value shall in no case be less than 25% on average for all samples and less than 20% for individual samples for clay placed as part of the final cover construction and documented in accordance with ch. NR 516, Wis. Adm. Code.

4. Clay Content: A clay content of 25% by weight or better.
5. A minimum of 50% by weight shall pass the 200 sieve.
6. All barrier layer material shall be obtained by the Contractor from off-site sources.

Foundation and Gas Control Layer and Drainage Layer:

1. Soil Classification: SP based on Unified Soil Classification System
2. Permeability: $\geq 1.x10^{-3}$ cm/sec.
3. Percent Fines: <10% smaller than 0.074 mm by weight. Drainage Layer maximum size shall be 1/2 inch.
4. All layer materials in this section shall be obtained by Contractor from off-site sources.

Cover Soil Layer:

1. Soil Classification: General Fill meeting the requirements of Section 02220.
2. Permeability: No Requirements.
3. Percent Fines: No Requirements.
4. All layer materials in this section shall be obtained by Contractor from off-site sources.

Topsoil:

1. Soil material capable of supporting adequate vegetative growth meeting the requirements of Section 02900, Landscaping.

5.2.7 Crushed Stone and Gravel

The Contractor shall furnish and place all crushed stone and gravel in accordance with the Specifications and Drawings. Representative samples of the crushed stone or gravel shall be furnished to the Engineer, along with the source location. The crushed stone or gravel products shall conform to Specification Section 02230 classifications for Bank Run Gravel; Crushed Stone or Screened Gravel for Foundations; Road Gravel; and Filter and Bedding Gravel. The placement, compaction, and layer thickness of crushed stone or gravel shall conform to applicable requirements established in Specification Sections 02220 and 02230.

5.2.8 Riprap

The Contractor shall furnish and place riprap for channel slopes and ditches in accordance with the Specifications and Drawings. Representative samples of riprap and riprap bedding shall be furnished to the Engineer, along with the source location. The riprap material will comply with the applicable Wisconsin Department of Transportation Standard Specifications for Road and Bridge Construction. The placement of riprap shall conform to the Specification Section 02271.

5.3 RELOCATION OF EXISTING SOIL AND SOLID WASTE

The Contractor shall follow all regulations and obtain the necessary permits for all work in roads, rights-of-way, etc; all permits required by local, state and federal agencies for discharging water from excavations to rivers and streams. The Contractor shall perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

The Contractor shall conduct the following environmental monitoring during the soil and solid waste relocation activities:

1. Identify through field instrumentation the potential for combustible gas release and the volatilization of contaminants.
2. Apply the action levels, as described in the Site Safety Plan, Section 01060 of

the Specifications, associated with persistent readings obtained with field instrumentation (photoionization or flame ionization detectors) in the breathing zone of the workers during disruption activities.

3. Maintain a log of the location, time, type, and value of each reading and/or sampling. Provide copies of daily log sheets to the Engineer for his review of the data.

5.3.1 Disposal of Existing Empty Drums, Drummed Wastes and Other Wastes

The Contractor shall construct a temporary secured, bermed and lined storage area for dewatering solids from the drums on the LL site. The drums shall be transported to that pad for dewatering and the Contractor shall take all necessary steps to prevent leakage or spillage of material from the drums during transportation. This may include using overpack drums. Storage of liquids from the drums will remain separate from any other liquids. Upon completion of dewatering of the drum contents, the Contractor will implement the actions described in par. 3.5.D.2 and 3.5.D.3 of Section 02220 of the Specifications.

The Contractor shall dispose of all empty drums and the steel activated carbon tank by appropriate methods in accordance with state and federal regulations.

The Contractor shall dispose of the drill corings and sample jars and their contents by transporting them and thin-spreading on the LTR site in designated areas with all necessary steps being taken to prevent spillage of material during transportation. The Contractor will immediately cover these materials with a minimum of six inches of select fill.

5.3.2 Disposal of Excavated Solid Waste, Soils, and Water Removed by Dewatering Systems

The Contractor shall manage and dispose of excavated solid waste and soils and water removed by dewatering systems in accordance with the procedures outlined in paragraphs 3.5.C, D, and E of Section 02220 of the Specifications.

5.3.3 Disposal of Purge and Development Water

Purge and development water resulting from the installation of groundwater wells will be stored in the temporary secured, bermed and lined storage area in portable tanks or drums. The Contractor will transport this water to the on-site groundwater treatment system when it is complete and able to treat water.

5.3.4 Disposal of Other Waste

The Contractor shall take appropriate steps to obtain approval from treatment/disposal (T/D) facilities for disposal of the wastes. The Contractor shall complete and submit appropriate waste disposal applications to a minimum of three T/D facilities for each type of waste requiring different treatment/disposal methods in order to obtain competitive price quotes. The Contractor shall also be responsible for the collection and shipment of any waste/soil samples required by the T/D facilities.

The Contractor shall provide to the Engineer a full description of transportation options and costs, descriptions of the T/D facilities from which price quotes were requested, addresses and contact names, the facilities' licenses, permits, compliance status, and the facilities' quoted prices for each disposal option signed by a representative of the facility authorized to sign binding price quotes prior to completing final arrangements. The Engineer and Owner shall evaluate the information regarding the transportation options and T/D facilities and select a transportation option and a facility for the wastes to be disposed at. Final selection of a transportation option and T/D facility(ies) shall be based on environmental compliance status, transportation and treatment/disposal cost, and availability.

The Contractor shall prepare the wastes to meet the requirements of the T/D facility(ies) and applicable transportation regulations. The Contractor shall prepare and submit waste transportation and disposal manifests, land ban notices and all other documents required for submittal to the Owner for review at least two (2) weeks prior to off-site disposal of wastes. The Contractor shall prepare transportation and disposal manifests, land ban notices and all other documents required for shipment of wastes, as approved by the Owner, for each load of waste material transported from the site.

5.3.5 Loading and Transport of Wastes

The Contractor shall perform loading activities to minimize the formation of dust. Application of water to roadways and active work areas shall be utilized as required. The Contractor shall conduct all loading activities in accordance with all federal, state, and local regulations. The Contractor shall decontaminate all equipment used for the loading and/or transportation of wastes.

5.4 SOIL/BENTONITE SLURRY WALL

5.4.1 General

Installation Contractor shall have a minimum of five years of experience in successfully installing soil bentonite slurry trenches to equal or greater depths and areas as shown on the Plans and Specifications. Key labor and supervisory personnel shall be experienced in this type of work. A slurry trench specialist approved by the Engineer shall supervise the construction, slurry and backfill preparation and quality control. The minimum criteria for the installation of the slurry wall are shown in the Plans and Specifications and the Contractor shall be responsible for construction methods which account for the actual field conditions. All products for the slurry wall construction activities shall be consistent with Section 02234, Part 2 of the Specifications.

Testing and inspection of the slurry, backfill, stabilizing agent and finished slurry wall shall be performed by the Contractor as part of the Quality Control procedures. The Contractor shall provide all assistance necessary to obtain representative samples of the slurry and backfill for quality assurance checks by Engineer. The Contractor shall use the services of a qualified geotechnical laboratory for the performance of slurry and soil-bentonite backfill conformance testing during construction. The Contractor shall comply with the following reference standards for the soil/bentonite slurry wall activities:

- ASTM American Standard for Testing of Materials.
- API Standard 13B "Standard Procedures for Testing Drilling Fluids."
- ASTM D2434, Permeability of Granular Soils (Constant Head).

