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State of Michigan
Department of Environmental Quality
HAZARDOUS WASTE LIMITED STORAGE FACILITY OPERATING LICENSE

NAME OF LICENSEE: Gage Products Company

NAME OF FACILITY OWNER: Gage Products Company

NAME OF FACILITY OPERATOR: Gage Products Company

NAME OF TITLEHOLDER OF LAND: Gage Products Company

FACILITY NAME: Gage Products Company

FACILITY LOCATION: 625 Wanda Street, Ferndale, Michigan 48220-2657

EPA IDENTIFICATION (ID) NUMBER: MID 005 338 801 EFFECTIVE DATE: March 31, 2015

REAPPLICATION DATE: October 2, 2024 EXPIRATION DATE: March 31, 2025

AUTHORIZED ACTIVITIES

Pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), being §§324.11101 to 324.11153 of the Michigan Compiled Laws, and the hazardous waste management administrative rules (hereafter called the "rules") promulgated thereunder, being R 299.9101 *et seq.* of the Michigan Administrative Code, by the Michigan Department Environmental Quality (MDEQ), an operating license (hereafter called the "license") is issued to Gage Products Company (hereafter called the "licensee") to operate a hazardous waste limited storage facility (hereafter called the "facility") located at latitude 42.45302° and longitude -83.11353°. The licensee is authorized to conduct the following hazardous waste management activities:

☒ LIMITED STORAGE
- ☒ Container
- ☒ Tank

APPLICABLE REGULATIONS AND LICENSE APPROVAL

The conditions of this license were developed in accordance with the applicable provisions of the rules, effective November 5, 2013. The licensee shall comply with all terms and conditions of this license, Part 111, and its rules. This license consists of the 17 pages of conditions attached hereto, as well as those in Attachments 1 through 7, and the applicable rules contained in R 299.9101 through R 299.11008, as specified in the license. For purposes of compliance with this license, applicable rules are those that are in effect on the date of issuance of this license in accordance with R 299.9521(3)(a).

This license is based on the information in the license application submitted on February 5, 2013, and any subsequent amendments (hereafter referred to as the "application"). Pursuant to R 299.9519(11)(c), the license may be revoked if the licensee fails, in the application or during the license issuance process, to disclose fully all relevant facts or, at any time, misrepresents any relevant facts. As specified in R 299.9519(1), the facility shall be constructed, operated, and maintained in accordance with Part 111 of Act 451, the rules, and this license.

This license is effective on the date of issuance and shall remain in effect for ten years from the date of issuance, unless revoked pursuant to R 299.9519 or continued in effect as provided by the Michigan Administrative Procedures Act, 1969 PA 306, as amended (Act 306).

Issued this 31st day of March, 2015

by Bryce Feighner

Bryce Feighner, P.E., Chief
Office of Waste Management and Radiological Protection

HAZARDOUS WASTE FACILITY OPERATING LICENSE
FOR

GAGE PRODUCTS COMPANY
MID 005 338 801

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PART I
STANDARD CONDITIONS

A. TERMINOLOGY AND REFERENCES

Throughout this license, the term "Office" means the Office of Waste Management and Radiological Protection within the MDEQ responsible for administering Part 111 of Act 451 and the rules. Throughout this license, "Director" means the Director of the MDEQ or the Director's duly authorized designee such as the Office Chief. All of the provisions of Title 40 of the Code of Federal Regulations (CFR) referenced in this license are adopted by reference in R 299.11003.

B. EFFECT OF LICENSE

Except as otherwise provided by law, any treatment, storage, or disposal of hazardous waste not specifically authorized in this license is prohibited. Issuance of this license does not authorize any injury to persons or property, any invasion of other private rights, or any infringement of federal, state, or local law or regulations {R 299.9516(8)}; nor does it obviate the necessity of obtaining such permits or approvals from other units of government as may be required by law. Compliance with the terms of this license does not constitute a warranty or representation of any kind by the MDEQ, nor does the MDEQ intend that compliance with this license constitutes a defense to any order issued or any action brought under Act 451 or any other applicable state statute or §106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act, 1980 PL 96-150 (CERCLA), {42 U.S.C. 9606(a)}, the Resource Conservation and Recovery Act of 1976, as amended (RCRA), and its rules, or any other applicable federal statute. The licensee, however, does not represent that it will not argue that compliance with the terms of this license may be a defense to such future regulatory actions. Each attachment to this license is a part of, and is incorporated into, this license and is deemed an enforceable part of the license.

C. SEVERABILITY

The provisions of this license are severable, and if any provision of this license, or the application of any provision of this license to any circumstance, is held invalid, the application of such provision to other circumstances and the remainder of this license shall not be affected thereby.

D. RESPONSIBILITIES

1. The licensee shall comply with Part 111 of Act 451, the rules, and all conditions of this license, except to the extent authorized by the MDEQ pursuant to the terms of an emergency operating license. Any license noncompliance, except to the extent authorized by the MDEQ pursuant to the terms of an emergency operating license, constitutes a violation of Part 111 of Act 451 and is grounds for enforcement action, license revocation, license modification, or denial of a license renewal application. {§§11148, 11150, and 11151 of Act 451; R 299.9521(1)(a) and (c) and (3)(a) and (b); and 40 CFR §270.30(a)}

2. If the licensee wishes to continue an activity regulated by this license after the expiration date of this license, the licensee shall submit a complete application for a new license to the Office Chief at least 180 days before this license expires, October 2, 2024, unless an extension is granted pursuant to R 299.9510(5). To the extent the licensee makes a timely and sufficient application for renewal of this license, this license and all conditions herein will remain in effect beyond the license expiration date and shall not expire until a decision on the application is finally made by the MDEQ, and if the application is denied or the terms of the new license are limited, until the last day for applying for judicial review of the new license or a later date fixed by order of the reviewing court consistent with §91(2) of Act 306. {R 299.9521(1)(a) and (c) and (3)(a) and 40 CFR §270.30(b)}

3. The licensee shall comply with the conditions specified in R 299.9521(1)(b)(i) to (iii) and 40 CFR §270.30(c) through (k), (l)(2), (3), (5), (7), and (11), and (m). {§§11123(3), 11146(1) and (2), and 11148(1) of Act 451 and R 299.9501(1), R 299.9516, R 299.9519, R 299.9521(1)(a) and (b) and (3)(a) and (b), R 299.9522, and R 299.9525}

4. The licensee shall give notice to the Office as soon as possible prior to any planned physical alterations or additions to the licensed facility. {R 299.9501 and R 299.9519(1) and Part 6 of the Part 111 Rules}

E. SUBMITTAL DEADLINES

When the deadline for submittals required under this license falls on a weekend or legal state holiday, the deadline shall be extended to the next regular business day. This extension does not apply to the deadline for financial mechanisms and associated renewals, replacements, and extensions of financial mechanisms required under this license. The licensee may request extension of the deadlines for submittals required under this license. The licensee shall submit such requests at least five business days prior to the existing deadline for review and approval by the Office Chief. Written extension requests shall include justification for each extension. {R 299.9519 and R 299.9521(3)(a)}

PART II
GENERAL OPERATING CONDITIONS

A. GENERAL WASTE ANALYSIS

The licensee shall ensure that any waste managed at the facility has been properly characterized pursuant to R 299.9302 and comply with the procedures described in the attached Waste Analysis Plan, Attachment 1, of this license. {R 299.9605(1) and 40 CFR §264.13}

B. SECURITY

The licensee shall comply with the barrier, surveillance, and signage requirements of R 299.9605(1) and 40 CFR §264.14.

C. GENERAL INSPECTION REQUIREMENTS

The licensee shall inspect the facility in accordance with the Inspection Schedule, Attachment 2, of this license, and comply with the inspection requirements of R 299.9605(1) and 40 CFR §264.15.

D. PERSONNEL TRAINING

The licensee shall comply with the personnel training requirements of R 299.9605 and 40 CFR §264.16. The Personnel Training Program, Attachment 3, of this license, shall, at a minimum, cover all items in R 299.9605 and 40 CFR §264.16.

E. PREPAREDNESS AND PREVENTION

The licensee shall comply with the preparedness and prevention requirements of R 299.9606 and 40 CFR Part 264, Subpart C.

F. CONTINGENCY PLAN

The licensee shall comply with the contingency plan requirements of R 299.9607 and 40 CFR Part 264, Subpart D. The Contingency Plan, Attachment 4, of this license and the prescribed emergency procedures shall be immediately implemented by the licensee whenever there is a fire, explosion, or other release of hazardous waste or hazardous waste constituents that threatens or could threaten human health or the environment, or if the licensee has knowledge that a spill has reached surface water or groundwater.

G. DUTY TO MITIGATE

Upon notification from the Office Chief or his or her designee that an activity at the facility may present an imminent and substantial endangerment to human health or the environment, the licensee shall immediately comply with an order issued by the Office Chief pursuant to §11148(1) of Act 451 to halt such activity and conduct other activities as required by the Office Chief to eliminate the said endangerment. The licensee shall not resume the halted activity without the prior written approval from the Office Chief. {§11148 of Act 451 and R 299.9521(3)(b)}

H. MANIFEST SYSTEM

The licensee shall comply with the manifest requirements of R 299.9304, R 299.9305, and R 299.9608.

I. RECORD KEEPING AND REPORTING

1. The licensee shall comply with the written operating record requirements of R 299.9609 and 40 CFR §264.73 and Part 264, Appendix I.

2. The licensee shall comply with the biennial report requirements of R 299.9610. {R 299.9521(1)(a) and 40 CFR §270.30(l)(9)}

3. The licensee shall submit the results of all environmental monitoring required by this license and any additional environmental sampling or analysis conducted beyond that required by this license, in the form of an Environmental Monitoring Report, to the Office Chief within 60 days after any sample collection. {R 299.9521(1)(a) and R 299.9521(3)(b) and 40 CFR §270.30(l)(4)}

4. The licensee shall provide environmental monitoring information or data that is required pursuant to this license to an authorized representative of an environmental or emergency response department of the city of Ferndale or county of Oakland, who requests such information or data and that has jurisdiction over the facility. Such information or data shall be made available on the same day the licensee forwards this information to the Office Chief. {R 299.9521(3)(b)}

5. The licensee shall immediately report to the Office Chief any noncompliance with the license that may endanger human health or the environment by doing both of the following:

   (a) The licensee shall immediately notify the Hazardous Waste Section at 517-284-6562, if the noncompliance occurs Monday through Friday during the period of 8:00 a.m. to 5:00 p.m., except state holidays, or by calling the MDEQ Pollution Emergency Alerting System (PEAS) at 1-800-292-4706 during all other times. This notice shall include the following:

      (i) Information concerning the fire, explosion, release, or discharge of any hazardous waste or hazardous waste constituent that could threaten human health or the environment, that has reached surface water or groundwater, or that may endanger public drinking water supplies or the environment; and

      (ii) A description of the occurrence and its cause, including all of the information outlined in R 299.9607(2)(a)-(i).

   (b) The licensee shall also follow up the verbal notice by providing a written report to the Office Chief within five days of the time the licensee becomes aware of the circumstances. The written report shall contain all of the information in Condition II.I.5.(a)(i)-(ii) of this license, along with a description of the noncompliance and its cause; the periods of noncompliance (including exact dates and times); whether the noncompliance has been corrected and, if not, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance and when those activities occurred or will occur. The Office Chief

may waive the five-day written notice requirement in favor of submittal of a written report within 15 days of the time the licensee becomes aware of the circumstances.

{R 299.9521(1)(a) and R 299.9607 and 40 CFR §270.30(l)(6)}

6. The licensee shall report all other instances of noncompliance with this license, Part 111 of Act 451, the rules, and any other environmental laws or rules that apply to the licensed facility at the time monitoring reports required by this license are submitted or within 30 days, whichever is sooner. The reports shall contain the information listed in Condition II.I.5. of this license. {R 299.9521(1)(a) and 40 CFR §270.30(l)(10)}

7. The licensee may make minor modifications to the forms contained in the attachments to this license. The modifications may include changing the format, updating existing references and information, adding necessary information, and changing certification and notification information in accordance with Part 111 of Act 451 and its rules and RCRA and its regulations. The licensee shall submit the modifications to the Office Chief prior to implementing the use of the modified form(s). If the Office Chief does not reject or require revision of the modified form(s) within 14 days of receipt, the licensee shall implement use of the modified form(s) and the form(s) shall be incorporated into this license as a replacement for the existing form(s).

J. CLOSURE

The licensee shall comply with the closure requirements of R 299.9613. The licensee shall close the facility in accordance with the Closure Plan, Attachment 5, of this license, all other applicable requirements of this license, and all other applicable laws. {R 299.9613 and 40 CFR Part 264, Subpart G, except 40 CFR §§264.112(d)(1), 264.115, and 264.120}

K. FINANCIAL ASSURANCE FOR CLOSURE

1. On the effective date of this license, the facility closure cost estimate is $72,323.71. The licensee shall keep this estimate current as required under R 299.9702 and 40 CFR §264.142.

2. The licensee shall continuously maintain financial assurance for the current closure cost estimate as required under R 299.9703.

L. FINANCIAL ASSURANCE FOR CORRECTIVE ACTION

1. On the effective date of this license, the cost of performing corrective action at the facility is as follows:

Interim Measures	$0
RCRA Facility Investigation	$0
Corrective Measures Study	$0
Corrective Measures Implementation	$64,500
Total	**$64,500**

The licensee shall keep this estimate current as required under R 299.9712.

2. The licensee shall continuously maintain financial assurance for corrective action as required under R 299.9713, in accordance with the following schedule:

(a) Initial corrective action financial assurance shall be submitted within 60 days after MDEQ approval, or approval with modifications, of the *2014 RCRA Facility Investigation, Risk Evaluation, and Corrective Measures Plan,* dated April 4, 2014.

(b) Annual updates for inflation and/or an updated corrective action cost estimate shall be submitted within 60 days prior to the anniversary date of the financial mechanism.

M. FINANCIAL REPSONSIBILITY FOR LIABILITY COVERAGE

The licensee shall continuously maintain liability coverage for sudden and accidental occurrences, as required by R 299.9710.

N. WASTE MINIMIZATION

The licensee shall certify, at least annually, that the licensee has a hazardous waste minimization program in place. {R 299.9609(1)(a) and 40 CFR §264.73(b)(9) and §3005(h)}

O. LAND DISPOSAL RESTRICTIONS

The licensee shall comply with all of the requirements of 40 CFR Part 268. {R 299.9627 and 40 CFR Part 268}

P. AIR EMISSION STANDARDS

1. The licensee shall comply with the requirements of 40 CFR Part 264, Subpart AA, regarding air emission standards for process vents; Subpart BB, regarding air emission standards for equipment leaks; and Subpart CC, regarding air emission standards for tanks, surface impoundments, and containers.

2. The licensee shall notify the Office Chief of any waste management units that become subject to the requirements of 40 CFR Part 264, Subparts AA, BB, and/or CC within 30 days of the start of the regulated activity.

{R 299.9630, R 299.9631, and R 299.9634 and 40 CFR Part 264, Subparts AA, BB, and CC}

Q. DOCUMENTS TO BE MAINTAINED AT THE FACILITY

The licensee shall maintain at the facility the following documents and amendments required by this license, until closure/postclosure is completed, certified by an independent registered professional engineer, and the facility is released from financial assurance requirements for closure/postclosure by the Director:

1. Waste Analysis Plan, including Quality Assurance/Quality Control (QA/QC) Plans.
2. Inspection Schedules and records.
3. Personnel Training Program documents and records.
4. Contingency Plan.
5. Closure Plan.
6. Cost estimates for facility closure and corrective action and copies of related financial assurance documents.
7. Operating record.

8. Site Security Plan.
9. Facility engineering plans and specifications.
10. Record keeping procedures.
11. Environmental monitoring plans, including Sampling and Analysis Plans and QA/QC Plans.
12. Environmental monitoring data and statistical records.
13. Preventative procedures (Personnel Protection Plan).
14. Hazardous waste minimization program certification.

{R 299.9521(3)(a)}

R. ENGINEERING PLANS

The licensee shall construct, operate, and maintain the facility in accordance with the Engineering Plans, Attachment 6, of this license, and any modifications to those plans shall be made in accordance with this license.

S. TRUCK ROUTING

The licensee shall route tanker trucks delivering and picking up hazardous wastes at the facility either along Nine Mile Road and Wanda Street, or along Eight Mile Road, West End Street, Bennet Street, and Wanda Street. The licensee shall not route tanker trucks delivering and picking up hazardous wastes at the facility along Nine Mile Road, west of Hilton Street. The licensee shall post signs at the entrances to the facility indicating the acceptable hauling routes to and from the facility. Except as otherwise stated in this condition, the licensee shall not route tanker trucks hauling hazardous waste to or from the facility through residential neighborhoods.

T. WANDA SCHOOL PROPERTY TRUCK PARKING PROHIBITION

The licensee shall not park tanker trucks that contain hazardous wastes at the facility on the former Wanda School Property, Parcel A. A truck shall be considered empty when it meets the criteria for empty containers in R 299.9207. For the purposes of this license, "tanker truck" shall replace "container" in R 299.9207 to define empty tanker trucks.

PART III
CONTAINER STORAGE CONDITIONS

A. COVERAGE OF LICENSE

The hazardous waste container storage area at the facility shown in Drawing A1 is covered by this license. Any expansion or enlargement beyond the facility boundary shown in Drawing A1 or beyond the 2,750-gallon storage design capacity requires a new operating license for the expansion, enlargement, or alteration of an existing facility from the Director. Drawing A1 is incorporated into this license as part of Attachment 6. {R 299.9521(1)(b)}

B. WASTE IDENTIFICATION AND QUANTITY

The licensee may store no more than a total volume of 2,750 gallons of the hazardous wastes listed in Table C2.A.2 of Attachment 1 for up to 90 days in containers at the facility, subject to the terms of this license. The maximum number of containers of hazardous waste that may be stored at the facility is 50 containers that have a capacity of 55 gallons or less. {R 299.9521(2)(d)}

C. USE AND MANAGEMENT OF CONTAINERS

1. The licensee shall manage all containers in compliance with R 299.9521(3)(b), R 299.9614, and R 299.9627 and 40 CFR §§264.171, 264.172, 264.173, and 268.50(a)(2)(i).

2. The licensee shall only place containers, stacked no greater than two high, into the hazardous waste container storage area referenced in Condition III.A. of this license in accordance with the configuration described in Section D-2b and shown in Drawing A1 in Attachment 6 of this license or an alternate configuration approved by the Office Chief. {R 299.9521(3)(b)}

3. The licensee shall operate and maintain the containment system in accordance with the requirements of R 299.9614 and 40 CFR §264.175 and the attached plans and specifications in Attachment 6 of this license.

D. SPECIAL REQUIREMENTS FOR IGNITABLE WASTES

1. The licensee shall locate containers holding ignitable or reactive wastes in accordance with R 299.9614 and 40 CFR §264.176.

2. The licensee shall take precautions to prevent the accidental ignition or reaction of ignitable or reactive wastes by following the procedures specified in Attachment 6 of this license. The licensee shall document compliance with this condition and place this documentation in the operating record. {R 299.9605 and 40 CFR §264.17(a) and (c)}

E. PROHIBITION ON STORING REACTIVE WASTES

The licensee is prohibited from storing reactive wastes in the facility container storage area referenced in Condition III.A. of this license. {R 299.9521(2)(d) and (3)(b)}

F. SPECIAL REQUIREMENTS FOR INCOMPATIBLE WASTES OR MATERIALS

1. The licensee is prohibited from placing incompatible wastes or incompatible wastes and materials in the same container. {R 299.9521(2)(d) and (3)(b)}

2. The licensee shall prevent the placement of hazardous waste in an unwashed container that previously held an incompatible waste or material. {R 299.9614 and 40 CFR §264.177(b)}

3. The licensee shall document compliance with Conditions III.F.1. and III.F.2. of this license and place this documentation in the operating record. {R 299.9605 and 40 CFR §264.17(c)}

4. The licensee shall separate containers of incompatible wastes as indicated in the procedures contained in Section D-2b of Attachment 6 of this license. {R 299.9614 and 40 CFR §264.177(c)}

G. DISPOSITION OF ACCUMULATED LIQUIDS

The licensee shall remove all liquids accumulated in the containment system within 24 hours of detection and manage the liquids in accordance with the requirements of Part 111 of Act 451 and the rules. {R 299.9521(3)(b) and R 299.9614(1)(a) and 40 CFR §264.175(b)(5)}

PART IV
TANK SYSTEM STORAGE CONDITIONS

A. COVERAGE OF LICENSE

The hazardous waste tank system storage area at the facility shown in Drawings S4 and M1 are covered by this license. Any expansion or enlargement beyond the facility boundary shown in Drawings S4 and M1 or beyond the 22,250-gallon tank system storage design capacity requires a new operating license for the expansion, enlargement, or alteration of an existing facility from the Director. Drawings S4 and M1 are incorporated into this license as part of Attachment 6. {R 299.9521(1)(b)}

B. WASTE IDENTIFICATION AND QUANTITY

The licensee may store no more than a total volume of 22,250 gallons of the hazardous wastes listed in Table C2.A.2 in Attachment 1 for up to 90 days in the tank systems identified as Tank**s** SWT72, SWT73, SWT74, SWT75, and SWT76 in Table D.1 of Attachment 6, subject to the terms of this license. {R 299.9521(2)(d)}

C. DESIGN, CONTAINMENT, AND ASSESSMENT OF TANK SYSTEMS

The licensee shall operate and maintain all tank systems in accordance with the applicable requirements of R 299.9615 and 40 CFR §§264.193 and 264.194 and in accordance with the attached plans and specifications in Attachment 6 of this license.

D. MANAGEMENT OF TANK SYSTEMS

The licensee shall label and manage the tank systems in accordance with the requirements of R 299.9615 and R 299.9627; 40 CFR §§264.194, 264.196, and 268.50(a)(2)(ii); R 29.4101 to R 29.4504 pursuant to the provisions of the Fire Prevention Act, 1941 PA 207, as amended, National Fire Protection Association (NFPA) Standard No. 704; and the spill and overfill prevention procedures specified in Attachment 6 of this license. {R 299.9615}

E. SPECIAL REQUIREMENTS FOR IGNITABLE WASTES

1. The licensee shall not place ignitable waste in a tank system unless the procedures described in Attachment 6 of this license are followed. The licensee shall document compliance with this condition and place this documentation in the operating record. {R 299.9605, R 299.9609, and R 299.9615 and 40 CFR §§264.17(c), 264.73(b)(3), and 264.198(a)}

2. The licensee shall maintain the protective distances between the tank systems and any public ways, streets, alleys, or adjoining property lines that can be built upon, as required in Tables 2-1 through 2-6 of the NFPA's "Flammable and Combustible Liquids Code" (1977 or 1981) as specified in Attachment 6 of this license and as required by R 299.9615 and 40 CFR §264.198(b).

F. PROHIBITION ON STORING REACTIVE WASTES OR MATERIALS

The licensee is prohibited from storing reactive wastes or materials in tank systems at the facility. {R 299.9521(2)(d) and (3)(b)}

G. SPECIAL REQUIREMENTS FOR INCOMPATIBLE WASTES OR MATERIALS

The licensee shall not place incompatible wastes or incompatible wastes and materials in the same tank system or place hazardous waste in a tank system that has not been decontaminated and that previously held an incompatible waste or material unless the procedures specified in Attachment 6 of this license are followed, as required by R 299.9615 and 40 CFR §264.17(b). The licensee shall document compliance with this condition and place this documentation in the operating record. {R 299.9609 and R 299.9615 and 40 CFR §§264.17(c), 264.73(b)(3), and 264.199}

H. DISPOSITION OF ACCUMULATED LIQUIDS

The licensee shall remove spilled or leaked waste and accumulated precipitation from the tank system within 24 hours of detection and manage it in accordance with the requirements of Part 111 of Act 451 and the rules. {R 299.9521(3)(b) and R 299.9615 and 40 CFR §264.193(c)(4)}

PART V
CORRECTIVE ACTION CONDITIONS

A. CORRECTIVE ACTION AT THE FACILITY

1. The licensee shall implement corrective action for all releases of a contaminant from any waste management unit (WMU) at the facility, regardless of when the contaminant may have been placed in or released from the WMU. For the purposes of this license, the term "corrective action" means an action determined by the Office Chief to be necessary to protect the public health, safety, welfare, or the environment, and includes but is not limited to, investigation, evaluation, cleanup, removal, remediation, monitoring, containment, isolation, treatment, storage, management, the temporary relocation of people, and the provision of alternative water supplies, or any corrective action allowed under Title II of the federal Solid Waste Disposal Act, PL 89-272, as amended, or regulations promulgated pursuant to that act. For the purposes of this license, the process outlined in Part 111 of Act 451 and the environmental protection standards adopted in R 299.9629 shall be used to satisfy the corrective action obligations under this license. {§§11102 and 11115a of Act 451 and R 299.9629}

2. To the extent that a release of a hazardous substance, as defined in §20101(t) of Act 451, that is not also a contaminant, as defined in §11102(2) of Act 451, is discovered while performing corrective action under this license, the licensee shall take concurrent actions as necessary to address the Part 201, Environmental Remediation, of Act 451, remedial obligations for that release. {R 299.9521(3)(b)}

B. CORRECTIVE ACTION BEYOND THE FACILITY BOUNDARY

The licensee shall implement corrective action beyond the facility in accordance with §11115a of Act 451 and R 299.9629(2).

C. IDENTIFICATION OF WASTE MANAGEMENT UNITS AND AREAS OF CONCERN

The WMUs and areas of concern (AOCs) at the facility are identified below and shown on the figure in Attachment 7 of this license.

1. The following WMUs and AOCs, identified in the application and the 2014 RCRA Facility Investigation, Risk Evaluation, and Corrective Measures Plan, received by the Department on April 8, 2014, require further corrective action at this time. Consistent with the approved RFI Work Plan and its updates, approved with modifications on October 19, 2012, corrective action to address these WMUs and AOCs shall be implemented on an area-wide basis, rather than a WMU- or AOC-specific basis.

   (a) AOC 8 — Open Area on Parcel A

   (b) Parcel C

WMU 1	Tote and Drum Storage Area
WMU 2	Truck Well
WMU 3	Former Underground Storage Tank (UST) Area by the Truck Well
WMU 4	Bulk Tank Storage Area
WMU 5	Generated Hazardous Waste Storage Area
WMU 7	Railroad Loading/Unloading Area
WMU 9	Former UST Areas by Fill House 2

WMU 10	Tank Wagon Loading/Unloading Area
WMU 11	Fill House 1
AOC 1	Former Generated Hazardous Waste Storage Area
AOC 2	Former Storage Area at the Boiler Building

2. The following WMUs and AOCs do not require corrective action at this time:

   (a) The following WMUs and AOCs were identified in the application and the 2014 RCRA Facility Investigation, Risk Evaluation, and Corrective Measures Plan, received by the Department on April 8, 2014, as currently operating pursuant to the act and its rules with no evidence of a release of any contaminants. Corrective action may be required when any of the units undergoes final closure.

WMU 6	Limited Storage Area Tanks
WMU 12	Fill House 6
WMU 14	Tanker Off-Loading Area North of Fill House 6
AOC 3	Back Storage Area
AOC 7	Covered Area Storage

   (b) The following WMUs and AOCs, identified in the application 2014 RCRA Facility Investigation, Risk Evaluation, and Corrective Measures Plan, received by the Department on April 8, 2014, based on the design of the units and available information that indicates that no known or suspected releases of contaminants from the units have occurred.

WMU 8	Former Piping Area
WMU 13	Former UST Area by Fill House 6
WMU 15	Former UST Area on Parcel A
WMU 24	Truck Wells with Oily Concrete Stains
WMU 25	Floor Drains to Publicly-Owned Treatment Works
WMU 26	Paint Rooms with Paint Filters Present
WMU 27	The Mechanical Room
WMU 28	Asbestos in Floor and Ceiling Tiles and Pipe Wraps
AOC 4	Former Steam-Out and Storage Area
AOC 5	Unpaved Area of Silman Avenue
AOC 6	Silman Avenue Sewers
AOC 9	Fill Material in Sewer Trenches
AOC 10	Jewell Avenue

{§§11102 and 11115a of Act 451 and R 299.9521(3)(b) and R 299.9629}

3. Within 30 days of discovery of a new WMU or a release of a contaminant from a new WMU, the licensee shall provide written notification to the Office Chief. The written notification shall include all of the following information:

   (a) The location of the unit on the facility topographic map.

   (b) The designation of the type of unit.

   (c) The general dimensions and structural description, including any available drawings of the unit.

(d) The date the unit was operated.

(e) Specification of all waste(s) that have been managed in the unit.

(f) All available information pertaining to any release of a contaminant from the unit.

4. Based on a review of all of the information provided in Condition V.C.3 of this license, the Office Chief may require corrective action for the newly-identified WMU. The licensee shall submit a written Investigation Work Plan to the Office Chief within 60 days of written notification by the Office Chief that corrective action for the unit is required.

{§§11102 and 11115a of Act 451; R 299.9504(1), R 299.9508(1)(b), and R 299.9629; and 40 CFR §270.14(d)}

D. CORRECTIVE ACTION INVESTIGATION

The licensee shall conduct a Corrective Action Investigation (CAI) to determine if a release of a contaminant(s) from any of the WMUs identified in Condition V.C. of this license has occurred and, if a release(s) has occurred, evaluate the nature and extent of the release(s). The licensee shall submit a written CAI Work Plan, CAI Final Report documenting compliance with the approved CAI Work Plan and supporting further corrective action at the facility, and CAI progress reports to the Office Chief for review and approval in accordance with Condition V.I. of this license. The Office Chief will approve, modify and approve, or provide a Notice of Deficiency (NOD) for the CAI Work Plan and CAI Final Report. Upon approval, the CAI Work Plan and CAI Final Report become enforceable conditions of this license. Pursuant to the provisions of Condition V.C.1 of this license, on April 8, 2014, the Department received the 2014 RCRA Facility Investigation, Risk Evaluation, and Corrective Measures Plan from the facility, which is currently under review. {§§11102 and 11115a of Act 451 and R 299.9629}

E. INTERIM MEASURES

The licensee shall conduct interim measures (IM) at the facility, if determined necessary by the licensee or the Office Chief, to clean up or remove a released contaminant or to take other actions, prior to the implementation of corrective measures, as may be necessary to prevent, minimize, or mitigate injury to public health, safety, welfare, or the environment. The licensee shall submit a written IM Work Plan, an IM Final Report documenting compliance with the approved IM Work Plan and supporting further corrective action at the facility, and IM progress reports to the Office Chief for review and approval in accordance with Condition V.I. of this license. The Office Chief will approve, modify and approve, or provide an NOD for the IM Work Plan and IM Final Report. Upon approval, the IM Work Plan and IM Final Report become enforceable conditions of this license. {§§11102 and 11115a of Act 451 and R 299.9629}

F. DETERMINATION OF NO FURTHER ACTION

1. The licensee shall continue corrective action measures to the extent necessary to ensure that the applicable environmental protection standards adopted in Part 111 of Act 451 are met, if the limits are not less stringent than allowed pursuant to the provisions of RCRA.