5.4.2 Inspection and Testing during Slurry Wall Construction.

The Contractor shall perform the following quality control testing during construction of the slurry wall in accordance with Specification Section 02234:

1. Testing of soil-bentonite shall be through samples collected at mid-point between top and bottom of slurry wall at a frequency as follows:
   - Permeability (per ASTM D5084) - 1 Shelby-Tube sample test for every 1000 CY in place.
   - Slump (per ASTM C143) - 1 Slump cone sample test for every 500 CY in place.
   - Particle-size (per ASTM D422) - 1 Shelby-Tube sample test for every 500 CY in place.
2. Testing of bentonite slurry includes the following tests:
   - Viscosity
   - Filtration
   - Specific gravity or density
   - Sand content
   - pH

   All requirements specified in Section 02234 shall take precedence over the above summarized list. The Contractor shall comply with the following testing sequence:
   - Viscosity, sand content, and specific gravity of the slurry shall be tested during excavation at least daily, after every rainfall, and as directed by the Engineer.
   - Filtration and pH of the slurry shall be tested at least daily at point of mixing.
3. The Contractor shall be responsible for verifying that base of excavation is clear of all loose soil or other foreign materials, as well as verifying the depth of the slurry trench. The Contractor shall be responsible for verifying to the Engineer that the trench is continuous and keyed to the minimum specified

depth into the underlying lower clay unit. Trench continuity shall be assured by the movement of trench excavation equipment, such that the excavating tools can be passed vertically (from top to bottom of the trench) as well as moved horizontally along the axis of the trench without encountering unexcavated material. Verification of the 3-foot key-in depth of the slurry trench, depth of trench and vertical continuity shall be by sounding techniques with a drop line at 10-foot intervals along the centerline of the trench and by visual identification of clay unit during excavation.

5.5 GEOSYNTHETICS

5.5.1 General

The geosynthetic manufacturer shall be a specialist in the manufacture of the particular material and have produced and successfully installed a minimum of five million square feet. The Contractor will be required to submit the following items:

1. Shop Drawings: Including manufacturer's data, specifications, installation instructions and dimensions; an affidavit certifying that each geosynthetic furnished complies with all requirements specified.
2. Geotextile Design Information: The Contractor shall submit for the engineer's review and approval the geotextile manufacturer's design information, design criteria, and design computations demonstrating that the proposed geotextile satisfies the performance requirements. The manufacturer shall use and reference design criteria recommended by the Geosynthetic Research Institute (GRI) to meet the performance requirements of the geotextile filter fabric. In addition, the Contractor shall submit the Apparent Opening Size test data performed according to ASTM D4751.

The geotextile filter fabric shall comply with the average minimum values for the

properties identified in paragraph 2.1.A of Section 02244 of the Specifications. The geotextile erosion control matting shall meet the criteria established in paragraphs 2.2.A thru F of Section 02244 of the Specifications.

5.5.2 Geotextile Filter Fabric Tests

The Contractor shall perform visual field inspections of the geotextile materials and repair any holes or tears. The geotextile manufacturer shall be a specialist in the manufacture of the material and have produced and successfully installed a minimum of five million square feet. The CQA requirements as specified in Section 02244, Geosynthetics shall take precedence over this summarized requirement.

5.6 FENCING

The Contractor or fencing subcontractor shall be a firm experienced in the erection of the type fencing identified in the Specifications. The design criteria shall comply with the standards of the Chain Link Fence Manufacturer's Institute for "Galvanized Steel Chain Link Fence Fabric" and Federal Specification RR-F-191 (latest revision), unless otherwise shown or specified. The Contractor/fencing subcontractor shall provide each type of fence and gate as a complete unit produced by a single manufacturer, including necessary erection accessories, fittings and fastenings. The Contractor/fencing subcontractor shall comply with applicable provisions and recommendations of the following reference standards, except as otherwise shown or specified:

- ASTM A 53, Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless.
- ASTM A 121, Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
- ASTM A 153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- ASTM A 392, Specification for Zinc-Coated Steel Chain-Link Fence Fabric.

- ASTM C 33, Specification for Concrete Aggregates (Including Tentative Revision).
- ASTM C 150, Specification for Portland Cement.
- ASTM G 23, Standard Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.
- Chain Link Fence Manufacturer's Institute, Galvanized Steel Chain-Link Fence Fabric.
- Federal Specification, RR-F-191 (latest revision), Fencing, Wire and Post, Metal (Chain-Link Fence Fabric).

The Contractor/fencing subcontractor shall install the fencing framework, fabric and accessories in accordance with ASTM F 567 and the provisions specified in paragraph 3.3. A thru N of Section 02831 of the Specifications.

5.7 LANDSCAPING

The Contractor or landscape subcontractor shall be specialized in landscaping. The Contractor/landscape subcontractor shall have a minimum of five years of experience of performing substantially similar work.

For source quality control, landscape materials shall be shipped with certificates of inspection as required by governmental authorities and comply with governing regulations applicable to landscape materials. The Engineer shall receive inspection of delivery slips for materials to verify specified quantities of bulk deliveries of soil amendments and fertilizers.

Standard products shall be packaged with the manufacturer's certified analysis. For other materials as applicable, an analysis shall be provided by a recognized laboratory in accordance with methods established by the Association of Official Analytical Chemists or as specified.

Off-site topsoil shall be obtained from local sources and only from naturally well-drained sites where topsoil occurs in depths of not less than 4-inches; not from bogs or marshes. Topsoil shall be inspected by the Engineer before reuse. At the time of inspection the Engineer shall require representative soil samples to be tested for physical properties, pH, organic matter, and available phosphate and potassium. If deficiencies in the topsoil are found, as a result of this analysis, they shall be corrected to meet specifications. The Engineer shall conduct a final inspection, including maintenance to determine acceptability. Materials shall be replaced in rejected areas and specified maintenance shall continue until reinspection by the Engineer has determined the area to be acceptable.

The Contractor/landscape subcontractor shall comply with applicable provisions and recommendations of the following reference standards, except where otherwise shown or specified:

- ASTM C 602, Agricultural Liming Materials.
- ASTM D 2487, Classification of Soils for Engineering.
- ASTM D 977, Emulsified Asphalt.
- Association of Official Analytical Chemists, Official Methods of Analysis.
- Official Seed Analysts of North America, Standards of Quality.
- FSO-F-241D, Fertilizer, Mixed, Commercial.
- Wisconsin Department of Transportation, Standard Specifications for Construction, latest edition.

5.8 INSTALLATION OF STRUCTURES AND STRUCTURE MATERIALS

For source quality control for cast-in-place concrete, the Contractor shall employ an acceptable laboratory to perform materials evaluation, testing and design of concrete mixes. The Contractor shall be responsible for collecting all the necessary samples. The Contractor shall report test results in writing to the Engineer on same day tests are made.

The Owner shall employ a testing laboratory to perform sampling and testing during concrete placement in accordance with the following procedures:

- Sampling: ASTM C 172.
- Slump: ASTM C 143, one test for each load at point of discharge.
- Air Content: ASTM C 31, one for each set of compressive strength specimens.
- Compressive Strength: ASTM C 39, one set for each 100 cubic yards or fraction of concrete; 1 specimen tested at 7 days, 2 specimens tested at 28 days.

Note: When the total quantity of concrete is less than 50 cubic yards, the strength tests may be waived by Engineer if field experience indicates evidence of satisfactory strength.

The Contractor will take field measurements prior to preparation of Shop Drawings and fabrication where required, to ensure proper fitting of the work. The Contractor shall comply with the applicable provisions and recommendations of the following of the following reference standards, except as otherwise shown or specified:

- ACI 301, Specifications for Structural Concrete for Building (includes ASTM Standards referred to herein except ASTM A 36).
- ACI 347, Recommended Practice for Concrete Formwork.
- ACI 304, Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
- ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
- ACI 305, Recommended Practice for Hot Weather Concreting.
- ACI 306, Recommended Practice for Cold Weather Concreting.
- ACI 318, Building Code Requirements for Reinforced Concrete.
- ASTM A 36, Structural Steel.
- Concrete Reinforcing Steel Institute, Manual of Standard Practice, include ASTM Standards referred herein.
- AISC Code of Standard Practice for Steel Buildings and Bridges.