2. Based on the results of the CAI and other relevant information, the licensee shall submit a written request for a license minor modification to the Office Chief if the licensee wishes to

terminate corrective action for a specific WMU identified in Condition V.C. of this license. The licensee must demonstrate that there have been no releases of a contaminant(s) from the WMU and that the WMU does not pose a threat to public health, safety, welfare, or the environment.

3. Based on the results of the CAI and other relevant information, the licensee shall submit a written request for a license major modification to the Office Chief if the licensee wishes to terminate facility-wide corrective action. The licensee must conclusively demonstrate that there have been no releases of a contaminant(s) from any of the WMU at the facility and that none of the WMUs pose a threat to public health, safety, welfare, or the environment.

4. If, based upon a review of the licensee's request for a license modification pursuant to Condition V.F.2. or V.F.3. of this license, the results of the completed CAI, and other relevant information, the Office Chief determines that the releases or suspected releases of a contaminant(s) do not exist and that the WMU(s) do not pose a threat to public health, safety, welfare, or the environment, the Office Chief will approve the requested modification, subject to Conditions V.F.5. and V.F.6., below.

5. A determination of no further action shall not preclude the Office Chief from requiring continued or periodic monitoring of air, soil, groundwater, or surface water, if necessary to protect public health, safety, welfare, or the environment, when facility-specific circumstances indicate that potential or actual releases of a contaminant(s) may occur.

6. A determination of no further action shall not preclude the Office Chief from requiring further corrective action at a later date, if new information or subsequent analysis indicates that a release or potential release of a contaminant(s) from a WMU at the facility may pose a threat to public health, safety, welfare, or the environment. The Office Chief will initiate the necessary license modifications if further corrective action is required at a later date.

{§§11102 and 11115a of Act 451 and R 299.9629(2)}

G. CORRECTIVE MEASURES STUDY

If the Office Chief determines, based on the results of the CAI and other relevant information, that remedial activities are necessary, the Office Chief will notify the licensee in writing that a Corrective Measures Study (CMS) is required. If required by the Office Chief, the licensee shall conduct a CMS to develop and evaluate the corrective measures alternative(s) necessary to address the release(s) of a contaminant(s) or hazardous substances and the WMU(s) that are identified in the approved CAI Final Report as requiring final remedial activities. The licensee shall submit a written CMS Work Plan, a CMS Final Report documenting compliance with the approved CMS Work Plan and supporting further corrective action at the facility, and CMS progress reports to the Office Chief for review and approval in accordance with Condition V.I. of this license. The Office Chief will approve, modify and approve, or provide an NOD for the CMS Work Plan and CMS Final Report. Upon approval, the CMS Work Plan and CMS Final Report become enforceable conditions of this license. Pursuant to the provisions of Condition V.C.1 of this license, on April 8, 2014, the Department received the 2014 RCRA Facility Investigation, Risk Evaluation, and Corrective Measures Plan from the facility, which is currently under review. {§§11102 and 11115a of Act 451 and R 299.9629}

H. CORRECTIVE MEASURES IMPLEMENTATION PLAN

1. The licensee shall conduct final corrective measures based on the CMS Final Report approved by the Office Chief. The licensee shall submit a written Corrective Measures Implementation (CMI) Work Plan to the Office Chief for review and approval. The licensee shall also submit a written CMI Final Report documenting the compliance with the approved CMI Work Plan and providing justification that the corrective actions may cease and CMI progress reports to the Office Chief for review and approval in accordance with Condition V.I. of this license. The Office Chief will approve, modify and approve, or provide an NOD for the CMI Work Plan and CMI Final Report. Upon approval, the CMI Work Plan and CMI Final Report become enforceable conditions of this license. Pursuant to the provisions of Condition V.C.1 of this license, on April 8, 2014, the Department received the 2014 RCRA Facility Investigation, Risk Evaluation, and Corrective Measures Plan from the facility, which is currently under review.

2. The Office will provide notice of its draft decision on the CMI Work Plan to persons on the facility mailing list and provide an opportunity for a public hearing.

3. The licensee shall implement the approved CMI Work Plan within 90 days of receipt of the Office Chief's written approval of the Work Plan.

{§§11102 and 11115a of Act 451 and R 299.9629}

I. SUMMARY OF CORRECTIVE ACTION SUBMITTALS

The licensee shall submit the required documents in accordance with Conditions V.D., V.E, V.G, and V.H. of this license and the schedule below.

Document	Submittal Deadline
Written notification of a new release of a contaminant from an existing WMU, a new WMU, or a release of a contaminant from a new WMU	Within 30 days of discovery
CAI Work Plan for a newly-identified release of a contaminant from an existing WMU, a new WMU, or a release of a contaminant from a new WMU	Within 60 days of receipt of notification that a CAI is required
Revised CAI Work Plan for WMUs and contaminant releases	Within 60 days of receipt of CAI Work Plan NOD
CAI progress reports	Within 90 days of initiation of the CAI and every 90 days thereafter, unless otherwise approved
CAI Final Report for WMUs and contaminant releases	Within 90 days of completion of CAI investigation. RCRA Facility Investigation Report, Risk Evaluation, and Corrective Measures Plan received April 8, 2014
Revised CAI Final Report for WMUs and contaminant releases	Within 60 days of receipt of CAI Final Report NOD
IM Work Plan for WMUs and contaminant releases	Within 90 days of receipt of notification that IM Work Plan is required

Document	Submittal Deadline
Revised IM Work Plan for WMUs and contaminant releases	Within 60 days of receipt of IM Work Plan NOD
IM progress reports	Within 90 days of initiation of the IM and every 90 days thereafter, unless otherwise approved
IM Final Report for WMUs and contaminant releases	Within 90 days of completion of the IM
Revised IM Final Report for WMUs and contaminant releases	Within 60 days of receipt of IM Final Report NOD
CMS Work Plan for WMUs and contaminant releases	Within 90 days of receipt of notification that CMS is required. RCRA Facility Investigation Report, Risk Evaluation, and Corrective Measures Plan received April 8, 2014
Revised CMS Work Plan for WMUs and contaminant releases	Within 60 days of receipt of CMS Work Plan NOD
CMS progress reports	Within 90 days of initiation of the CMS and every 90 days thereafter, unless otherwise approved
CMS Final Report for WMUs and contaminant releases	Within 90 days of completion of the CMS
Revised CMS Final Report for WMUs and contaminant releases	Within 60 days of receipt of CMS Final Report NOD
CMI Work Plan for WMUs and contaminant releases	Within 90 days of approval of the CMS Final Report. RCRA Facility Investigation Report, Risk Evaluation, and Corrective Measures Plan received April 8, 2014
Revised CMI Work Plan for WMUs and contaminant releases	Within 60 days of receipt of CMI Work Plan NOD
CMI progress reports	Within 90 days of implementation of the CMI Work Plan and every 90 days thereafter, unless otherwise approved
CMI Final Report for remediated WMUs and contaminant releases	Within 90 days of the remedial actions have been completed and cleanup criteria have been met
Revised CMI Final Report for WMUs and contaminant releases	Within 60 days of receipt of CMI Final Report NOD

J. CORRECTIVE ACTION DOCUMENTS RETENTION

The licensee shall maintain all corrective action documents required by this license at the facility. The documents shall be maintained for the operating life of the facility or until the facility is released from financial assurance requirements for corrective action by the Director, whichever is longer. The licensee shall offer such documents to the Office Chief prior to discarding those documents. {§§11102 and 11115a of Act 451 and R 299.9521(3)(b) and R 299.9629}

SECTION C

WASTE CHARACTERISTICS

This section describes the chemical and physical nature of the hazardous wastes stored at Gage Products Company Limited Storage Facility and the Waste Analysis Plan for sampling, testing, and evaluating the wastes to ensure that sufficient information is available for the safe handling of the wastes. This section also addresses the Land Disposal Restrictions (40 CFR 268). The information submitted is in accordance with the requirements of Michigan Act 451 Part 111, Rule 299.9605, which incorporates 40 CFR 264 Subpart B by reference. And also in accordance with 40 CFR 270.14 (b) (2).

For simplicity in reference, this Section will utilize the outline template featured in the MDEQ Document EQP 5111 Attachment Templates A2 and A3. However, in keeping with the organization of the other Sections in Gage's license application, the first letter of each section will be featured as "C".

SECTION C

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C-2 CHEMICAL AND PHYSICAL ANALYSIS (40 CFR 270.14 (b) (2) and 264.13 (a))

C2.A Waste Description *[R 299.9504(1)(c) and 40 CFR §270.14(b)(2)]*

Gage Products Company operates a reclamation process, used to recover and recycle the paint solvent-related products they blend and supply to customers. Used solvents are shipped to Gage primarily in bulk tank trailers, and also in drums. The reclamation process itself is exempt from licensing requirements. Gage does not generate waste subject to the limited storage licensing requirements.

C2.A. 2 Waste Description as Received From Off site Generators

Gage operates a hazardous waste Limited Storage Facility in order to accommodate temporary storage of off-site wastes prior to recycling. The Limited Storage Facility consists of a three-bay loading/unloading area, an above-ground storage tank farm, and container storage area. Both the above ground storage tank system and the containerized waste storage are equipped with secondary containment systems. The container storage area includes a segregated area for storage of corrosives. Gage has the capability to receive D002 corrosive waste for transshipment only, as an added service to customers.

In keeping with the requirements as defined in Section 324.11103 (7) of Michigan's Hazardous Waste Management Act, Public Act of 1994, Number 451, as amended, Gage Products' Limited Storage Facility does not receive hazardous wastes from treatment, storage, or disposal facilities.

Hazardous wastes received for recycling are characterized with EPA waste codes F001, F002, F003, F005, D001, D005, D006, D007, D008, D011, D018 and D035. Wastes received under these primary waste codes may exhibit additional Toxicity Characteristics pursuant to 40 CFR 261.24 which must be listed on, profiles, waste manifests and land-disposal-restriction-notifications as additional (secondary) waste codes. This subset of additional (secondary) codes may include: D019, D021, D038, D039, and D040 (all are listed constituents of F001, F002, F003, or F005). Gage will only accept these additional (secondary) wastes for storage if they are secondary codes required to properly inform the receiving facility of land disposal restrictions and associated treatment standards for the wastes properly received under the primary EPA waste codes F001, F002, F003, F005, D001, D002, D005, D006, D007, D008, D011, D018 and D035. The wastes are temporarily stored either in Limited Storage Facility's container storage area in 55-gallon drums or in one of the five storage tanks designated for off-site waste. D002 wastes are only stored in containers within a designated corrosive storage area in the Limited Storage Facility's container storage area. The segregated area for corrosive storage is limited to a 12-drum capacity. Table C2.A.2 is a complete list of the wastes accepted at Gage, along with a description, characteristics, and basis for hazard designation.

C2.A.2(a) Procedures for Obtaining Chemical and Physical Analyses from Off site Generators

Gage's operational model of the closed-loop recycling process is based on the fact that Gage Products Company initially supplies solvents to its customers, and remains involved in customers' processes and usage of the solvents. Gage subsequently receives the solvent, mixed with paint solids, as off-site waste. Because Gage blends and supplies the solvents initially, the facility has in-depth knowledge of the chemical and physical properties of the wastes, because the wastes are derived from the products which Gage initially formulated and produced to meet the specific application requirements of the customers (generators).

The solvent products Gage supplies to its customers have precise specifications. Because of this, Gage has accurate data on the composition and physical properties of the used solvents when they are returned as off-site waste. Solvent products blended at Gage undergo quality control (QC) analysis prior to approval for shipment, for density via densitometer, and composition via gas chromatograph.

Prior to receipt of wastes for storage, waste profiles for each waste stream are provided to Gage Products Company by the generator. The original product specification information, described above, is used as a basis for creating waste profiles. Generators use the available product knowledge, along with any additional analysis or process knowledge, to complete waste profiles for submittal to Gage Products. A copy of this profile template is included in Appendix C1. Gage evaluates and approves each profile prior to receipt for storage, to insure that the waste stream can be stored and managed appropriately. Current profiles are retained at the facility. In addition, all incoming waste streams are subject to an annual recertification.

Upon arrival of the waste load, a representative sample of the waste is analyzed, to insure that the composition is consistent with the profile. Incoming wastes slated for storage are analyzed for composition utilizing gas chromatography, and also analyzed for density, and pH. The results are compared with information stored in the Material Specifications Reference. This analysis process meets the requirements of 40 CFR Part 264.13 (a) (1&2) and demonstrates compliance with this section and with Michigan Act 451 R299.9504(1)(c) and 40 CFR Part 270.14 (b) (2). A copy of the waste composition calculator template is included in Appendix C2.

Gage provides initial and recurrent training to Limited Storage Facility employees to insure waste samples are collected, transported, analyzed, stored, and disposed properly and safely. A complete description of Gage's employee training program is included in Section H of this document. Gage Products maintains certification under the ISO 9002 and 14001 standards for quality and environmental management, and has a work instruction program under these systems addressing appropriate sampling, handling, and management procedures. Employee training includes the procedures to sample bulk tankers as well as drummed wastes. The supervisor documents the employees' training effectiveness annually. Procedures for sampling and analysis are detailed in the QA/QC Plan, Section C3.

The specifics of the waste analysis program are described in Section C3, the Waste Analysis Plan.

The types of hazardous wastes recycled and stored at Gage Products Company are described briefly below. The wastes and basis for hazard designation are summarized in Table C2.A.2

Listed Hazardous Wastes

- **Spent halogenated solvents used in degreasing (F001).**
- **Spent halogenated solvents (F002).**
- **Spent non-halogenated solvents (F003).**
- **Spent non-halogenated solvents (F005).**

Characteristic hazardous wastes

- **Hazardous waste exhibiting the characteristic of ignitability (D001, ignitable)** Liquid organic solvents that exhibit the characteristic of ignitability by manifesting a flash point less than 60 C (140 F) as determined by using a Pensky-Martens or Setaflash Closed Cup Tester and their respective ASTM standards.

- **Hazardous waste exhibiting the characteristic of corrosivity (D002 alkaline, or other corrosive subcategory)** The alkaline subcategory is defined as having a pH higher than 12.5. The other Corrosive Subcategory is defined as those waters that exhibit corrosivity to steel as defined in 261.22(a)(2).

- **Hazardous wastes exhibiting Toxicity Characteristic for metals (D005, D006, D007, D008, and D011)** Some of the liquid organic solvent wastes to be managed may be hazardous because they contain Barium (D005), Cadmium (D006), Chromium (D007), Lead, (D008), or Silver (D011).

  Secondary waste codes exhibiting the toxicity characteristic include D018 – benzene, D019 – carbon tetrachloride, D021 – chlorobenzene, D035 – methyl ethyl ketone, D038 – pyridine, D039 – tetrachloroethylene, D040 – trichloroethylene.

  Table C2.A.2 lists the details of the waste types Gage Products Company is authorized to receive and store under its Limited Storage License:

C2.A.2 Hazardous wastes Accepted at the Limited Storage Facility

Hazardous Waste Code	Waste Description	Hazardous Waste Characteristics	Basis for Hazardous Designation	Hazardous Waste Management Unit
D001	Liquid organic solvents	Ignitable	Raw material information/Testing	Tank & container storage
D002	Liquid organic & inorganic solvents	Corrosive	Raw material information/Testing	Container storage
F001	Spent halogenated solvent (degreasing)	Toxic (solvents)	Process Knowledge/Testing	Tank & container storage
F002	Spent halogenated solvent	Toxic (solvents)	Process Knowledge/Testing	Tank & container storage
F003	Spent non-halogenated solvent	Toxic (solvents)	Product Composition Before Use/Process	Tank & container storage
F005	Spent non-halogenated solvent	Toxic (solvents)	Product Composition Before Use/Process	Tank & container storage
D005	Liquid organic solvents containing toxicity characteristic metals	Toxic - Barium	Raw material information/Testing	Tank & container storage
D006	Liquid organic solvents containing toxicity characteristic metals	Toxic – Cadmium	Raw material information/Testing	Tank & container storage
D007	Liquid organic solvents containing toxicity characteristic metals	Toxic – Chromium	Raw material information/Testing	Tank & container storage
D008	Liquid organic solvents containing toxicity characteristic metals	Toxic – Lead	Raw material information/Testing	Tank & container storage
D011	Liquid organic solvents containing toxicity characteristic metals	Toxic – Silver	Raw material information/Testing	Tank & container storage
D018	Liquid organic solvents containing toxics	Toxic – Benzene	Raw material information/Testing	Tank & container storage
D019	Liquid organic solvents containing toxics	Toxic – Carbon Tetrachloride	Raw material information/Testing	Tank & container storage
D021	Liquid organic solvents containing toxics	Toxic – Chlorobenzene	Raw material information/Testing	Tank & container storage
D035	Liquid organic solvents containing toxics	Toxic – Methyl Ethyl Ketone	Raw material information/Testing	Tank & container storage
D038	Liquid organic solvents containing toxics	Toxic – Pyridine	Raw material information/Testing	Tank & container storage
D039	Liquid organic solvents containing toxics	Toxic - Tetrachloroethylene	Raw material information/Testing	Tank & container storage
D040	Liquid organic solvents containing toxics	Toxic - Trichloroethylene	Raw material information/Testing	Tank & container storage

C2.B Containerized Waste *[R 299.9504(1)(c) and 40 CFR §264.172]*

C2.B.1 Wastes' Compatibility With Containers

The basis of Gage's closed loop reclamation program is the recycling of organic solvents which were originally blended at Gage, and are intended for reuse. Therefore, Gage Products is familiar with the physical properties of the subsequent solvent waste, and the importance of container compatibility for the waste. Prior to receipt of waste in containers, the generator must indicate on the profile the type of container in which the waste will be shipped. This information is reviewed prior to waste stream approval and transport to Gage, to insure that the material of container construction listed is compatible with the lading. Steel drums are the standard container in which solvent products are shipped, and in which organic solvent-type waste is shipped to Gage Products Company.

In the event D002 corrosive wastes are profiled for approval, the facility will review the packaging compatibility on an individual basis, based on the corrosive component(s) indicated on the waste profile.

C2.C Waste in Tank Systems *[R 299.9504(1)(c) and 40 CFR §§264.190(a), 264.191(b)(2), 264.192(a)(2)]*

C2 C.1 Wastes' Compatibility With Tanks

Gage Products Company primarily receives solvent wastes for storage and recycling via bulk transport in tanker trailers. These wastes may be stored, prior to recycling, in one of the five above ground designated storage tanks with secondary containment. The Limited Storage Facility tanks are constructed of SA 240-304 stainless steel. Stainless steel is unreactive to organic solvents, and water. Specific information on the tank system, is provided in Section D. D002 wastes are only received in containers, stored in a segregated corrosives container storage area, and are never bulked into any of the waste storage tanks.

C3 WASTE ANALYSIS PLAN

This section of the license application addresses requirements for the Waste Analysis Plan for the hazardous waste management units and the hazardous waste Limited Storage Facility for Gage Products Company. All activities associated with the Waste Analysis Plan will be conducted at the Gage Products Company facility, located at 625 Wanda Avenue, Ferndale Michigan.

All sampling and analytical work performed by Gage Products Company or an off-site generator is done in accordance with "Test Methods of Solid Waste, Physical/Chemical Methods", 3rd Edition (U.S. EPA Office of Water and Waste Management, SW–846, 1986), or equivalent ASTM methods.

C3.A COMMERCIAL FACILITY

Gage Products is a commercial facility that receives waste s generated off site. Gage Products has developed a Waste Analysis Plan to ensure that its facility at 625 Wanda Avenue in Ferndale will accept only wastes that it is authorized to receive. The hazardous wastes stored at Gage Products will be properly characterized prior to waste acceptance. All generators are required to provide a complete waste characterization including chemical analysis when appropriate. Waste screening will be conducted on every shipment of waste to ensure that the waste conforms to the waste profile from the generator, and information on incoming manifests and to ensure that the waste is properly managed within the facility. . This information may be verified by an inspection of the generator's facility on a case by case basis.

All analysis performed pursuant to this application will be consistent with the QA/QC Plan included in Section C4. All samples for the purpose of waste characterization will be collected, transported, stored, and disposed by trained and qualified individuals in accordance with the QA/QC Plan.

In accordance with R299.9609 and 40 CFR 264.73 and Part 264, Appendix I, Gage Products Company will retain all records and results of waste determinations performed as specified in 40 CR4R 264.13, 264.17, 264.314, 264.1034, 264.1063, 264.1083, 268.4(a), and 268.7 in the facility operating record until closure of the facility.

Gage Products Company screens each incoming shipment and analyzes representative samples of the wastes for "fingerprint" parameters. In the event that the screening process indicates that the waste is not consistent with the manifest or the waste characterization, the waste is re-evaluated to determine if it is acceptable. Generators are required to recertify annually that the waste has not changed significantly. This is verified through incoming shipment analysis and screening.

Rejected shipments are handled in accordance with Rejected Load Procedures found in Appendix B.1.

C3.A.1 Initial Waste Characterization Requirements for Generators *[R299.9605(1) and R299.9504(1)(c) and 40 CFR 264.13(b)(5)]*

Prior to accepting a waste stream, generators submit a completed waste profile characterization to Gage's Environmental Department. Gage then reviews the information to ensure the waste stream is consistent with the types of waste used in the reclamation process, and that can be stored in accordance with Gage's Limited Storage Facility license.

Gage Products Company performs the same characterization and analysis for wastes received with the intention of transshipment.

A copy of the waste profile is included in Appendix C1

As described in Section C2, the original product specification information is also used as a basis for creating waste profiles. If the waste stream is coming from a customer who is imminently switching to a Gage-supplied raw material, data from the waste generated by the product of the previous supplier is reviewed. This data includes material safety data sheet(s), laboratory analysis, and/or a sample.

C3.A.1(a) Generator Waste Characterization Discrepancies [*R299.9605(1) and R299.9504(1)(c) and 40 CFR 264.13(a)(3) and (4), 264.13(b)(c)and 264.72]*

Off-site waste is not scheduled for shipment to Gage Products Company unless a waste profile has been reviewed and approved. When a waste shipment arrives at Gage, a sample is immediately obtained and analyzed, and compared with the profile, and the Material Specifications Reference. Upon identifying a discrepancy, a determination will be made as to whether Gage can manage the waste. If the waste requires a minor profile adjustment for composition or physical property, this is the course of action. If the discrepancy causes the waste to differ significantly from the profile, a determination is made whether Gage can manage the waste, in accordance with the conditions of the Limited Storage Facility license; that is, if the discrepancy causes a change in waste codes, or is such that the waste is incompatible with the storage equipment and processes at Gage. If the waste possesses codes which Gage Products is not authorized to store, the waste is rejected. Additionally, if there is any concern about incompatibity with the equipment facilitating storage at Gage, the waste would be rejected.

If the discrepancy can be reconciled with a profile adjustment, the generator is notified, and the profile is adjusted or the waste is re-profiled accordingly. If the waste is to be rejected, the generator is contacted, and a course of action is

determined in accordance with the document describing rejected waste procedures contained in Appendix B1.

C3A.1(b) Subsequent Waste Shipment Procedures *[R299.9605(1) and R299.9504(1)(c) and 40 CFR 264.13(a)(3) and 264.13(b)(4)]*

Analysis of waste is conducted on each load upon arrival at Gage Products, so the program includes current analytical information on each waste stream. If the composition of the supplied product is changed, Gage has that knowledge available to make anticipated adjustments on the profile before the arrival of the subsequent waste load. Furthermore, profile information is reviewed for each waste stream on an annual basis. If no profile changes appear to be warranted, the generator is required to certify annually that there are no process or waste stream changes.

C3A.1(c) Additional Waste Analysis Requirements [R299.9605(1) and R299.9504(1)(c) and 40 CFR 264.13(b)(6) and 264.13(c)(3)]

Gage Products Company will review the waste profile information to ensure that the facility is authorized to receive the waste, and can manage the waste in compliance with the following:

General requirements for ignitable, reactive, or incompatible wastes R299.9605 and 40 CFR 264.17

Compliance with this requirement is described in Section F5.

Gage Products Company conducts a fingerprint analysis using the analytical parameters discussed in Section C2.A.2(a) to screen all incoming shipment of hazardous wastes. Unacceptable waste streams will be handled in accordance with the rejection procedures outlined in Appendix B.1.

Special requirements for bulk and containerized liquids R299.9605 and 40 CFR 264.314

All waste received for storage at Gage Products Company Limited Storage Facility are restricted wastes as defined in 40 CFR 268 and are required to meet specific treatment standards prior to land disposal. Gage Products Company does not perform land disposal, but the requisite paperwork and chain of notification/certification are maintained in order to assure that all 40 CFR 268 requirements are met. EPA has established treatment standards either as specific technologies or as performance standards based on the performance of best demonstrated available technology (BDAT). Compliance with performance standards may be monitored by measuring the concentration level of the hazardous constituents (or in some circumstances, indicator pollutants) in the waste, treatment residual, or in the extract of the waste to meet the treatment standard. When treatment standards are expressed as specific technologies, such technologies must be employed.

Test methods and procedures (Subpart AA) R299.9630 and 40 CFR 264.1034(d)
Gage's storage facility does not have any regulated process vents which are subject to Subpart AA. However, Gage's solvent supply and reclamation program is based on organic solvent reclamation. Utilizing the knowledge of the organic solvent content of the solvents supplied to customers, it is assumed that the organic solvent concentration of the offsite waste causes the ***reclamation*** process to be subject to Subpart AA. Therefore, Gage has a program for equipment subject to compliance with Subpart AA, ***which includes the process vent from the reclamation process equipment***.

Test methods and procedures (Subpart BB) R299.9631 and 40 CFR 264.1063(d)
As mentioned above, Gage's solvent supply and reclamation program is based on organic solvent reclamation. The resulting wastes would be considered subject to Subpart BB, by virtue of the fact that they contain >10 percent organics. Gage has a facility program for compliance with Subpart BB, which is described in detail in Section E.

Waste determination and procedures (Subpart CC) 40 CFR 264.1083
As mentioned above, Gage's solvent supply and reclamation program is based on organic solvent reclamation. Generators must verify on the waste profile form whether the waste contains organic solvent that meets the requirements for Subpart CC.

Based on product and process knowledge, Gage makes the assumption that the wastes stored in the Limited Storage Facility tanks are subject to Subpart CC. Gage has a facility program for compliance with Subpart CC, which is described in detail in Section E.

Waste analysis and record keeping LDR requirements R299.9627 and 40 CFR 268.7
Generator process knowledge will be used to determine whether characteristic waste meets the applicable treatment standards or to demonstrate that the waste has been treated by the appropriate specified treatment technology. Since Gage Products is the original supplier of the original product, the facility is able to provide detailed information on the composition of the resulting waste, as it applies to LDR requirements. In accordance with R299.9627 and 40 CFR 268.41, where treatment standards are based on concentrations in the waste extract, generators shipping waste to the facility will determine if their wastes meet treatment standards.

Record keeping requirements for these sections are described in Section C3.A.3

C3.A.2 Waste Acceptance Procedures*[R299.9605(1) and R299.9504(1)(c) and 40 CFR 264.13(c), 264.74(a) and (b), and 264.73(b)]*

Wastes arrive at Gage Products Company in tanker trucks and containers (drums).

Upon receipt of waste from an off-site generator, Gage Products Company will perform the following tasks:

- Review paperwork
- Visually inspect the waste
- Perform waste screening/fingerprint analysis of waste

Gage Products Company performs the same analysis for wastes which are intended for recycle, or with the intention of transshipment.

These tasks are discussed below.

C3.A.2(a) Review Paperwork *[R299.9605(1) and R299.9504(1)(c), and 40 CFR 264.13(c), 264.72(a) and (b), and 264.73(b)]*

Gage Products Company will review all paperwork, including manifests and LDR notifications, before any wastes are accepted by the facility. Gage Products will review all paperwork for completeness. In addition, the manifest and LDR notification will be compared for consistency. The manifest will also be compared to the waste profile and analytical information provided by the generator and to the waste shipment to ensure the accuracy of information provided on shipment paperwork. The manifest will also be compared to the number of containers, the volume, and/or the weight of the waste in the shipment. All discrepancies will be resolved before processing the waste.

Completeness of manifest. Acceptance of a waste shipment is based on a correctly completed manifest by the generator of the waste. When a waste shipment arrives at Gage Products Company, the manifest is reviewed to ensure it is accurate and complete. At a minimum, the following information must be on each manifest:

- The generator's name and EPA identification number
- Each transporter's name and EPA identification number
- The destination of the waste shipment, including address and EPA identification number
- A Department of Transportation UN number and shipping description
- The quantity or volume of waste in the shipment
- The number and type of containers in the shipment
- A signed, dated certification of the shipment's content
- A signed, dated transporter's acknowledgement of receipt of material.

The completeness of the land disposal restriction notification form, if applicable, is also checked upon arrival at Gage. (a copy of the form is included in Appendix C.3). The following information on the form is reviewed upon receipt of the waste shipment:

- Generator's name

- Generator's identification number
- Information regarding all substances and their respective treatment standards applicable to the identified waste stream
- Certification as required by 40 CFR 268.7

IF APPLICABLE

- Subcategory of the waste code
- Treatability group(s) of waste(s)
- CFR section and paragraph were treatment standard appears.

C3.A.2(b) Visual Inspection of Waste *[R299.9605(1) and R299.9504(1)(c) and 40 CFR 264.13(c)]*

Gage Products Company will visually inspect all containers upon arrival. Containers are inspected to ensure none are leaking. The square root of the number of drums from each generator is sampled, selected using the Table of Random Number in Appendix C5.The container samples will be taken to the laboratory to continue with the fingerprinting process. Each tank wagon is sampled for fingerprint analysis.

C3.A.2(c) Waste Screening/Fingerprinting *[R299.9605(1) and R299.9504(1)(c) and 40 CFR 264.13(b)(14) and 264.13(c)(2)]*

Table C3.A.1 lists the waste analysis procedures, including screening parameters for each hazardous waste, the rationale for the selection of these parameters, test methods that will be used to test for these parameters, the appropriate reference, whether the waste is specified in R299.9216, and if so, the applicability to the waste's F-listed status, the frequency of waste screening, and the rationale for frequency.

Both containers and tankwagons are sampled using a COLIWASA sampling device. This method allows Gage to obtain a comprehensive representative sample of the waste, from the top to the bottom of the vessel. This method was selected for its simplicity, ability to obtain a representative sample, and consistency with U.S EPA test methods. All samples collected at the facility are obtained in secondarily contained areas by trained facility employees. This method is authorized in Appendix I of 40 CFR 261.