- AISC Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings including "Commentary".
- ASTM A 36, Structural Steel.
- ASTM A 123, Zinc (Hot Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip.
- AWS D1.1, Structural Welding Code.
- ASTM A 366, Steel, Carbon, Cold Rolled Sheet, Commercial Quality.
- ASTM A 385, High Quality Zinc Coatings (Hot-Dip) on Assembled Products.
- ASTM A 525, General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot Dip Process.
- ASTM A 569, Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.
- NAAMM, Metal Finishes Manual, and Metal Bar Grating Manual.

The Contractor shall retain the services of a Professional Engineer registered in the State of Wisconsin to complete the structural design. Design calculations, design drawings, and shop drawings shall be prepared under the direction of this Professional Engineer. All calculations and drawings shall bear the Professional Engineer's seal. The structural design includes the following structures as shown in the Conceptual Layout or identified in the Specifications:

- Treatment Metal Building and Foundation System
- Storage Tanks Metal Building, Foundation System, and Containment Structure
- Miscellaneous Concrete Structures
- Flow Splitter and Support and Miscellaneous Steel Structures

The design shall comply with the applicable provisions and recommendations of the following codes, unless otherwise specified. The more stringent provision will govern if a conflict occurs between codes and the latest editions of codes shall apply:

- Wisconsin Administrative Code (WAC), Structural Requirements
- ACI 318, Building Code Requirements for Reinforced Concrete
- ACI 350R, Environmental Concrete Structures
- ASCE 7-92, Minimum Design Loads for Buildings and Other Structures
- Metal Building Manufacturers Assoc. (MBMA), Metal Building Systems Manual

All structures shall be designed and constructed to safely support all loads, as specified. The Contractor shall provide and install all structures and structural materials in accordance with Section 03000 of the Specifications, including:

- Concrete Materials
- Grout
- Structural Steel
- Steel Grating
- Anchorage Devices
- Control Room and Restroom Materials

5.8.1 Concrete Work

The Contractor shall construct all concrete framework in compliance with ACI 347. Ready mixed concrete shall comply with ASTM C 94. Placement of concrete shall comply with ACI 304 and ACI provisions for cold weather (ACI 306) and hot weather (ACI 305) as appropriate. The Contractor shall make all concrete solid, compact and smooth, and free of laitance, cracks and cold joints. All concrete for liquid retaining structures, and all concrete in contact with earth, water, or exposed directly to the elements shall be watertight. The Contractor shall cut out and properly replace to the extent ordered by the Engineer, or repair to the satisfaction of the Engineer, surfaces which contain cracks or voids, are unduly rough, or are in any way defective. Patches or plastering will not be acceptable.

The Contractor shall begin initial curing as soon as free water has disappeared from exposed surfaces and where possible, keep continuously moist for not less than 72 hours.

Contractor shall continue curing by using a moisture-retaining cover and shall cure formed surfaces by moist curing until forms are removed. Contractor shall provide protection as required to prevent damage to exposed concrete surfaces. Curing by use of membrane-forming curing compound meeting ASTM C309, Type I, shall be used only when authorized by the Engineer.

5.8.2 Reinforcement, Joints and Embedded Items

The Contractor shall comply with the applicable recommendations of specified codes and standards, and the CRSI (Manual of Standard Practice) for details and methods of reinforcement placement and supports. The Contractor shall provide construction, isolation, and control joints as specified or required. The Contractor shall set and build anchorage devices and embedded items required for other work attached to or supported by cast-in-place concrete.

5.8.3 Grout

The Contractor shall place grout in accordance with the manufacturer's instruction and as specified by the Engineer is the instructions differ from the Specifications. Manufacturers of proprietary products shall make available the services of a qualified employee to aid in assuring proper use of the product. Temperature and weather limitations shall be consistent with concrete standards. For equipment bases, the Contractor shall completely fill void space with a non-shrink cementatious grout in accordance with Specifications.

5.8.4 Structural Steel Erection

The Contractor shall comply with the AISC Specifications and Code of Standard Practice for erecting steel structures. All structures shall be level and plumb within tolerances as specified in the AISC Manual.

5.8.5 Steel Grating Installation

The Contractor shall use anchorage devices and fasteners to secure grating , as recommended by the manufacturers. The Contractor shall perform all cutting, drilling, fitting and welding required for installation in accordance with the manufacturer's instructions and operating regulations.

5.8.6 Anchorage Devices Installation

The Contractor shall use drilling equipment and install expansion anchors in accordance with the manufacturer's instructions. Expansion anchors shall not be used for pipe larger than 2 inches in diameter unless otherwise shown or approved by the Engineer. Concrete inserts shall be used in accordance with manufacturer recommendations. The Contractor shall conform to the minimum distances for placement of expansion anchors in accordance with paragraph 3.11 of Section 03000 of the Specifications, unless otherwise shown or approved by the Engineer.

5.8.7 Interior Room Materials Installation

All interior room materials shall be constructed or installed by the Contractor in accordance with the manufacturer's recommendations and as specified in Section 03000 of the Specifications.

5.8.8 Painting

The Contractor's manufacturer will provide products manufactured by either one of the following companies or equal; Kop-Coat/Carboline Company, Incorporated or Tnemec Company, Incorporated. The Contractor shall comply with applicable provisions and recommendations of the following reference standards, except where otherwise shown or specified:

- ANSI A13.1, Scheme for the Identification of Piping Systems.
- OSHA 1910.144, Safety Color Code for Marking Physical Hazards.

- SSPC Volume 2, Systems and Specifications, Surface Preparation Guide and Paint Application Specifications.

In accordance with requirements of regulatory agencies, coatings for surfaces in contact with potable water or water being treated for potable use shall not impart any taste or odor to the water or result in any organic or inorganic content in excess of the maximum contaminant level established by applicable laws or regulations. All such coatings shall be approved by the applicable regulatory agency.

5.9 WELL INSTALLATIONS AND APPURTENANCES

5.9.1 Observation, Leachate Head Level and Monitoring Wells

The Contractor shall comply with the requirements of the following reference standards unless otherwise specified:

- AWWA A100 Standard for Water Wells.
- ASTM D1586
- OSHA Requirements (29 CFR 1910 and 1926)

The Contractor shall comply with all federal, state, or local laws, ordinances, or rules and regulations relating to the performance of the work. Where provisions of the pertinent codes, standards and the regulations conflict with this Specification the more stringent provision shall govern. The Contractor shall comply with the Wisconsin Administrative Code, Chapter NR 141 and Chapter NR 508. The Contractor shall be experienced in the installation of wells and shall employ persons on this project site of sufficient experience and competency to classify soils and develop the soil boring logs as specified. The Contractor shall designate this person and identify this person to the Engineer prior to the soil boring work.

The Contractor shall develop all monitoring wells in accordance with Section 11211.01, 3.2 of the Specifications. A water well report and updated Well Information Form

(WIF) shall be completed by the Contractor and submitted to the Engineer and WDNR within 60 days of the completion of any well.

5.9.2 Ground Water Extraction and Leachate Collection Wells

The Contractor shall comply with the requirements of the following reference standards unless otherwise specified:

- American Welding Society Standard Qualification Procedure.
- American Welding Society Specifications.
- ASTM A53, Specifications for Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless.
- AWWA A100 Standard for Water Wells.
- OSHA Requirements.

The Contractor shall comply with all federal, state, or local laws, ordinances, or rules and regulations relating to the performance of the work. Where provisions of the pertinent codes, standards and the regulations conflict with this Specification the more stringent provision shall govern. The Contractor shall comply with the Wisconsin Administrative Code, Chapter NR 812 (formerly NR 112) and Chapter NR 141, Section NR 141.20. The Contractor shall be experienced in installation of pumping wells and shall employ persons on this project site of sufficient experience and competency to classify soils and develop the soil boring logs as specified. The Contractor shall designate this person and identify to the Engineer prior to the work.