Since this is the universal sampling method employed by Gage, the above information is supplied in lieu of a Table C3.A.2, since a list of sampling methods and rationale is not applicable to Gage's operations.

Each waste shipment is sampled and analyzed for waste verification parameters. The selection of these waste verification parameters is based on the need to identify restricted waste and waste characteristics that will affect the recycling processes, and to provide information adequate to provide for safe handling and storage. Fingerprint analysis on an incoming waste is checked against the

baseline parameters located in the Gage Products Company Material Specifications Reference. This reference contains the gas chromatograph from a representative sample of the solvent waste generated. The gas chromatograph of an incoming waste is compared to this baseline to ensure the waste material is, in fact, what is expected. If it is not, either the waste profile will be amended, the waste stream will be re-profiled according to its actual identity, or the waste stream will be rejected.

Waste verification parameters are subset of the parameters required for proper waste characterization. The waste verification parameters and tests for wastes to be accepted and stored at the Gage Products Company Limited Storage Facility are weight percent- solids, gas chromatography of extracted solvents; weight percent – water; and pH. This Limited Storage Facility permit applies only to the storage and handling of wastes in the Limited Storage Facility although reference is often made to the testing required prior to recycling. Gage Products Company will apply the higher testing standards related to proper recycling in order to ensure safe storage and handling as well as provide the information normally required prior to eventual recycling as appropriate for the spent solvent wastes.

Waste shipments are only accepted for treatment when the fingerprint analysis listed in in Table C3.A1 are conducted and the criteria are met:

Table C3.A.1 Waste Analysis Procedures

Screening Parameter	Rationale for Parameter	Test Method	Reference	Frequency	Rationale for Frequency
Percent solids	Recycling process capability	Weigh/heat/weigh	ASTM Method 2369 - Modified	Every load	Needed for recycling process compatibility
Organic solvent composition	To determine if expected solvent constituents are present and to provide a clean basis for comparison to original product specification	Gas Chromatography	ASTM Method E260	Every load	Needed for recycling process compatibility
Water	Recycling process capability	Carl Fisher water analysis	ASTM Method D1364-78	Every load	Needed for recycling process compatibility
pH	Determine compatibility with process	pH meter	SW 846 Method 9040	Every load	Needed for recycling process compatibility

Gage's solvent closed loop recovery program is based on recycling organic solvents originally supplied. Therefore, Gage assumes that solvent wastes received meet the definition for being subject to 40 CFR Parts 264, Subparts AA and BB. Gage uses this process knowledge in acknowledging the applicability of these subparts.

If it is determined that the waste does not meet Gage's waste criteria for receipt, the generator is contacted. The course of action (return to generator or reject to another facility) is determined, and executed according to the procedures detailed in Appendix B.

C3.A.3 Procedures to Ensure Compliance with Land Disposal Restrictions (LDR) Requirements *[R299.9627 and 40 CFR Part 268]*

All shipments of wastes subject to LDR received at the facility will be accompanied by appropriate generator notification and LDR notification in accordance with R299.9627 and 40 CFR 268.7. The LDR notification accompanying generator wastes will be reviewed, and any discrepancies in the LDR notification and the associated manifest, analytical records, or Waste Profile From will require shipment rejection unless additional, satisfactory, clarifying information is provided by the generator. All information obtained to document LDR compliance will be maintained in the facility operating record until closure of the facility.

If the facility receives a shipment of waste without LDR notification, or a notification with incorrect or incomplete information, the generator will be contacted, and will be required to provide an LDR before the waste is received for storage or for treatment.

The still bottom waste which Gage generates from its solvent recovery process is shipped offsite for combustion in cement kilns or for incineration. This still bottom waste is characterized and managed within all requirements for generators of hazardous waste. It is also accompanied by the appropriate notifications.

In accordance with the LDR regulations, all wastes shipped off site will be analyzed, or generator knowledge will be used when appropriate, to determine whether the waste meets the applicable LDR treatment standards specified in R299.9627 and 40 CFR 268.41-43. All analytical results will be maintained in the facility operating record until closure of the facility. Wastes that are determined through analysis to meet treatment standards as specified in R299.9627 and 40 CFR 268.41-43 will be disposed of in accordance with applicable regulations.

Gage Products will supply LDR notifications and certification, including appropriate analytical records to support the certification to the receiving facility with the first shipment of each waste stream. The notifications and certifications will contain the information required under R299.9627 and 40 CFR 268.7. Any additional data obtained from the generators (i.e. Waste Profile Forms, original LDR notifications analysis provide by generators) will be provided to the licensed TSDF where the waste will be sent.

C3.A.3(a) Spent Solvent Wastes *[R299.9627 and 40 CFR 264.13(a)(1), 268.7, 268.30, 268.31, 268.40, 268.41, 268.42, and 268.43]*

Spent solvent wastes (F001 – F005) are accepted at the facility. Generator process knowledge will be used to determine the presence of spent solvent wastes (F001 – F005). Since Gage is often the supplier of the original solvent, the facility has detailed composition knowledge of solvents before use, and can assist generators (customers) in characterizing wastes based on this information. Generator process knowledge will be documented on the waste material profile report and LDR notification. The LDR notification will provide additional information regarding the appropriate treatment standards for the waste and whether it has already been treated to the appropriate treatment standards.

C3.A.3(b) Listed Wastes *[R299.9627, R299.9213, and R299.9214 and 40 CFR 264.13(a)(1), 268.7, 268.33, 268.34, 268.35, 268.36, 268.39, 268.40 268.41, 268.42, and 268.43]*

Gage Products Company does not receive any listed wastes for storage.

C3.A.3(c) Characteristic Wastes*[R299.9627, R299. 9208, and R299.9212, and 40 CFR 261.3(d)(1), 268.13(a)(1), 268.7, 268.9, 268.37, 268.40 268.41, 268.42, and 268.43 and Part 268, Appendix I and Apendix IX]*

Generator process knowledge will be used to determine whether characteristic waste meets the applicable treatment standards or to demonstrate that the waste has been treated by the appropriate specified treatment technology. In accordance with R299.9627 and 40 CFR 268.41, where treatment standards are based on concentrations in the waste extract, generators shipping waste to the facility will determine if their wastes meet treatment standards.

C3.A.3(h) Waste Mixtures and Wastes with Overlapping Requirements *[R299.9627 and 40 CFR264.13(a), 268.7, 268.41(b), 268.43(b), and 268.45(a)]*

Generator process information and analytical data will be used to demonstrate that those waste mixtures and wastes with multiple codes are properly characterized. Each waste that has more than one characteristic will be identified with a number for each characteristic. Waste identified as meeting a listing and exhibiting a characteristic will be primarily identified with the listed waste code for the purpose of profiling, approval, manifesting.

C3.A.3(i) Dilution and Aggregation of Wastes *[R299.9627 and 40 CFR 268.3]*

The still bottom waste from the solvent recovery process is disposed as a co-fuel in cement kilns, or for incineration. No process residue from waste received for storage or processing at Gage Products is destined for land disposal.

It should be noted that Gage Products Company understands that applicable requirements of 40 CFR 268 must be complied with for any hazardous waste that Gage Products Company may generate but that Gage's generated wastes not

handled in the Limited Storage Facility are not subject to this permit as they are not handled in the regulated unit.

C3.C Notification, Certification, and Record Keeping Requirements ***[R299.9627 and R299.9609 and 40 CFR Part 264.73, 268.7, and 268.9(d)]***

All initial shipments of wastes subject to LDR received at the facility will be accompanied by appropriate one-time (minimum) LDR notification in accordance with R299.9627 and 40 CFR 268.7. All information obtained to document LDR compliance will be maintained in the facility operating record until closure of the facility.

C3.C.1 Retention of Generator Notices and Certifications ***[R299.9627 and 268.7(a)(7)]***

Gage Products Company will retain a copy of all notices, certifications, demonstrations, data, and other documentation associated with compliance to LDRs:

- Notices of restricted wastes not meeting treatment standards or exceeding levels specified in RCRA 3004(D), including the information listed in R299.9627 and 40 CFR 268.7(a)(1).
- Notices of restricted wastes meeting applicable treatment standards and prohibition levels, including the information in $299.9727 and a40 CFR 278.7(a)(2)

C3.C.2 Notification and Certification Requirements for Treatment Facilities ***[R299.9627 and 268.7(b)]***

Gage Products Company is not considered a treatment facility for the purpose of this application.

C3.C.3 Waste Shipped to Subtitle C Facilities

Gage Products Company does not ship waste to Subtitle C facilities.

C3.C.4 Waste Shipped to Subtitle D Facilities

Gage Products Company does not ship waste to Subtitle D facilities.

C3.C.5 Recyclable Materials

Gage Products Company does not accept recyclable materials used in a manner constituting disposal.

C3.C.6 Record Keeping ***[R299.9608(4), R299.9609, R299.9610(3), and R299.9627 and 40 CFR 264.72, 264.73, 268.7(a)(5), 268.7(a)(6), 268.(a)(7) and 268.7(d)]***

Gage Products Company maintains a facility operating log in accordance with R299.9609 and 264.73. A complete list of records maintained for the operating log is found in Section M-2 of this license application.

Copies of all necessary notifications and certifications, as well as relevant inspection forms and monitoring data, are also maintained on file at the facility. Files will be maintained for a minimum of three years (for inspection records and LDR notification), or until facility closure (for inventory records).

If a significant manifest discrepancy is discovered (such as variation in one-piece count or misrepresentation of the type of waste or corrosive rather than flammable) that cannot be resolved with the generator or transporter within 15 days of receipt, facility personnel will submit to the Director and Regional Administrator a letter describing the discrepancy and all attempts to reconcile the discrepancy. The letter will include a copy of the discrepant manifest or shipping document.

Gage Products Company will keep records of the name and location of each entity receiving a a hazardous waste-derived product.

C3.C.7 Required Notice *[R299.9605(1) and 40 CFR 264.12(a) and (b)]*

Gage Products Company will notify the Office Chief in writing at least four weeks before the date the facility expects to receive hazardous waste from a foreign source. Notice of subsequent shipments of the same waste from the same foreign source is not required. When receiving such hazardous waste, the facility will comply with applicable treaties or other agreements entered into between the country in which the foreign source is located and the United States.

When Gage is to receive hazardous waste from an off-site source, the facility will inform the generator in writing that the facility has the appropriate license for and will accept the waste the generator is shipping. The facility will keep a copy of this written notice in the operating record.

C4 Quality Assurance/Quality Control

C4a Program Goals

The goal of the Quality Assurance/Quality Control program is to provide accurate and precise data on the physical and chemical properties of waste so that the wastes are handled safely. This is accomplished by ensuring that:

- The wastes are properly identified and characterized.
- Wastes which do not meet Gage Products company criteria are not accepted
- All personnel involved in sample collection and sample screening are trained in proper procedures.

C4b Sampling Program

Gage provides initial and recurrent training to Limited Storage Facility employees to insure waste samples are collected, transported, analyzed, stored, and disposed properly and safely. A complete description of Gage's employee training program is included in Section H of this document. Gage Products maintains certification under the ISO 9002 and 14001 standards for quality and environmental management, and has a work instruction program under these systems addressing appropriate sampling, handling, and management procedures.

Designated sampling personnel are knowledgeable of sample collection procedures and receive on-the-job sampling-collection training for the specific sampling procedures used at Gage Products Company. This training includes the procedures to sample bulk tankers as well as drummed wastes. The supervisor documents the employees' training effectiveness annually.

Sampling equipment is inspected for proper decontamination and operability before any shipment is sampled. Each inspection is documented, noting any problems and corrective actions taken.

C4c Chain-of-Custody (LSF Storage Area)

The operator or assistant operator collects a screening sample(s) from a waste shipment. To document sample possession from the time of collection until the sample has been received by the sample custodian/coordinator, the individual collecting the sample will complete the chain-of-custody information on the material batch sheet. An example of the batch ticket form is provided in Appendix C4. Proper custody of the samples will be documented, and changes in sample custody will be documented. As few people as possible will handle the samples. While collecting the sample it is the responsibility of the operator or assistant for the care and custody of the samples until they are transferred. This chain-of-custody procedure will be followed during all waste sampling activities.

Each record will contain the following information: signature of the sampler, date and time of the collection, sample type, signature of persons involved in the chain of possession, manifest number, generator name, and inclusive dates and times of possession.

A tag or the sample container itself will be labeled. The information to appear on the tag or container will include the following: the date upon which it is obtained; manifest number, generator name; and the name of the sampler.

C4d Chain-of-Custody (Laboratory)

All collected samples will be under strict chain-of-custody procedures. This means that all samples must be traceable from the time the samples are received at the Gage Products or at an outside third party laboratory door until results are reported and sample disposition has been determined.

All samples will be received at the Gage Products or outside third party certified analytical laboratory by the sample custodian/coordinator. At Gage, this is normally the laboratory technician's responsibility. It will be the responsibility of the sample custodian/coordinator to determine: 1) which analyses are to be performed on the arriving samples; and 2) the manner in which those samples will be split, preserved, and stored or routed. It is the objective of the sample custodian/coordinator to ensure that the receipt of all samples is consistent with the requirements and that all pertinent information relative to those samples is recorded.

It is the sample custodian/coordinator's responsibility to examine whether or not each of the sample containers is individually properly labeled and whether or not the paperwork matches the contents of the bottle (or package). In addition, the sample custodian/coordinator will note whether or not all the dates and times are consistent, and whether or not the sample description on the paperwork matches the description on the sample container.

All samples received at Gage Product Company or a third party certified analytical laboratory must be logged in before work is performed on the samples. The purpose of the log-in procedure, including sequential numbers assigned to all samples received in the facility, is to ensure that the analytical laboratory has a means by which samples can be tracked for any sequence of events during a particular analytical period. In handling projects in this manner, the analytical laboratory and/or Gage Products laboratory can ensure a consistent and documented sequence of events under any analytical situation.

All samples received by the Gage Products laboratory or be a third party laboratory will be kept in a designated area and will be distributed for analysis to the laboratory only when the analyst has signed for the samples on the chain-of -custody form.

C4e Maintenance of Laboratory Custody

Laboratory custody must be consistent with all the chain-of-custody requirements from the beginning of sampling to the final report.

It will be the responsibility of every analyst signing for a sample or samples to ensure that: a) these samples are kept in a minimum-access facility, and b) they are within their possession during the particular period during which they are being analyzed.

All samples received for analysis by the Gage Products or outside third party laboratory will be stored in the analytical laboratory chain-of-custody facilities until a final report is issued. No chain-of-custody samples may be discharged until written permission is received relative to disposal of those samples.

The Gage Products or third party laboratory will conduct all analyses in accordance with U.S. EPA's SW-856 "Test Methods for Evaluating Solid Waste " 3rd ed. Nov. 1986 or with equal ASTM methods. These procedures incorporate stringent quality-control requirements and describe accuracy, calibration criteria, internal standards, and method-detection limits.

C4f Gage Products In-House Laboratory Analysis

The operator or assistant operator will take the collected sample and the accompanying chain-of-custody form to the Gage Products laboratory.

In the laboratory, the operator or assistant operator will complete all check-in procedures cited above. The laboratory custodian/coordinator analyst will perform the necessary fingerprint analyses and compare the results to previous loads received from the generator in question. The analytical results are retained in Gage Products Company's Material Specification Reference. All test results are documented on a chain-of - custody form and are kept on file at Gage Products Company.

Gage Products Company laboratory personnel have been trained to perform the analytical procedures outlined under Fingerprint Analyses c-2e (i). The supervisor documents the employees' analytical skills and training effectiveness annually.

Analytical equipment is inspected and serviced semi-annually and routinely checked before each analysis. Equipment is checked with blanks, standards or replicates; and records are kept of these results. Left over or used samples are disposed appropriately.

C4g Data Evaluation

Analytical data are evaluated as part of the screening and acceptance procedures for waste shipments. The data are compared to screening tests of previous shipments of the waste stream, other samples of the same shipment, and waste characterization data. Any discrepancies that cannot be attributed to normal sampling or laboratory variation are investigated further.

The analytical results of the sample shipment are examined by the operator, assistant operator, or laboratory personnel. If the shipment is consistent with the pre-shipment analysis, the previous shipment's analysis and other information, the material is accepted for recycling or storage. Test results are filed by the custodian/coordinator, operator, or assistant operator.

C4h References

Hatayama, H.K., J.J. Chen, E. R. de Vera, R.D. Stephens, and P.L. Storm. 1980. *A method for determining the Compatibility of Hazardous Wastes.* EPA-600/2-8-076. U.S. Environmental Protection Agency. Cincinnati, Ohio.

U.S. Environmental Protection Agency. "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods". U.S. EPA Office of Water and Waste Management. SW-846.

U.S. Environmental Protection Agency. 1984. *Waste Analysis Plans.* A Guidance Manual. EPA/530-SW-84-012. Office of Solid Waste.

APPENDIX C1

Gage Products Company Waste Profile Form

Waste Stream Number (Gage Assigns): _____

Products Company

Waste Profile Form

821 Wanda Avenue Ferndale, Michigan 48220
248-541-3824
EPA ID No. MID 005 338 801

IMPORTANT: This form is to be completed by a representative of the waste generator. Please complete all of the following questions and return to: Gage Products Company, 821 Wanda Ferndale, Michigan 48220 Fax: 248-398-4837 Attention: Environmental Manager.

GENERATOR INFORMATION

Generator Name: _____ EPA ID No. _____
Mailing Address: _____
City: _____ State: _____ Zip Code: _____
Site Address: _____
City: _____ State: _____ Zip Code: _____
Contact: _____ Telephone No. _____
Contact e-mail address: _____
Emergency Contact: _____ Emergency Phone: _____

GENERAL WASTE STREAM INFORMATION

Waste Description: _____
Process Generating the Waste: _____
Is this a "Hazardous Waste" as defined by Federal or State Regulations? ☐ Yes ☐ No
If YES, enter the applicable Waste Code Identification Number(s) (example D001, D035 EP Toxicity/TCLP):
☐ D001 Other applicable waste codes: _____
Recommended Personal Protective Equipment and special handling procedures: _____
_____
Anticipated Volume: _____ ☐ Gallons ☐ Other
Per: ☐ Day ☐ Week ☐ Month ☐ Year ☐ One time only
To be transported in: ☐ Bulk ☐ Drums If drum, type & size: _____
☐ Other: _____
Is representative sample included? ☐ Yes ☐ No If YES, complete the RSC found on the last page.

WASTE PROPERTIES

Physical State: ☐ Liquid Other: _____
Odor: ☐ None ☐ Mild ☐ Strong Describe: _____
Flashpoint (Degrees Fahrenheit): ☐ < 73° ☐ 73-100 ° ☐ 101-140 ° ☐ 141-200 ° ☐ >200 ° ☐ NA
Layers: ☐ Single Phased ☐ Bi-Layered ☐ Multi-Layered
Density: _____ ☐ Lb/Gal ☐ Lb/yd 3 ☐ g/cc ☐ Other: _____
Color: _____ Percent Solids: _____ pH: _____
Note if the waste exhibits any of the following health hazards:
☐ Carcinogenic ☐ Infectious/Biological ☐ Radioactive ☐ Poison-Inhalation Hazard

REACTIVITY

Note if the waste exhibits any of the following reactive properties:
☐ Water Reactive ☐ Autopolymerizable ☐ Acid Reactive ☐ Pyrophoric ☐ Strong Oxidizer ☐ Autoignitable
☐ Thermally Sensitive ☐ Alkaline Reactive ☐ Shock Sensitive ☐ Explosive ☐ None of These

Waste Stream Number (Gage Assigns):

WASTE CLASSIFICATION

RCRA Waste Description per 40 CFR 261: _____

RCRA EPA Waste Code(s) per 40 CFR 261: _____

Waste is subject to Land Disposal Restrictions per 40 CFR 268: ☐ Yes ☐ No

Waste is Subject to Subpart CC Regulations? ☐ Yes ☐ No

COMPLETE WASTE DESCRIPTION

Concentration ranges are suggested, but must total at least 100 %. Units must be identified and are to be in parts per million and/or percentages. Attach additional pages if necessary. Wastes must conform with Gage's control specifications, as designated in "Control Specification of Inbound Spent Solvent, Recovered Spent Purge, and Other Solvent Streams".

Components	Range	Components	Range

TRANSPORTATION INFORMATION

Gage will accept delivery of waste materials in a time and manner that is scheduled by Gage Products.

If the waste is a U.S. DOT hazardous material, complete the following:

Proper U.S. DOT Shipping Name: _____

N.O.S. Description, if applicable: _____

Hazard Class: _____ UN or NA Number: _____

Required Labels: _____ Required Placards: _____

CERCLA Reportable Quantity/Component: _____

Waste is to be shipped only by a permitted carrier:

Transporter:
- ☐ Great Lakes Terminal and Transport - EPA ID No. ILD 024 921 074, Phone 800-458-8858
- ☐ S&C Transport - EPA ID No. MID186804399, Phone 734-422-0200
- ☐ Harold Marcus LTD - EPA ID No. MIT 270 012 321, Phone 519-695-3734

Other Transporter: _____ EPA ID No. _____

Address: _____ Contact: _____

_____ Phone: _____

Permit No. _____

SUPPLEMENTAL INFORMATION

☐ MSDS ☐ Analytical Data ☐ Memo/Letter ☐ Waste Composition ☐ Other ☐ None

Waste Stream Number (Gage Assigns):

LAND DISPOSAL RESTRICTIONS, RESTRICTED WASTE NOTIFICATION

Indicate the EPA waste code and corresponding treatment standards in the appropriate sub-section below.

☐ Waste Carries D001 Waste Code:

Treatability Group (Check one):

- ☐ Non-wastewater (>1% TOC, >1% TSS)
- ☐ Wastewater (<1% TOC, <1% TSS)

Waste Sub-category (Check one):

- ☐ High TOC (>10% Total Organic Carbon)
- ☐ Low TOC (<10% Total Organic Carbon)

(If this stream is D001, Non-wastewater, High TOC as indicated above):

☐ The Treatment Technology specified by EPA 40 CFR 268.40, for this waste stream is RORGS; CMBST; or POLYM. This treatment standard is defined in 40 CFR 268.42.

☐ Waste Carries F001-F005 Waste Code(s):

Treatment standards are defined for individual components - 40 CFR 268.40

☐ Waste Carries Other Waste Code(s):

Code(s): _____

Indicate subcategory, treatability group, and 40 CFR citation where treatment technology is specified:

_____

CERTIFICATION

Is this a Part 111 of Act 451 hazardous waste (R299.9201 to R299.9229)? ☐ Yes ☐ No

Does the waste represented by this Waste Profile form contain any of the following pesticides or herbicides: Endrin, Lindane, Methoxychlor, Toxaphene, 2,4,0D, 2,4,5-TP (silvex), chlordane, Heptachlor (and its epoxide)? ☐ Yes ☐ No

Is the waste from a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (40 CFR Part 300, Appendix B) or DEQ mandated cleanup? ☐ Yes ☐ No

Does the waste represented by this Waste Profile Form contain concentrations of radioactive elements regulated by the Nuclear Regulatory Commission? ☐ Yes ☐ No

Does the waset represented by this Waste Prfile Form contain concentrations of PCBs regulated under 40 CFR Part 147, "PCB Compounds", of Act 451 or 40 CFR Part 761? ☐ Yes ☐ No

Do the Waste Profile Form and all attachments contain true and accurate descriptions of the waste material, and has all the relevant information within the possession of the generator regardng known or suspected hazards pertaining to the waste been disclosed to the facility? ☐ Yes ☐ No

GENERATOR CERTIFICATION STATEMENT: I hereby certify that as an authorized representative of the generator named herein, to the best of my knowledge all information submitted in this and attached document is true and accurate and that all wastes have been properly containerized and labeled. Samples analyzed to obtain the information reported on this form were representative of the waste and all known and suspected hazardous components have been included in the documentation.

SIGNATURE	TITLE
PRINTED NAME	DATE

APPENDIX C2

Gage Products Company Waste Composition Calculator

WASTE COMPOSITION CALCULATOR REVISION 2

Date
Generator

Solids, wt% 0.0
Water, wt% 0.0

Manifest:

Top layer, %	100 wt %
Water GC	0.00
Water KF	0.00
Solids	0.00
Methanol	0.00
Ethanol	0.00
Acetone	0.00
IPA	0.00
MEK	0.00
Ethyl Acetate	0.00
mixed Hexanes	0.00
i-BuOH	0.00
n-BuOH	0.00
IPAC	0.00
mixed Heptanes	0.00
MIBK	0.00
Toluene	0.00
Propyl Propionate	0.00
n-Butyl Acetate	0.00
VMP Naphtha	0.00
PM Acetate	0.00
Xylene	0.00
MNAK	0.00
IBIB	0.00
Cyc 53/GP-100	0.00
Cyc 63/GP-150	0.00
EB Acetate	0.00
DBE	0.00
Sum	0.00

Bottom layer, %	0 wt %
Water GC	
Water KF	
Solids	
Methanol	
Ethanol	
Acetone	
IPA	
MEK	
Ethyl Acetate	
mixed Hexanes	
i-BuOH	
n-BuOH	
IPAC	
mixed Heptanes	
MIBK	
Toluene	
Propyl Propionate	
n-Butyl Acetate	
VMP Naphtha	
PM Acetate	
Xylene	
MNAK	
IBIB	
Cyc 53/GP-100	
Cyc 63/GP-150	
EB Acetate	
DBE	
Sum	0.00

Report these values	wt %
Water	
Water	
Solids	
Methanol	0.0
Ethanol	0.0
Acetone	0.0
IPA	0.0
MEK	0.0
Ethyl Acetate	0.0
mixed Hexanes	0.0
i-BuOH	0.0
n-BuOH	0.0
IPAC	0.0
mixed Heptanes	0.0
MIBK	0.0
Toluene	0.0
Propyl Propionate	0.0
n-Butyl Acetate	0.0
VMP Naphtha	0.0
PM Acetate	0.0
Xylene	0.0
MNAK	0.0
IBIB	0.0
Cyc 53/GP-100	0.0
Cyc 63/GP-150	0.0
EB Acetate	0.0
DBE	0.0
Sum	0.0
Total	**0.0**

This number MUST be 96 - 101% ===>

f not, include small peaks, check water & solids, there's an error!

HAP, wt%	0.0
VOC, wt%	100.0

APPENDIX C3

Gage Products Company Land Disposal Restriction Form

Products Company

NOTIFICATION OF HAZARDOUS WASTE RESTRICTED FROM LAND DISPOSAL

Phone 248-541-3824 **Fax 248-541-2524**

This notification form must be completed by the generator and shall accompany the first shipment of restricted waste subject to the Land Disposal Restrictions (40 CFR 268 Subpart C). Use a separate notification form for each US DOT description (i.e. Line 11a, 11b, 11c, 11d) on the Uniform Hazardous Waste Manifest.

- Complete all information in Section I.
- Check Box 1 or 2 describing notification requirements. If Box 3 is checked, Box 2 must also be checked.
- If Box 2 is checked, identify any potential Underlying Hazardous Constituents in Section II. Sign certification.

SECTION I			
GENERATOR'S NAME:			
EPA ID NUMBER:		WASTE PROFILE NUMBER:	
DATE OF SHIPMENT:		MANIFEST NUMBER:	
MANIFEST LINE NUMBER:	(Check One) ☐ **9a1** ☐ **9a2** ☐ **9a3** ☐ **9a4**		
TREATABILITY GROUP:	(Check One) ☐ Wastewater ☐ NonWastewater		
HAZARDOUS DEBRIS:	☐ Yes, debris is subject to the alternative treatment standards of 40 CFR 268.45		

EPA HAZARDOUS WASTE CODE(S)							

Please check one:

☐1. This waste is subject to Land Disposal Restrictions. The (non-wastewater) hazardous waste stream carries only the D001 code for ignitability. It is being treated by CMBST, RORGS, OR POLYM, and as such, the generator is not required to determine and identify underlying hazardous constituents in the characteristic waste (40 CFR 268.9(a)).

If this box is checked, generator must sign below and needs only submit page 1 of this document to meet the LDR notification requirement.

☐2. This waste stream is subject to Land Disposal Restrictions. It carries an applicable waste code, F001-F005, or F039, or is a characteristic hazardous waste. As such, underlying hazardous constituents of concern are identified on the following pages.

If this box is checked, generator must sign below, identify any underlying hazardous constituents on the following pages and submit pages 1-5 of this document to meet the LDR notification requirement.

☐3. The waste meets the applicable treatment standards of 40 CFR 268.40, Treatment Standards for Hazardous Wastes.

Certification for Number 3 above: I certify under penalty of law that I have personally examined and am familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR part 268 subpart D. I believe that the information I submitted is true, accurate, and complete. I am aware there are significant penalties for submitting a false certification, including the possibility of fines and imprisonment.

I have used the following to make the above determination:

☐ Knowledge of the waste producing process, raw materials used and reaction products, or

☐ Results of analysis for the constituents in Table UTS or the Treatment Standards for Hazardous Wastes.

Waste analysis data attached? ☐ Yes ☐ No

Authorized Signature: _____ Date: _____

Printed Name: _____

Land Disposal Restriction Notification

SECTION II

The wastes identified on the above mentioned manifest document number and bearing the EPA Hazardous Waste Number(s) identified in Section I are subject to the Land Disposal Restrictions of 40 CFR 268 Subpart C. The wastes do not meet the applicable treatment standards specified in 40 CFR 268 Table UTS or RCRA Section 3004 (d). In compliance with the requirements of 40 CFR 268.7 and 268.9, we are indicating below the applicable underlying constituents of concern. The underlying constituents of D001 wastes that can be treated by CMBST do not have to be determined. (Refer to 40 CFR 268.9 (a). Generators are required to identify the constituents in F001-F005, F039, D001 (except as stated above), D002, and D012-D043 wastes.