The Contractor shall perform a step-drawdown pumping test on each installed well to determine each well's capacity, and submit the raw data to the Engineer. The Contractor shall perform a constant rate time-drawdown test on each installed well to determine aquifer characteristics:

1. Based on the results of the step-drawdown test, the Contractor shall determine a pumping rate for the time-drawdown test that will use most of the available drawdown. The rate shall be approved by the Engineer.

2. The well shall be pumped at a constant rate continuously for a minimum of 24 hours and a maximum of 72 hours. The test may be terminated prior to 72 hours if the Engineer determines that steady-state conditions have been achieved. The pumping rate shall be measured and recorded every 15 minutes for the first 2 hours, then every hour thereafter.

3. Water levels in the pumped well and any existing monitoring wells within 100 ft. of the pumped well shall be measured to the nearest 0.01 ft. during the test. Levels shall be recorded at these approximate intervals:

Time Since Pump Started (or Stopped)	Pump Well Time intervals	Observation Wells
0-5 min.	15 sec.	1 min.
5-60 min.	5 min.	5 min.
60-120 min.	15 min.	15 min.
2-6 hr.	60 min.	60 min.
6 hr. to end of test	120 min.	120 min.

4. When the pump is stopped at the end of the test, well recovery in pumping and observation wells shall be measured until the well reaches 90% recovery, or for 12 hrs., whichever occurs first in the pumping well and observation wells. The data shall be recorded at the time intervals specified in paragraph 3.3-B-3.

5. The Contractor shall reduce the pumping test data by methods appropriate to the test conditions. The Contractor shall submit to the Engineer:
   a. Calculations of tranmissivity;
   b. Calculations of storativity (if data are available from a observation well).
   c. All raw data recorded during the test.
   d. Documentation of the test equipment and set-up configuration.

6. The Contractor shall comply with the provisions of Paragraph 3.3-E, of Section 11211 of the Specifications, concerning the disposal of pumping test discharges.

The Contractor shall complete boring and well installation logs in accordance with Section 11211 of the Specifications and submit the logs to the Engineer and WDNR, as required by the Wisc. Adm. Code NR 112 and NR114 within 60 days of well installation.

The Contractor shall be responsible for providing all necessary power, pumps, prime movers, pipelines, hoses, meters, gauges, electric cables, extension cords, motor starters, protection controls, etc. necessary to complete the testing. Pumps used for this work shall be of sufficient capacity to fully develop the well and measure the well's capacity. The Contractor shall comply with all applicable federal and state regulations, including manifesting, placarding, etc.

5.9.3 Abandonment of Wells and Borings

The Contractor shall comply with all federal, state, or local laws, ordinances, or rules and regulations relating to the performance of the work. Where provisions of the pertinent codes, standards and the regulations conflict with this Specification the more stringent provision shall govern. The Contractor shall comply with the Wis. Adm. Code NR 141 and Chapter NR 508.

5.9.4 Sump and Sample Pumps

Sump and sample pump equipment shall be furnished as a standard product of the manufacturer. All sump pump equipment shall be the product of one manufacturer. The manufacturer's products and installation procedures shall comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

- Wisconsin Administrative Code
- Standards of the Hydraulic Institute
- National Electric Code
- Standards of National Electrical Manufacturers Association
- Institute of Electrical and Electronic Engineers
- American National Standards Institute

5.10 AIR STRIPPING SYSTEM

The Contractor shall require the manufacturers of products specified for the air stripping system to have at least 2 years experience in producing the type of units and show evidence of at least 3 installations in satisfactory service for a minimum of one year.

Air stripping units, blowers, and the main control panel shall be tested for their intended functions by the manufacturer before shipment. The manufacturer shall submit to the Contractor the test reports certifying that the tested units are fully functional and free of defects before shipment. The following tests are required:

1. Air Stripping Units: Test each assembled unit filled with potable water. Verify aerator performance with a shop blower connected to the assembled unit.
2. Blowers: Test each blower with the actual motor for smooth running, noise level as specified, and vibration level to the manufacturer's published vibration criteria.
3. Main Control Panel: All system hardware components shall be tested to verify proper operation of the equipment. Test shall include, but not be limited to, the following:
    a. AC/DC power checks.
    b. Power fail/restart tests.
    c. Diagnostic checks.
    d. Test demonstrating that all specified equipment functional capabilities are working properly.
    e. All PLC input/output devices shall be tested to verify proper operation and basic calibration. PLC I/O testing shall be performed with simulated digital and analog input and output signals.

The air stripping system shall be installed as an integrated system. When inspecting and installing the air stripper system, the Contractor shall perform all on-site testing and

certification as required for the system. The Contractor shall provide all field labor and equipment for the installation of the platform/stand, grating, ladder, etc. as specified and shall install air stripping units on said platform/stand. The Contractor shall make all water, air and instrumentation connections under the direct supervision of the specified air stripping system manufacturer's representative. The Contractor shall locate flowmeters in vertical piping section so as to provide minimum straight uninterrupted piping runs of 10 pipe diameters upstream and 5 pipe diameters downstream from the flow transducers, in accordance with manufacturer's recommended installation instructions.

For field quality control, the Contractor shall retain a qualified representative of the manufacturer for a minimum period of 60 hours (on-site time exclusive of travel), which may not necessarily be consecutive, to perform the following services. A minimum of three field trips are required. If more trips are required as determined by the Engineer, additional trips shall be made.

Equipment Installation (40 hours minimum):

- Supervise installation of the equipment and accessories as specified in paragraph 3.1 A.1 of Section 11379 of the Specifications.
- Inspect the completed installation and note any deficiencies or changes.
- Assist the Contractor during start-up, adjusting, and field testing of completed installation.
- Furnish test forms, procedures for field testing and proposal to dispose of failed discharge water during field testing.
- Instruction of Owner's operating personnel (16 hours minimum).

The following field testing procedures shall be conducted as part of the field quality control for the air stripping system:

Field test and calibrate equipment to demonstrate to the Owner's representative that all equipment will satisfactorily perform the functions and criteria identified in the Specifications. Provide the Owner with all required test apparatus. Follow testing procedures recommended by the manufacturer and approved by the Engineer. Repeat

field test after modifications and/or additions are made to the system, until test results are satisfactorily accepted by the Engineer. During on-site field testing, the treated water shall be sampled and tested every hour for two 8-hour days with a portable gas chromatograph to provide immediate data on TCA removal efficiency of the units. When test results of two consecutive 8-hour days meet the specified TCA removal efficiency, the system will be considered to be acceptable. If the air stripping system fails to conform to required treatment at the end of the first testing day period, additional tests - one every hour for two 8-hour days shall be performed for as long a period of time as necessary so that test results of two consecutive 8-hour days meet or exceed the treatment requirement specified for TCA removal efficiency. The Contractor shall be responsible for the ultimate disposal of the failed discharge water during field testing. Use of polishing pond during field testing will not be permitted. The Contractor shall be responsible for storage of treated water. Use of installed storage tanks may be acceptable upon the Engineer's approval.

The Contractor shall demonstrate that the installed system is fully operational for a consecutive 14 calendar-day period. During this demonstration period, the Contractor shall be responsible for the system operation and meeting the discharge permit limitations. After the successful demonstration, the Owner shall assume responsibility for the operation of the system.

After the equipment is fully operational for 14 days, and before the Owner assumes responsibility for the operation of the equipment, the equipment manufacturer's operating specialists shall instruct the Owner's operating personnel in the care, maintenance and proper operation of the equipment. The Contractor shall retain qualified representatives of the manufacturers to instruct the Owner's personnel in the fundamentals, operation, aerator de-scaling, troubleshooting and maintenance of the equipment and accessories specified, and shall provide the following minimum training hours:

- Air Stripping System Including Blowers: 4 hours.
- General Instrumentation and Control System: 8 hours.
- Programmable Logic Controller (PLC): 16 hours.