40 CFR 268.48 TABLE UTS – UNIVERSAL TREATMENT STANDARDS

√	Regulated constituent	CAS No.	Wastewater standard	Non-wastewater standard	√	Regulated constituent	CAS No.	Wastewater standard	Non-wastewater standard
			mg/l	mg/kg3 unless noted as in "mg/l TCLP"				mg/l	mg/kg3 unless noted as in "mg/l TCLP
	Organic Constituents:					Benzo(a)pyrene	50-32-8	0.061	3.4
						Bromodichloromethane	75-27-4	0.35	15
	Acenaphthylene	208-96-8	0.059	3.4		Bromomethane/Methyl bromide	74-83-9	0.11	15
	Acenaphthene	83-32-9	0.059	3.4		4 –Bromophenyl phenyl ether	101-55-3	0.055	15
	Acetone	67-64-1	0.28	160		n-Butyl alcohol	71-36-3	5.6	2.6
	Acetonitrile	75-05-8	5.6	38		Butylate	2008-41-5	0.042	1.4
	Acetophenone	96-86-2	0.010	9.7		Butyl benzyl phthalate	85-68-7	0.017	28
	2-Acetylaminofluorene	53-96-3	0.059	140		2-sec-Butyl-4,6-dinitrophenol/ Dinoseb	88-85-7	0.066	2.5
	Acrolein	107-02-8	0.29	NA		Carbaryl	63-25-2	0.006	0.14
	Acrylamide	79-06-1	19	23		Carbenzadim	10605-21-7	0.056	1.4
	Acrylonitrile	107-13-1	0.24	84		Carbofuran	1563-66-2	0.006	0.14
	Aldicarb sulfone	1646-88-4	0.056	0.28		Carbofuran phenol	1563-38-8	0.056	1.4
	Aldrin	309-00-2	0.021	0.066		Carbon disulfide	75-15-0	3.8	4.8 mg/l TCLP
	4-Aminobiphenyl	92-67-1	0.13	NA		Carbon tetrachloride	56-23-5	0.057	6.0
	Aniline	62-53-3	0.81	14		Carbosulfan	55285-14-8	0.028	1.4
	Anthracene	120-12-7	0.059	3.4		Chlordane (alpha and gamma isomers	57-74-9	0.0033	0.26
	Aramite	140-57-8	0.36	NA		p – Chloroaniline	106-47-8	0.46	16
	Alpha-BHC	319-84-6	0.00014	0.066		Chlorobenzene	108-90-7	0.057	6.0
	Beta-BHC	319-85-7	0.00014	0.066		Chlorobenzilate	510-15-6	0.10	NA
	Delta-BHC	319-86-8	0.023	0.066		2 - Chloro - 1, 3-butadiene	126-99-8	0.057	0.28
	gamma-BHC	58-89-9	0.0017	0.066		Chlorodibromomethane	124-48-1	0.057	15
	Barban	101-27-9	0.056	1.4		Chloroethane	75-00-3	0.27	6.0
	Bendiocarb	22781-23-3	0.056	1.4		bis(2 – Chlorethoxy)methane	111-91-1	0.036	7.2
	Benomyl	17804-35-2	0.056	1.4		bis(2 – Chloroethyl)ether	111-44-4	0.033	6.0
	Benzene	71-43-2	0.14	10		Chloroform	67-66-3	0.046	6.0
	Benz(a)anthracene	56-55-3	0.059	3.4		Bis(2-Chloroisopropyl) ether	39638-32-9	0.055	7.2
	Benzal chloride	98-87-3	0.055	6.0		p-Chloro-m-cresol	59-50-7	0.018	14
	Benzo(b)fluoranthene (difficult to distinguish from Benzo (k) fluoranthene)	205-99-2	0.11	6.8		2-Chloroethyl vinyl ether	110-75-8	0.062	NA
	Benzo(k)fluoranthene (difficult to distinguish from Benzo (b) fluoranthene)	207-08-9	0.11	6.8		Chloromethane/Methyl chloride	74-87-3	0.19	30
	Benzo(g, h, i)perylene	191-24-2	0.0055	1.8					

Regulated constituent	CAS No.	Wastewater standard	Non-wastewater standard	Regulated constituent	CAS No.	Wastewater standard	Non-wastewater standard
		mg/l	mg/kg3 unless noted as in "mg/l TCLP"			mg/l	mg/kg3 unless noted as in "mg/l TCLP"
Organic Constituents:				cis - 1, 3 - Dichloropropylene	10061-01-5	0.036	18
2-Chloronaphthalene	91-58-7	0.055	5.6	trans - 1, 3 - Dichloropropylene	10061-02-6	0.036	18
2 - Chlorophenol	95-57-8	0.044	5.7	Dieldrin	60-57-1	0.017	0.13
3 - Chloropropylene	107-05-1	0.036	30	Diethyl phthalate	84-66-2	0.20	28
Chrysene	218-01-9	0.059	3.4	p – Dimethylamino-azo-benzene	60-11-7	0.13	NA
o- Cresol	95-48-7	0.11	5.6	2 - 4 - Dimethyl phenol	105-67-9	0.036	14
m- Cresol difficult to distinguish from p - cresol)	108-39-4	0.77	5.6	Dimethyl phthalate	131-11-3	0.047	28
p- Cresol difficult to distinguish from m - cresol)	106-44-5	0.77	5.6	Di-n-butyl phthalate	84-74-2	0.057	28
M–Cumenyl methylcarbamate	64-00-6	0.056	1.4	1,4-Dinitrobenzene	100-25-4	0.32	2.3
Cyclohexanone	108-94-1	0.36	0.75 mg/l T CLP	4, 6-Dinitro-o- cresol	534-52-1	0.28	160
o, p' - DDD	53-19-0	0.023	0.087	2, 4 - Dinitrophenol	51-28-5	0.12	160
p, p' - DDD	72-54-8	0.023	0.087	2, 4 - Dinitrotoluene	121-14-2	0.32	140
o, p' - DDE	3424-82-6	0.031	0.087	2, 6- Dinitrotoluene	606-20-2	0.55	28
p, p' - DDE	72-55-9	0.031	0.087	Di - n - octyl phthalate	117-84-0	0.017	28
o, p' - DDT	789-02-6	0.0039	0.087	Di-n-propylnitrosamine	621-64-7	0.40	14
p, p' – DDT	50-29-3	0.0039	0.087	1,4-Dioxane	123-91-1	12.0	170
Dibenz(a, h)anthracene	53-70-3	0.055	8.2	Diphenylamine (difficult to distinguish from diphenylnitrosamine	122-39-4	0.92	13
Dibenz(a, e)pyrene	192-65-4	0.061	NA	Diphenylnitrosamine (difficult to distinguish from diphenylamine	86-30-6	0.92	13
1, 2 - Dibromo - 3 chloropropane	96-12-8	0.11	15	1,2-Diphenylhydrazine	122-66-7	0.087	NA
1,2-Dibromoethane/ Ethylene dibromide	106-93-4	0.028	15	Disulfoton	298-04-4	0.017	6.2
Dibromomethane	74-95-3	0.11	15	Dithiocarbamates (total)	NA	0.028	28
m - Dichlorobenzene	541-73-1	0.036	6.0	Endosulfan I	959-98-8	0.023	0.066
o - Dichlorobenzene	95-50-1	0.088	6.0	Endosulfan II	33213-65-9	0.029	0.13
p - Dichlorobenzene	106-46-7	0.090	6.0	Endosulfan sulfate	1031-07-8	0.029	0.13
Dichlorodfluromethane	75-71-8	0.23	7.2	Endrin	72-20-8	0.0028	0.13
1, 1Dichloroethane	75-34-3	0.059	6.0	Endrin aldehyde	7421-93-4	0.025	0.13
1, 2 - Dichloroethane	107-06-2	0.21	6.0	EPTC	759-94-4	0.042	1.4
1, 1 - Dichloroethylene	75-35-4	0.025	6.0	Ethyl acetate	141-78-6	0.34	33
trans - 1, 2 - dichloroethylene	156-60-5	0.054	30	Ethyl benzene	100-41-4	0.057	10
2, 4 - Dichlorophenol	120-83-2	0.044	14	Ethyl cyanide/Propane nitrile	107-12-0	0.24	360
2, 6 - Dichlorophenol	87-65-0	0.044	14	Ethyl ether	60-29-7	0.12	160
2, 4 - Dichlorophenoxyacetic acid/2, 4-D	94-75-7	0.72	10	bis(2 - Ethylhexyl)phthalate	117-81-7	0.28	28
1, 2 – Dichloropropane	78-87-5	0.85	18				

	Regulated constituent	CAS No.	Wastewater standard	Non-wastewater standard		Regulated constituent	CAS No.	Wastewater standard	Non-wastewater standard
			mg/l	mg/kg3 unless noted as in "mg/l TCLP"				mg/l	mg/kg3 unless noted as in "mg/l TCLP"
	Organic Constituents:								
	Ethyl methacrylate	97-63-2	0.14	160		Molinate	2212-67-1	0.042	1.4
	Ethylene oxide	75-21-8	0.12	NA		Naphthalene	91-20-3	0.059	5.6
	Famphur	52-85-7	0.017	15		2 - Naphthylamine	91-59-8	0.52	NA
	Fluoranthene	206-44-0	0.068	3.4		o - Nitroaniline	88-74-4	0.27	14
	Fluorene	86-73-7	0.059	3.4		p - Nitroaniline	100-01-6	0.028	28
	Formetanate hydrochloride	23422-53-9	0.056	1.4		Nitrobenzene	98-95-3	0.068	14
	Heptachlor	76-44-8	0.0012	0.066		5 – Nitro - o - toluidine	99-55-8	0.32	28
	Heptachlor epoxide	1024-57-3	0.016	0.066		o - Nitrophenol	88-75-5	0.028	13
	Hexachlorobenzene	118-74-1	0.055	10		p - Nitrophenol	100-02-7	0.12	29
	Hexachlorobutadiene	87-68-3	0.055	5.6		N – Nitrosodiethyl-amine	55-18-5	0.40	28
	Hexachlorocyclo-pentadiene	77-47-4	0.057	2.4		N – Nitrosodimethyl-amine	62-75-9	0.40	2.3
	HxCDDs (All Hexa-chlorodibenzo - p - dioxins	NA	0.000063	0.001		N – Nitroso-di-n-butylamine	924-16-3	0.40	17
	HxCDFs (All Hexa-chlorodibenzofurans)	NA	0.000063	0.001		N – Nitroso-methylethylamine	10595-95-6	0.40	2.3
	Hexachloroethane	67-72-1	0.055	30		N - Nitrosomorpholine	59-89-2	0.40	2.3
	Hexachloropropylene	1888-71-7	0.035	30		N - Nitrosopiperidine	100-75-4	0.013	35
	Indeno (1, 2, 3 - c, d pyrene	193-39-5	0.0055	3.4		N - Nitrosopyrrolidine	930-55-2	0.013	35
	Iodomethane	74-88-4	0.19	65		Oxamyl	23135-22-0	0.056	0.28
	Isobutyl alcohol	78-83-1	5.6	170		Parathion	56-38-2	0.014	4.6
	Isodrin	465-73-6	0.021	0.066		Total PCBs (sum of all PCB isomers, or all Aroclors)	1336-36-3	0.10	10
	Isosafrole	120-58-1	0.081	2.6		Pebulate	1114-71-2	0.042	14
	Kepone	143-50-0	0.0011	0.13		Pentachlorobenzene	608-93-5	0.055	10
	Methacrylonitrile	126-98-7	0.24	84		PeCDDs (All Penta-chlorodibenzo-p-dioxins	NA	0.000063	0.001
	Methanol	67-56-1	5.6	0.75 mg/l TCLP		PeCDFs (All Penta-chlorodibenzo-furans	NA	0.000063	0.001
	Methapyrilene	91-80-5	0.081	1.5		Pentachloroethane	76-01-7	0.055	6.0
	Methiocarb	2032-65-7	0.056	1.4		Pentachloronitro-benzene	82-68-8	0.055	4.8
	Methomyl	16752-77-5	0.028	0.14		Pentachlorophenol	87-86-5	0.089	7.4
	Methoxychlor	72-43-5	0.25	0.18		Phenacetin	62-44-2	0.081	16
	3 - Methylcholanthrene	56-49-5	0.0055	15		Phenanthrene	85-01-8	0.059	5.6
	4, 4 - Methylene bis (2-chloroaniline)	101-14-4	0.50	30					
	Methylene chloride	75-09-2	0.089	30		Phenol	108-95-2	0.039	6.2
	Methyl ethyl ketone	78-93-3	0.28	36		Phorate	298-02-2	0.021	4.6
	Methyl isobutyl ketone	108-10-1	0.14	33		Phthalic acid	100-21-0	0.055	28
	Methyl methacrylate	80-62-6	0.14	160		Phthalic anhydride	85-44-9	0.055	28
	Methyl methansulfonate	66-27-3	0.018	NA		Physostigmine	57-47-6	0.056	1.4
	Methyl parathion	298-00-0	0.014	4.6		Physostigmine salicylate	57-64-7	0.056	1.4
	Metolcarb	1129-41-5	0.056	1.4					
	Mexacarbate	315-18-4	0.056	1.4					

	Regulated constituent	CAS No.	Wastewater standard	Non-wastewater standard		Regulated constituent	CAS No.	Wastewater standard	Non-wastewater standard
			mg/l	mg/kg3 unless noted as in "mg/l TCLP"				mg/l	mg/kg3 unless noted as in "mg/l TCLP"
	Organic Constituents:					Organic Constituents			
	Promecarb	2631-37-0	0.056	1.4		Tris-(2,3 Dibromo-propyl) phosphate	126-72-7	0.11	0.10
	Pronamide	23950-58-5	0.093	1.5		Vernolate	1929-77-7	0.042	1.4
	Propham	122-42-9	0.056	1.4					
	Propoxur	114-26-1	0.056	1.4		Vinyl chloride	75-01-4	0.27	6.0
	Prosulfocarb	52888-80-9	0.042	1.4		Xylenes – mixed isomers (sum of o-m-, and p- xylene concentrations).	1330-20-7	0.32	30
	Pyrene	129-00-0	0.067	8.2		Inorganic Constituents			
	Pyridine	110-86-1	0.014	16		Antimony	7440-36-0	1.9	1.15 mg/l TCLP
	Safrole	94-59-7	0.081	22		Arsenic	7440-38-2	1.4	5.0 mg/l TCLP
	Silvex/2, 4, 5 - TP	93-72-1	0.72	7.9		Barium	7440-39-3	1.2	21 mg/l TCLP
	1,2,4,5-Tetrachlorobenzene	95-94-3	0.055	14		Beryllium	7440-41-7	0.82	1.22 mg/l TCLP
	TCDDs (All Tetra-chlorodibenzo-p-dioxins	NA	0.000063	0.001		Cadmium	7440-43-9	0.69	0.11 mg/l TCLP
	TCDFs (All Tetra-chlorodibenzofurans	NA	0.000063	0.001		Chromium (Total)	7440-47-3	2.77	0.60 mg/l TCLP
	1,1,1,2-Tetrachloroethane	630-20-6	0.057	6.0		Cyanides (Total)	57-12-5	1.2	590
	1,1,2,2-Tetrachloroethane	79-34-5	0.057	6.0		Cyanides (Amenable)	57-12-5	0.86	30
	Tetrachloroethylene	127-18-4	0.056	6.0		Fluoride	16984-48-8	35	NA
	2,3,4,6-Tetrachlorophenol	58-90-2	0.030	7.4		Lead	7439-92-1	0.69	0.75 mg/l TCLP
	Thiodicarb	59669-26-0	0.019	1.4		Mercury – Nonwaste water from Retort	7439-97-6	NA	0.20 mg/l TCLP
	Thiophanate-methyl	23564-05-8	0.056	1.4		Mercury – All Others	7439-97-6	0.15	0.025 mg/l TCLP
	Toluene	108-88-3	0.080	10		Nickel	7440-02-0	3.98	11 mg/l TCLP
	Toxaphene	8001-35-2	0.0095	2.6		Selenium	7782-49-2	0.82	5.7 mg/l TCLP
	Triallate	2303-17-5	0.042	1.4		Silver	7440-22-4	0.43	0.14 mg/l TCLP
	Tribromomethane/ Bromoform	75-25-2	0.63	15		Sulfide	18496-25-8	14	NA
	1,2,4 -Trichlorobenzene	120-82-1	0.055	19		Thallium	7440-28-0	1.4	0.20 mg/l TCLP
	1,1,1-Trichloroethane	71-55-6	0.054	6.0		Vanadium	7440-62-2	4.3	1.6 mg/l TCLP
	1,1,2-Trichloroethane	79-00-5	0.054	6.0		Zinc	7440-66-6	2.61	4.3 mg/l TCLP
	Trichloroethlene	79-01-6	0.054	6.0					
	Trichloromonofluoro-methane	75-69-4	0.020	30					
	2,4,5– Trichlorophenol	95-94-4	0.18	7.4					
	2,4,6– Trichlorophenol	88-06-2	0.035	7.4					
	2,4,5– Trichlorophen-oxyacetic acid/2,4,5-T	93-76-5	0.72	7.9					
	1,2,3-Trichloropropane	96-18-4	0.85	30					
	1,1,2 – Trichloro-1,2,2,-trifluoroethane	76-13-1	0.057	30					
	Triethylamine	101-44-8	0.081	1.5					