The manufacturer shall prepare installation reports and submit the reports within 30 days after completion of field testing and operation instruction. The reports shall include the following information:

- Field testing reports.
- Description of installation deficiencies not resolved to the Owner's satisfaction.
- Description of problems or potential problems.
- Record copy of materials used for the training sessions including an outline summary of the course.
- Wisconsin Administrative Code.
- Standards of the Hydraulic Institute.
- National Electric Code.
- Standards of National Electrical Manufacturers Association.
- Institute of Electrical and Electronic Engineers.
- American National Standards Institute.

5.11 METAL BUILDING SYSTEM

All Work of the metal building system shall comply with the requirements of the Wisconsin Administrative Code. The Contractor shall comply with the applicable provisions and recommendations of the following reference standards, except as otherwise shown and specified:

- Metal Building Manufacturers Association (MBMA), Metal Building Systems Manual.
- Steel Structures Painting Council (SSPC), Steel Structures Painting Manual Vol. 2.
- Underwriters' Laboratories Incorporated (U.L.) Bulletin of Research No. 52, Development of Apparatus and Test Method for Determining Wind-Uplift Resistance of Roof Assemblies.
- Federal Specification (FS) TT-P-636D, Primer Coating, Alkyd, Wood and Ferrous Metal.

The Contractor shall comply with the following building fabrication criteria:

1. Provide prefabricated metal buildings as produced by a manufacturer who is regularly engaged in the fabrication and erection of pre-engineered metal structures of the type and quality indicated.
2. Design sizes of prefabricated components and necessary field connections required for erection to permit easy assembly and disassembly. Fabricate components in such manner that once assembled they may be disassembled, repackaged and reassembled with a minimum amount of labor and maximum salvageability.
3. Clearly and legibly mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.

The Contractor shall provide an erector who is approved by the manufacturer, and has erected at least two structures fabricated by manufacturer. The Contractor shall retain the services of a metal building manufacturer who has on staff a Professional Engineer registered in the State of Wisconsin to complete the metal building design. Design calculations, design drawings, and shop drawings shall be prepared under the direction of this Engineer. All calculations and drawings shall bear his seal.

5.12 FIBERGLASS REINFORCED POLYESTER TANKS

The manufacturer of the tanks shall have at least 5 years experience in producing fiberglass reinforced polyester tanks and shall show evidence of at least 5 installations in satisfactory service. Each tank shall be hydrostatically tested by the manufacturer at tank capacity for four-hours before shipment. Each tank shall be inspected for defects in accordance with requirements of ASTM D 2563.

The Contractor shall retain manufacturer's technical representatives with demonstrated ability and experience in installation and operation to perform the services listed below:

1. Supervise installation of all equipment.
2. Inspect the completed installation and prepare an inspection report.
3. Instruct operating personnel in operation and user maintenance.

The Contractor and manufacturer representatives shall comply with applicable provisions and recommendations of the following except as otherwise indicated in the Specifications:

- ASTM C 33, Concrete Aggregates.
- ASTM D 3299, Filament-Wound Glass Reinforced Polyester Chemical-Resistant Tanks.
- ASTM D 2563, Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts.
- NBS Voluntary Product Standard PS15 - Custom Contact-Molded Reinforced-Polyester Chemical-Resistant Process Equipment.

For field quality control, the Contractor shall retain a qualified representative of the manufacturer for a minimum period of 2 hours to perform the following equipment installation services:

1. Oversee installation of the equipment and accessories specified herein.
2. Inspect the completed installation and note deficiencies.

Additionally, the manufacturer shall furnish test forms and procedures for field testing.

The Contractor shall comply with the following field testing provisions and recommendations :

1. Provide all test apparatus required.
2. Follow testing procedures recommended by the manufacturer and approved by the Engineer.
3. After installation is complete but before piping connections are made, block all outlets and fill the tank with water to the overflow elevation.

4. The tank must maintain the overflow elevation level with zero-leakage for a 24-hour period.
5. Repair all leaks in accordance with manufacturer's instructions.
6. Use of raw ground water for field testing may be acceptable. The Contractor shall be responsible for disposal of the water.

The Contractor shall prepare the manufacturer's installation reports and submit within 30 days after completion of field testing and operation instruction. The reports shall be prepared in accordance with the requirements of Section 01730, Operation and Maintenance Data of the Specifications, and shall include the following:

- Field testing reports.
- Description of installation deficiencies not resolved to the Owner's satisfaction.
- Description of problems or potential problems.

5.13 PIPING

5.13.1 Buried Piping Installation

The Contractor shall comply with the following regulatory agency's requirements for buried piping:

- Requirements of NFPA Standard No. 24 for "Outside Protection" where applicable to water pipe systems used for fire protection.
- Requirements of UL, FM and other jurisdictional authorities, where applicable.
- General and Supplementary Conditions regarding permit requirements for this project.

The Contractor shall comply with applicable provisions and recommendations of the following reference standards, except as otherwise indicated in the Specifications:

- ANSI B31.1, Power Piping.
- ASTM D 2321, Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
- ASTM D 2774, Practice for Underground Installation of Thermoplastic Pressure Piping.
- AWWA M23, PVC - Design and Installation.
- ASCE MOP No. 37, Design and Construction of Sanitary and Storm Sewers.
- ASTM C 478, Specifications for Precast Reinforced Concrete Manhole Sections.

The Contractor shall comply with the following general pipe testing provisions and recommendations:

1. Test all piping except as otherwise authorized by Engineer.
2. Notify Engineer 48 hours in advance of testing.
3. Provide all testing apparatus, including pumps, hoses, gages, and fittings.
4. Unless otherwise noted, pipelines shall hold specified test pressure for two hours.
5. Repair and retest pipelines which fail to hold specified test pressure or which exceed the allowable leakage rate.
6. Unless otherwise specified, test pressures required are at the lowest elevation of the pipeline section being tested.
7. Conduct all tests in the presence of the Engineer.
8. Advise local authorities having jurisdiction if their presence is required during testing.
9. Test piping at the test pressure listed in the Buried Piping Schedule.
10. For piping not included in the Schedule, the Engineer shall notify the Contractor in writing of the test pressure to be used.

The Contractor shall comply with the following pressure test procedures:

1. Complete backfill and compaction at least to the pipe centerline before testing, unless otherwise required or approved by Engineer.
2. Allow concrete for thrust blocks to reach design strength before testing.
3. Fill section to be tested slowly with water and expel all air. Install corporation cocks, if necessary, to remove all air.
4. Test only one section of pipe at a time.
5. Apply specified test pressure for two hours and observe pressure gage. Check carefully for leaks while test pressure is being maintained.

The Contractor shall comply with the following leakage testing procedures:

1. Conduct leakage test for all liquid-conveying piping after satisfactory completion of pressure test.
2. Allow concrete pipe to remain full of water at least 12 hours prior to starting leakage test.
3. Allowable Leakage Rates (gallons per hour per 1,000 feet per inch diameter): Thermoplastic Pipe: 0.0.
4. Leakage Test Procedure:
    a. Examine exposed pipe, joints, fittings and valves. Repair visible leakage or replace the defective pipe, fitting or valve.
    b. Refill the line under test to reach the required test pressure.
    c. Provide a test container filled with a known quantity of water at the start of the test. Attach the test pump suction to the test container.
    d. Pump water from the test container into the line with the test pump to hold the specified test pressure for the test period. Water remaining in the container shall be measured and the amount used during the test shall be recorded on the test report.

e. Perform all repair, replacement, and retesting required because of failure to meet testing requirements.

f. Leakage shall be less than rate specified above.

The Contractor shall comply with the following exfiltration testing procedures:

1. Plug and bulkhead the section of pipe to be tested at both ends and admit water until the pipe is full.
2. Bring water level to a height of not less than 4 feet above the exterior crown of pipe at the upstream end and maintain at that level for duration of the test.
3. Measure leakage from the pipe through drop in water surface in a manhole or other column used to maintain pressure, provided the part of the riser above the sewer where the water level is monitored is not less than 6 inches in diameter.
4. Duration of test shall not be less than 6 hours.
5. Leakage shall not exceed allowable leakage rates specified in Paragraph 3.4.D.3 of Section15051 of the Specifications.

The Contractor shall comply with the following vertical deflection test provisions for thermoplastic pipe:

1. After completion of backfill and at a time approved by the Engineer, the Contractor shall manually pull a 9-arm mandrel type gage through the pipe. Gage shall be set so that if vertical deflection of pipe exceeds 5 percent, it will stop. The Contractor shall excavate and relay all such piping. Gage shall be as manufactured by Quality Test Products, or equal.
2. Deflection test shall be conducted after the final backfill has been in place at least 30 days to permit stabilization of the soil-pipe system.

5.13.2 Exposed Piping Installation

The Contractor shall comply with the provisions and requirements of the regulatory agencies as follows:

- Applicable requirements of NFPA Standard No. 13 for "Installation of Sprinkler Systems" and NFPA Standard No. 14 for "Standpipe and Hose Systems" used for fire protection.
- Requirements of UL, FM and other jurisdictional authorities, where applicable.
- Refer to the General and Supplementary Conditions regarding requirements for this Project.

The Contractor shall comply with applicable provisions and recommendations of the following reference standards, except as otherwise shown or specified:

- ANSI B13.1, Code for Pressure Piping.
- ANSI B31.1, Power Piping.
- ANSI D1.1, Structural Welding Code.
- AWWA M23, PVC Piping.
- Manufacturers Standardization Society of the Valve and Fittings Industry:
  a. MSS SP-58, Pipe Hangers and Supports - Materials and Design.
  b. MSS SP-69, Pipe Hangers and Supports - Selection and Application.
- Federal Specification, FS WW-H-171, Hangers and Support, Pipe.
- ASTM A 575, Merchant Quality Hot-Rolled Carbon Steel Bars.
- Underwriters' Laboratories, Inc., Standard UL-203-Pipe Hanger Equipment.

The Contractor shall comply with the following general provisions and recommendations for testing of pipe:

1. Test all piping as specified below unless otherwise authorized by Engineer.
2. Notify Engineer 48 hours in advance of testing.
3. Provide all testing apparatus including pumps, hoses, gages, and fittings.

4. Pipelines shall hold the specified test pressure for two hours.
5. Repair and retest pipelines which fail to hold specified test pressures or which exceed the allowable leakage rate.
6. Test pressures required are at the lowest elevation of the pipeline section being tested, unless otherwise specified.
7. Conduct all tests in the presence of the Engineer. Repeat tests in the presence of local authorities having jurisdiction, if required.
8. Test piping at the test pressure listed in the Exposed Piping Schedule.
9. For piping not included in the Schedule, the Engineer will notify Contractor in writing of the test pressure to be utilized.

The Contractor shall comply with the following pressure test procedures:

1. Insure that all supports and restraint protection are securely in place.
2. Fill section to be tested slowly with water and expel all air. Install cocks, if necessary, to ensure removal of air.
3. Test only one section of pipe at a time.
4. Apply specified test pressure required for two hours and observe pressure gage. Check carefully for leaks while test pressure is being maintained.

The Contractor shall comply with the following leakage testing procedures:

1. Conduct leakage test for air piping at operating pressure.
2. Leakage Test Procedure:
    a. Examine exposed pipe, joints, fittings and valves. Repair visible leakage or replace the defective pipe, fitting or valve.
    b. Pressurize the line to maximum operating pressure.
    c. Apply soap solution at each joint. Visually inspect joint for leakage and repair as required.
    d. Repeat test until no leakage is observed.

The Contractor shall comply with the following general provisions and recommendations for testing the drainage pipe:

1. Test all drainage piping installed under this Section 15052 of the Specifications.
2. Provide all testing apparatus required.
3. Notify Engineer 48 hours in advance of test.
4. Conduct all tests in presence of Engineer and in presence of local authorities having jurisdiction.

The Contractor shall comply with the following testing procedures for drainage piping:

1. Perform test on entire system or on individual sections as approved by Engineer.
2. Completely seal all openings except highest opening in system or section to be tested.
3. Fill with water completely and test with at least 10 feet of water above highest point.
4. Allow water to stand in system for at least 15 minutes. Inspect for leaks and repair all leaks found. Retest repaired sections.

5.13.3 Thermoplastic Pipe and Accessories

The Contractor shall comply with the latest edition of the following reference standards for thermoplastic piping and accessories:

- ASTM D 1784, Rigid Poly (Vinyl Chloride) PVC Compounds and Chlorinated Poly (Vinyl Chloride) CPVC Compounds.
- ASTM D 1785, Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- ASTM D 2564, Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

- ASTM D 2467, Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- ASTM D 2464, Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- ASTM D 2513, Thermoplastic Gas Pressure Pipe, Tube and Fittings.
- ASTM D 2241, Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
- ASTM D 3034, Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- ASTM D 1238, Measuring Flow Rates of Thermoplastics by Extrusion Plastometer.
- ANSI B2.1, Pipe Threads.

5.14 VALVES AND APPURTENANCES

The Contractor's manufacturer shall have a minimum of 5 years of experience in the production of substantially similar equipment, and shall show evidence of satisfactory service in at least 5 installations. Each type of valve shall be the product of one manufacturer. All valves shall be fully assembled and shop-inspected for proper seating and shall be fully opened and closed to ensure they operate freely. The Contractor shall coordinate primer and finish paint systems with paint manufacturer.

The Contractor shall comply with applicable provisions and recommendations of the following reference standards, except as otherwise indicated in the Specifications:

- AWWA C500, Gate Valves for Water and Sewerage Systems.
- AWWA C504, Rubber-Seated Butterfly Valves.
- AWWA C507, Ball Valves, 6 Inch Through 48 Inch.
- AWWA C508, Swing Check Valves for Waterworks Service, 2 in. through 24 in. NPS.
- AWWA C509, Resilient-Seated Gate Valves, 3 through 12 NPS, for Water

and Sewerage Systems.

- AGMA Standards.
- NEMA, National Electrical Manufacturer's Association.

The Contractor shall retain a qualified representative of each electrically operated valve manufacturer for a minimum period of 8 hours to perform the following services:

1. Oversee installation of the equipment and accessories specified herein.
2. Inspect the completed installation and note deficiencies.
3. Assist Contractor during start-up, adjusting, and field testing of completed installation.
4. Furnish test forms and procedures for field testing.

For field testing, the Contractor shall field test and calibrate equipment to demonstrate that all equipment will satisfactorily perform the functions and criteria identified in the Specifications, follow testing procedures recommended by the manufacturer and approved by the Engineer and provided all test apparatus.

After equipment is fully operational, and before the Owner will assume responsibility for the operation of the equipment, the equipment manufacturers operating specialists shall instruct the Owner's operating personnel in the care, maintenance and proper operation of the equipment. During the first 30 days of continuous operation of the equipment, the Contractor shall retain a qualified representative of the manufacturers for a minimum period of 8 hours to instruct the Owner's personnel in the fundamentals, operation, troubleshooting and maintenance of the equipment and accessories. All training sessions shall be video-taped by Contractor in compliance with Section 01660 of the Specifications. The Owner's operating personnel shall comply with the provisions and recommendations in Section 01661 of the Specifications.

5.15 PLUMBING

The Contractor shall retain the services of a Professional Engineer registered in the State of Wisconsin to provide the detailed plumbing design for this project. Design calculations, design drawings, and shop drawings shall be prepared under the direction of Contractor's Engineer. All calculations and Drawings shall bear his seal. The plumbing design shall be in accordance with the applicable provisions and recommendations of the following codes except as otherwise shown in the Specifications. Where conflict occurs between codes, the more stringent provision shall govern and the latest editions of the codes shall apply:

- WAC, The Wisconsin Administrative Code.
- NEC, The National Electrical Code.
- ASHRAE, The American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
- ANSI, American National Standards Institute.
- NFPA, National Fire Prevention Association.
- NESC, The National Electrical Safety Code.
- Local codes in effect for this location.

The plumbing design shall be based on the plumbing work requirements as identified in the Specifications. The Contractor shall submit final record copies of plumbing design calculations and design drawings for the project. Each shall bear the seal of a Professional Engineer registered in the State of Wisconsin.

In the implementation of the requirements of general and special conditions, the plumbing subcontractor shall give full cooperation to other trades and shall furnish in writing to the Contractor and other subcontractors with copies to the Engineer, any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay. Where the work of the plumbing subcontractor will be installed in close proximity to, or will interfere with work of other trades, the Contractor shall

assist in working out space conditions to make a satisfactory adjustment. The plumbing subcontractor shall prepare composite working drawings and sections at a suitable scale not less than 1/4 inch to 1 foot, clearly showing how his work is to be installed in relation to the work of other trades. The plumbing subcontractor shall also furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

All plumbing piping shall be tested in accordance with local requirements. The Contractor shall conduct the testing for the drainage and vent system piping in the following manner:

1. Perform tests either on the entire system or on successive sections of the system.
2. Tightly close all openings except the highest opening of the system or section to be tested.
3. Fill the system or section with water to the point of overflow.
4. Test with a head of at least 10 feet of water, except for the uppermost 10 feet of the system.
5. Allow water to stand in the system for at least 15 minutes before inspecting.
6. Inspect the system or section for leaks, and repair any leaks found.

5.16 HEATING, VENTILATION AND AIR CONDITIONING

The Contractor shall retain the services of a Professional Engineer registered in the State of Wisconsin to provide the detailed HVAC design for this project. Design calculations, design drawings, and shop drawings shall be prepared under the direction of Contractor's Engineer and shall bear the seal of the Engineer. The HVAC design shall comply with the applicable provisions and recommendations of the following codes except as otherwise shown or specified. Where conflict occurs between codes, the more stringent provision shall govern and the latest editions of codes shall apply:

- WAC, The Wisconsin Administrative Code.
- NEC, The National Electrical Code.
- ASHRAE, The American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
- NSI, American National Standards Institute.
- NFPA, National Fire Prevention Association.
- NESC, The National Electrical Safety Code.
- Local codes in effect for this location.

The HVAC design shall be based on the HVAC work requirements as identified in the Specifications. The Contractor shall submit final record copies of HVAC design calculations and design drawings for the project. Each shall bear the seal of a Professional Engineer registered in the State of Wisconsin.

The Contractor shall retain a qualified representative of the manufacturer for a minimum period of 4 hours to perform the following services:

1. Oversee installation of the equipment and accessories specified herein.
2. Inspect the completed installation and note deficiencies.
3. Assist the Contractor during start-up, adjusting, and field testing of completed installation.

The manufacturer's representative shall revisit the job site as often as necessary until all trouble is corrected and the installation is entirely satisfactory to the Engineer.

5.17 ELECTRICAL WORK

All electrical work material and equipment shall be installed in accordance with the current standards and recommendations of the National Electric Code and any local electrical code which may apply. Where discrepancies arise between codes, the most restrictive regulation shall apply. All electrical material and equipment shall be new and

shall bear the label of the Underwriters' Laboratories, Inc. (UL), Factory Mutual Research Corporation (FM) or equal nationally recognized independent laboratory, wherever standards have been established and label service regularly applies. All electrical material and equipment shall conform in all respects to the latest approved reference standards as follows:

- National Electrical Manufacturers Association, NEMA.
- The American National Standards Institute, ANSI.
- The Institute of Electrical and Electronic Engineers, IEEE.
- Insulated Power Cable Engineers Association, IPCEA.
- National Electrical Code, NEC.
- National Electrical Safety Code, NESC.
- National Fire Protection Association, NFPA.
- Lightning Protection Institute, LPI.
- Local and State codes in effect for the site location.

The Contractor shall conduct standard installation tests with inspections to ensure that the following conditions exist:

- Connections: All circuits are properly connected in accordance with the Drawings and applicable approved Shop Drawings.
- Operation: All circuits and devices are operable.
- Identification: All conductors are properly identified at each terminal.

The Contractor shall conduct the following operational test provisions and recommendations:

- Operate all starters, circuit breakers and associated equipment to demonstrate suitability and compliance with Specifications and reference standards, except for short circuit interrupting rating or other inherent design features covered by shop tests.
- Test each electrical system after permanent cables are in place to demonstrate

that all circuits and equipment perform satisfactorily and that they are free from improper grounds and short circuits.

- Test all motors for direction of rotation and reverse connections if necessary.
- Check control circuits to determine that operation and sequence are correct and adjust limit switches, pressure switches, float switches, timers and other devices to give proper operation.

The Contractor shall conduct the following cable insulation testing provisions and recommendations in accordance with the Specifications:

1. Test each electrical circuit after cables are in place to demonstrate that the circuit and connected equipment perform satisfactorily and that they are free from improper grounds and short circuits.
2. Individually test all power, control and instrumentation cables for insulation resistance between phases and from each phase to ground.
   a. Test immediately after cables are installed, before they are put in service, in accordance with the following procedures and requirements:
      1) Measure the insulation resistance at 500 volts d.c. with a hand cranked "megger" insulation testing instrument, hand cranked Biddle Series 8000 is suitable. Battery driven testers will not be acceptable.
   b. Test instruments are to be provided by the Contractor.
3. If any insulation resistance measures less than 50 megohms, corrective action must be taken and testing repeated until the insulation is satisfactory to the Engineer.
4. Maintain a written record of circuits being tested, marking down circuit number or descriptive function and results of each step in the test procedures including repeated tests. Submit copies of written records within 10 days after tests are performed.

5. Electrical panels, equipment and devices need not be subjected to the insulation resistance tests twice. Therefore, panels, equipment and devices that have been previously subjected to these tests and for which a satisfactory certified test report, that is dated less than 6 months prior to installation, is submitted shall be isolated from the electrical distribution system while the insulation tests are performed.
6. Any cable which fails the insulation tests or which fails when energized shall be replaced with a new cable for the full length.

The Contractor shall comply with the following grounding system test provisions and recommendations:

1. Test the completed ground systems for continuity and for resistance to ground using an electrical ground resistance tester.
2. If the resistance to ground is greater than five ohms, the Contractor shall take corrective action, and repeat testing until resistance is less than five ohms.

MALCOLM PIRNIE

6

6

RECYCLED PAPER

6.0 SAMPLING, INSTALLATION DATA AND EQUIPMENT TESTING

This section describes the requirements for sampling and testing related to shop drawing samples, installation data and equipment testing for the quality procedure tasks discussed in the previous section. Sampling, installation data and equipment requirements for the specified work are further detailed in the Specifications. The Specifications are to be used along with the CQA Plan for clarification and interpretation of the requirements.

6.1 SAMPLING AND TESTING

6.1.1 Samples

The submittal of related shop drawing samples shall conform to the requirements of the General Conditions and to procedures described in the Specifications. Samples and shop drawings which are related to the same unit of work or Specification shall be submitted at the same time.

The Contractor shall review, approve, and submit all samples promptly. Samples shall be identified with correct reference to Specification Section, page, article and paragraph number, and drawing number when applicable. Samples shall clearly illustrate functional characteristics of the product and all related parts and attachments, and full range of color, texture, pattern and material. Samples shall be furnished so as not to delay fabrication, allowing the Engineer reasonable time for the consideration of the samples submitted.

The Contractor shall submit at least three samples of each item required for the Engineer's approval. Submission of samples shall conform to all applicable provisions under Shop Drawing Submittal and Correspondence Procedures of the Specifications. Two of the samples shall be delivered to the Engineer's home office unless otherwise authorized by the Engineer. One sample shall be delivered to the Engineer's field office. If the Contractor requires a sample for his use, he shall notify the Engineer in writing. The Contractor shall make all corrections required and shall resubmit the required number of new samples until approved.

The Contractor shall furnish test samples of material as may be required for examination and test. All samples of materials for tests shall be taken according to standard methods and as required by the Contract Documents.

6.1.2 Testing Laboratory Services

The Contractor shall employ and pay for an independent testing laboratory to perform the specified services. The laboratory selected shall be subject to approval by the Engineer. Inspection, sampling, testing and submittals shall be as specified in the individual sections of the Specifications.

Where applicable, the laboratory shall meet "Recommended Requirements for Independent Laboratory Qualification", latest edition, published by American Council of Independent Laboratories and the basic requirements of ASTM E 329, "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction". The laboratory shall be certified by the State of Wisconsin.

The Contractor shall require the laboratory to submit a copy of a report of inspection of facilities made by Materials Reference Laboratory of National Bureau of Standards during the most recent tour of inspection; with memorandum of remedies of any deficiencies reported by inspection.

The laboratory testing equipment shall be calibrated at maximum 12 month intervals by devices of accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants. The laboratory shall submit a copy of certificate of calibration, made by accredited calibration agency.

The Contractor and laboratory shall comply with the following provisions and recommendations:

- Cooperate with the Engineer and provide qualified personnel promptly on notice.
- Perform specified inspections, sampling and testing of materials and methods of construction; comply with applicable standards; ascertain compliance with requirements of Contract Documents.

- Promptly notify Engineer and Contractor, of irregularities or deficiencies of work, which are observed during performance of services.
- Promptly submit 5 copies of reports of inspections and tests to Engineer, including:
    1. Date issued.
    2. Project title and number.
    3. Testing laboratory name and address.
    4. Type of inspection or test.
    5. Date of inspection or sampling.
    6. Record of temperature and weather.
    7. Date of test.
    8. Identification of product and Specification Section.
    9. Location in Project.
    10. Name and signature of inspector.
    11. Results of tests and observations regarding compliance with Contract Documents.

Additional tests and services shall be performed as required to assure compliance with the Contract Documents.

The Contractor shall cooperate with laboratory personnel, provide access to work and to manufacturer's operations. The Contractor shall provide to the laboratory, representative samples of materials to be tested, in required quantities, and shall furnish labor and facilities to the laboratories in order to:

- Provide access to work to be tested.
- Obtain and handle samples at the site.
- Facilitate inspections and tests.

- Provide exclusive use for storage and curing of test samples.
- Provide forms for preparing concrete test beams and cylinders.

The Contractor shall notify the laboratory and Engineer sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests. The Contractor shall furnish copies of product test reports where required by the Specifications or requested by the Engineer.

6.2 INSTALLATION DATA

Installation data are defined as written instructions; drawings; illustrations, wiring and schematic diagrams; diagrams identifying external connections, terminal block numbers and internal wiring; and all other such information pertaining to installation of materials and equipment that is not furnished with shop drawings. Included are all printed manufacturers installation instructions, including those that may be attached to equipment and for which approval by the Engineer is not required.

The Contractor shall submit two copies of all installation data to the Engineer for each piece of equipment which he furnishes and for all other construction products for which such information is available from manufacturer. Data shall be acceptably identified and accompanied with a letter of transmittal.

The Contractor shall ensure that all specified equipment furnished under Divisions 11, 13, 14, 15 and 16 of the Specifications will include a qualified representative of the manufacturer to supervise the installation, adjustment and testing of the equipment and to instruct the Owner's operating personnel on operation and maintenance. A certificate from the manufacturer stating that the installation of equipment is satisfactory, that the unit has been satisfactorily tested and is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication and care of the unit shall be submitted within thirty days of completion of the performance test. Additional requirements for manufacturer's reports are specified in the appropriate sections of the Specifications.

6.3 FIELD TESTS OF EQUIPMENT

In addition to testing required by this Section 01660 of the Specifications, the Contractor shall perform all other tests required by detailed equipment Specifications. The Contractor shall make preliminary field tests of all equipment as soon as conditions permit in order to determine if equipment is properly installed; complies with operating cycles; and operational and free from overheating, overloading, vibration or other operating problems.

The Contractor shall furnish all labor, materials, instruments, fuel, incidentals, and expendables required, unless otherwise provided, and shall make all changes, adjustments and replacements required to place equipment in service and test it. The Engineer and Owner shall be given sufficient prior notice to witness the field tests.

To the maximum extent possible, the Contractor shall perform final field tests of equipment prior to initial start-up and operation of the Project. Where this is not practicable, final field tests shall be performed during initial start-up and operation of the Project. The purpose of the tests is to demonstrate that equipment is properly installed; completely ready for operation by the Owner; and in compliance with design conditions, material specifications and all other requirements of the Contract Documents.

The Contractor shall furnish all fuel and energy, labor, materials, instruments, lubricants and expendables required for the final tests except where otherwise specified. Until final field tests are completed and approved, the Contractor shall make all necessary changes, adjustments and replacements. The Contractor shall notify the Engineer at least 24 hours prior to the beginning of the final tests and the Engineer and Owner's operating personnel shall witness all tests. The Contractor shall keep notes and data on tests and submit copy to the Engineer.

MALCOLM PIRNIE

7

7

RECYCLED PAPER

7.0 RECORD DOCUMENTS

This section describes the provisions and requirements for reporting the CQA activities. The reporting requirements include such items as daily summary reports, inspection data sheets, test reports, corrective measure reports, acceptance reports and final documentation. The Specifications should be used to further clarify or interpret reporting requirements.

7.1 CONTRACTOR

The Contractor shall maintain and provide the Engineer with record documents as specified below and included in the Specifications, except where otherwise specified or modified in the Specifications.

The Contractor shall maintain in the field office, in clean, dry, legible condition, complete sets of the following:

- Drawings, Specifications, Addenda, Samples, photographs, Change Orders, other modifications of Contract Documents, test records, survey data, Field Orders, and all other documents pertinent to the Contractor's work.
- Provide files and racks for proper storage and easy access. File in accordance with filing format of Construction Specification Institute (CSI), unless otherwise approved by Engineer.
- Make documents available at all times for inspection by Engineer and Owner.
- Record documents shall not be used for any other purpose and shall not be removed from the Contractor's office without Engineer's approval.

The Contractor shall label each document "PROJECT RECORD" in 2-inch high printed letters and keep record documents current. The Contractor shall not permanently

conceal any work until required information has been recorded and shall legibly mark all drawings to record actual construction including:

- Depths of various elements of foundation in relation to datum.
- Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
- Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
- Field changes of dimensions and details.
- Changes made by Change Order or Field Order.
- Details not on original Drawings.

For Specifications and Addenda, the Contractor shall legibly mark up each Section to record:

- Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
- Changes made by Change Order or Field Order.
- Other matters not originally specified.

Upon Substantial Completion of the Work, the Contractor shall deliver the record documents to Engineer. Final payment will not be made until satisfactory record documents are received by Engineer. A transmittal letter containing the following items shall accompany the record documents:

- Date.
- Project title and number.
- Contractor's name and address.
- Title and number of each record document.
- Certification that each document as submitted is complete and accurate.
- Signature of Contractor, or his authorized representative.

7.2 ENGINEER

At the completion of the Remedial Action construction and start-up activities, the Engineer shall prepare a Construction Completion Report to be submitted to the USEPA and WDNR. This Report will document that the project is consistent with the design specifications, and that the Remedial Action has been properly implemented. At a minimum, the Report will include the following elements:

- Synopsis of Remedial Action and final documentation (including as-built drawings) that the constructed Remedial Action is consistent with the design specifications.
- Explanation of any modifications to the plans and why these were necessary for the project.
- Listing of the criteria, established before the Remedial Action was initiated, for judging the function of the Remedial Action and also explaining any modification to these criteria.
- Results of facility monitoring activities, indicating that the Remedial Action is meeting the performance criteria.
- Explanation of the operation and maintenance (including monitoring) to be undertaken at the facility.

MALCOLM PIRNIE

RECYCLED PAPER