APPENDIX C4

Batch Ticket

INCOMING MATERIAL BATCH SHEET

INBOUND MATERIAL PROCESSED INTO:	☐ TFE	☐ STORAGE TANK	☐ STILL	☐ REBOILER

Received In ProcessPro? ☐ YES ☐ NO Initials:	BT posted in ProcessPro? ☐ YES ☐ NO Initials:	Receiving info entered in MS Access? ☐ YES ☐ NO Initials:	Processing info entered in MS Access? ☐ YES ☐ NO Initials:

BATCH NUMBER:	DATE RECEIVED:	TIME RECEIVED: ☐ AM ☐ PM
GENERATOR:	MATERIAL CODE:	PROCESS PRO PO #:
RECEIVED IN? ☐ TANKER ☐ DRUMS	CARRIER:	PROCESS PRO INTERNAL LOT #:
TRAILER / TANKER #:	MANIFEST VOLUME: UOM:	MANIFEST # / EXTERNAL LOT #:
IF DRUMS, # OF DRUMS RECEIVED:	STICK LEVEL: UOM:	MANIFEST IN ORDER? ☐ YES ☐ NO ☐ N/A
LAND DISPOSAL RESTRICTION FORM? ☐ YES ☐ NO	TOTAL MEASURED VOLUME: UOM:	WASTE DESCRIPTION: (FOOT, FOOZ, ETC.)
COMMENTS:		

INCOMING MATERIAL ANALYSIS

SAMPLES PULLED? ☐ YES ☐ NO	SAMPLE TYPE: ☐ COLIWASA ☐ CIRCULATED	NAME OF SAMPLER: PRINT AND SIGN
DATE RELINQUISHED:	TIME RELINQUISHED: ☐ AM ☐ PM	NAME OF CUSTODIAN: PRINT AND SIGN
IS THIS A PRE-SHIPMENT SAMPLE? ☐ YES ☐ NO	DOES MATERIAL CONFORM WITH WASTE PROFILE / MATERIAL SPEC: ☐ YES ☐ NO	IS MATERIAL COMPATIBLE WITH GAGE WASTE? ☐ YES ☐ NO
ADDITIVE TO BE USED: ☐ AD0090-350 (SUMMER) ☐ AD0092-350 (WINTER) ☐ OC0019		IS INBOUND MATERIAL COMPATIBLE WITH SPECIFIED ADDITIVE? ☐ YES ☐ NO
COMMENTS:		
ANALYSIS PERFORMED BY: (SIGNATURE)		ANALYSIS PERFORMED BY: (PRINT)

TRUCK UNLOADING

ADDITIVE USED: ☐ AD0090-350 (SUMMER) ☐ AD0092-350 (WINTER) ☐ OC0019 ☐ N/A		AMOUNT OF ADDITIVE USED: UOM:
DATE ADDITIVE ADDED:	TIME ADDITIVE ADDED: ☐ AM ☐ PM	QUANTITY RECEIVED: (MATERIALS LESS ADDITIVE) UOM:
DATE CIRCULATION STARTED:	TIME CIRCULATION STARTED: ☐ AM ☐ PM	IF TANKER, LSF TANK PUMPED INTO:
DATE CIRCULATION ENDED:	TIME CIRCULATION ENDED: ☐ AM ☐ PM	IF DRUMS, STORED IN WHAT SECTION OF LSF: ☐ CORR ☐ NC
TANKER EMPTY UPON COMPLETION OF MATERIAL TRANSFER? ☐ YES ☐ NO ☐ N/A		TANKER INSPECTED BY: PRINT
DATE TANKER INSPECTED:	TIME TANKER INSPECTED: ☐ AM ☐ PM	TANKER INSPECTED BY: SIGNATURE

(ADDITIZED / MIXED / CIRCULATED) FEED ANALYSIS

UNUSUAL OBSERVATIONS:		
COMMENTS:		
FURTHER ANALYSIS:		
SIGNATURE:	PRINT NAME:	DATE:

MATERIAL DISPOSITION (HANDLING OF INBOUND WASTE)

MATERIAL DISPOSITION:	☐ REMANUFACTURED AT GAGE	☐ SHIPPED OFF-SITE FOR DISPOSAL
DATE OF TREATMENT OR DISPOSAL:		
METHOD OF TREATMENT:	☐ NEW TFE ☐ OLD TFE ☐ REBOILER (NOTIFY EHS BEFORE PROCEEDING) ☐ STILL (NOTIFY EHS BEFORE PROCEEDING) ☐ OTHER (DESCRIBE):	
SIGNATURE:	PRINT NAME:	DATE:

IN PROCESS QUALITY RESULTS

RECEIVER	AMOUNT (GALLONS)	TO TANK NUMBER	SEPARATED WATER %	SEPARATED WATER AMOUNT (GALLONS)	COMMENTS
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

INCOMING MATERIAL BATCH SHEET

TANK LEVEL INFORMATION

	MATERIAL CODE (E.G. WR0134)	TANK NUMBER	START LEVEL	END LEVEL	GALLONS POSTED	NOTES
CLEAN PRODUCTS CONSUMED (MATERIALS) OR GENERATED (RETURNS)						
WASTE MATERIALS CONSUMED (MATERIALS) OR GENERATED (RETURNS)						
RINSE MATERIALS CONSUMED (MATERIALS) OR GENERATED (RETURNS)						

PROCESSING INFORMATION

LOAD WASTE MATERIAL CODE:		FIN GOODS PRODUCT CODE:		WASTE #1 PRODUCT CODE:	
LOAD WASTE VOLUME:	UOM:	FIN GOODS VOLUME MADE:	UOM:	WASTE #1 VOLUME MADE:	UOM:
SEPARATED WATER VOLUME:		FIN GOODS MATERIAL PUMPED INTO TANK #:		WASTE #1 PUMPED INTO TANK #:	
STOCK WASTE MATERIAL CODE:		OTHER PRODUCT #1 CODE:		WASTE #2 PRODUCT CODE:	
STOCK WASTE VOLUME:	UOM:	OTHER PRODUCT #1 MADE:	UOM:	WASTE #2 VOLUME MADE:	UOM:
STOCK WASTE FROM WHAT TANK NUMBER?		OTHER PRODUCT #1 MATERIAL PUMPED INTO TANK #:		WASTE #2 PUMPED INTO TANK #:	
RINSE MATERIAL CODE:		OTHER PRODUCT #2 MADE:		WASTE #3 PRODUCT CODE:	
RINSE MATERIAL VOLUME:	UOM:	OTHER PRODUCT #2 CODE:	UOM:	WASTE #3 VOLUME MADE:	UOM:
RINSE FROM WHAT TANK #?		OTHER PRODUCT #2 MATERIAL PUMPED INTO TANK #:		WASTE #3 PUMPED INTO TANK #:	
GRAND TOTAL FEED VOLUME:	UOM:	GRAND TOTAL PRODUCT VOLUME:	UOM:	GRAND TOTAL WASTE VOLUME:	UOM:

COMMENTS / NOTES:

OVERALL YIELD %: (GRAND TOTAL PRODUCT VOLUME / GRAND TOTAL FEED VOLUME)	FIN GOODS TO INBOUND YIELD %: (FIN GOODS VOLUME MADE / LOAD WASTE VOLUME)
BOTTOMS PUMPED TO WASTE TANK START TIME: ☐ AM ☐ PM	BOTTOMS PUMPED TO WASTE TANK END TIME: ☐ AM ☐ PM

PROCESS TIME INFORMATION

PROCESSING DESCRIPTION	HOURS CONSUMED (X.XX)	PROCESSPRO TEST CODE ID
WASTE DRUM PUMPING / TRANSFER		T100
METHYLENE CHLORIDE CONTAINING MATERIAL TOTAL PROCESSING HOURS		T120
NEW TFE OPERATING HOURS		T200
NEW TFE BREAKDOWN HOURS		T204
NEW TFE CROSSLINK CLEARING HOURS		T206
NEW TFE MAINTENANCE HOURS		T208
OLD TFE OPERATING HOURS		T230
OLD TFE BREAKDOWN HOURS		T234
OLD TFE CROSSLINK CLEARING HOURS		T236
OLD TFE MAINTENANCE HOURS		T238
GRAND TOTAL HOURS CONSUMED:		

APPENDIX C5

Table of Random Numbers

Appendix C5

Table of Random Numbers

03	47	43	73	86	36	96	47	05	61	46	98	63	71	62
97	74	24	67	62	42	81	14	57	20	42	53	32	37	32
16	76	62	27	66	56	50	26	71	07	32	90	79	78	53
12	56	85	99	26	96	20	68	27	31	05	03	72	93	15
55	59	56	35	64	38	54	82	46	22	31	62	43	11	90

16	22	77	94	39	49	54	43	54	82	17	37	93	23	78
84	42	17	53	31	57	24	55	06	88	77	04	74	47	67
63	01	06	78	59	16	95	55	67	19	98	10	05	71	75
33	21	12	34	29	78	64	56	07	82	52	42	13	44	38
57	60	86	32	44	09	47	27	96	54	49	17	46	09	62

18	08	17	92	46	44	27	16	58	09	79	83	86	19	62
26	62	38	97	75	84	16	07	44	99	83	11	46	32	24
23	42	40	64	74	82	97	77	77	81	06	45	32	14	08
52	36	28	19	95	50	92	26	11	97	01	56	76	31	38
37	85	94	35	12	83	39	50	08	30	42	34	07	96	88

70	29	17	12	13	40	33	20	38	26	13	89	51	03	74
56	62	18	37	35	96	83	50	87	75	97	12	25	93	47
99	49	57	22	77	88	42	95	45	72	16	64	36	16	10
16	08	15	04	72	33	27	14	34	06	45	59	34	68	49
31	16	93	32	43	50	27	89	87	19	20	15	37	14	35

How to use the table of random numbers:

1. Segregate the containers (i.e. drums) according to waste types, and generator based on available information.
2. Number the containers containing the same waste types consecutively, starting from 01
3. Determine the number of samples required. For more than 100 containers, sample 10% of the containers. For shipments of 100 or fewer containers, the number of containers to sample equals the square root of the number of containers.
4. Using the set of random numbers above, choose any number as the starting point.
5. From this number, go down the column, then to the next column to the right, or go in any predetermined direction until you have selected the appropriate number of drums to sample, with no repetitions. Larger numbers are ineligible. (For example, if you wish to sample 5 drums out of a shipment of 20, and you choose 19 as the starting point on the column four, the next eligible numbers as you go down this column are 12 and 04. So far you have chosen only three eligible numbers. Proceed to the next column to the right. Going down and starting from the top of this column the next eligible numbers are 12 and 13. But 12 is already chosen. Proceeding to the sixth column, the next eligible number is 16. Your five random numbers, therefore, are 19, 12, 94, 13 and 16. The drums with corresponding numbers should be sampled.

F-2 INSPECTION SCHEDULE [40 CFR 270.14(b) (5), 264.15, 264.174, 264.193(i), 264.195, and 264.33]

F-2 a General Inspection Requirements

Gage Products conducts regular inspections of the Limited Storage Facility, including its associated tank farm and all ancillary equipment. The facility's structures and equipment, including monitoring equipment, safety and emergency equipment, security devices, and operating and structural equipment, are inspected routinely by plant personnel so as to identify malfunctions, deterioration, operator errors, and any other situation which may lead to the release of hazardous materials or be a threat to human health or the environment. Several work instructions and associated forms have been developed to facilitate facility inspections. The work instructions specify the areas to be inspected, the frequency of each type of inspection, and the type of problems for which to look. The inspector, when identifying a problem, is required to specify the type of problem identified and the remedial action required and to notify management in order to implement remedial action. Completed inspection report forms and the schedule of inspections are kept at the facility. The types of problems for which personnel look during the inspection in each area of the facility are outlined in Tables F.1, F.2, and F.3. The inspection frequency is also contained in these tables. Copies of the most current inspection forms can be found in Appendix F.

F-2 b Specific Inspection Requirements

F-2b (i) Tank Inspection

The Limited Storage Facility hazardous-waste storage tanks are inspected daily and an inspection log is maintained. The shell and seams of each tank are visually inspected for any signs of erosion, corrosion, or leaks. The tank containment structures, such as the dike walls, as well as floors and spill transfer equipment, are inspected daily for erosion, cracks, leaks, or malfunctions. Visual inspection of the tank bottoms are made via man-ways in the side of the skirts. Pumps, piping, hose, valves, and fittings are also inspected for any signs of corrosion, leaks, malfunctions, or evidence of operator errors. The area immediately surrounding the tanks is inspected weekly to detect signs of leakage. A roof covers the tank storage area; therefore minimal precipitation accumulates in the containment area.

Other equipment associated with the storage tanks at the facility that is routinely inspected includes: electrical equipment (circuit breakers and control panels), material handling equipment (pumps, hoses, connectors, piping, joints, and valves), monitoring equipment (gauges, overfill alarms), security equipment (fencing, gates and lighting), and safety and emergency equipment (eye wash/showers, water supply valves, alarms, and fire extinguishers).

TABLE F.1
HAZARDOUS-WASTE STORAGE TANKS
INSPECTION SCHEDULE
LIMITED STORAGE FACILITY

Equipment	Type of Problem	Frequency
Tank shells	Erosion or corrosion Cracks Leaks Operator error	Daily
Tank Squirt Protection	Erosion or corrosion Cracks Leaks	Weekly
Tank overfill control system	Inoperable Malfunctioning	Daily
Material transfer	Corrosion Leaks Malfunction Evidence of spills	Daily
Material handling	Malfunction Damage Operator error Evidence of spills	Daily
Electrical	Malfunction Damage Operator error	Daily
Containment structure	Erosion Cracks Leaks	Daily
Spill transfer	Malfunction Damage Operator error	Daily
Monitoring	Malfunction Damage Operator error	Daily

TABLE F.1
HAZARDOUS-WASTE STORAGE TANKS
INSPECTION SCHEDULE
LIMITED STORAGE FACILITY
(Continued)

Equipment	Type of Problem	Frequency
Security	Damage Malfunction No access	Weekly
Safety/emergency	Malfunction Out of place Reload	Weekly

TABLE F.2
HAZARDOUS-WASTE DRUM STORAGE
INSPECTION SCHEDULE
LIMITED STORAGE FACILITY

Equipment	Type of Problem	Frequency
Containers	Corrosion Leaks Condition and evidence of abuse Quantity Labeling	Weekly
Containment Area	Evidence of spills or leaks Liquid in containment area Cracks or other deterioration Aisle spacing, set-back distances Stacking height Number of containers Sump for any accumulations	Weekly
Fire Extinguishers	Operability and previous usage	Weekly
Other Safety Equipment	Not in proper location	Weekly
Warning Signs	Standing and legible	Weekly
Container	Evidence of spills or leaks	Daily
Unloading/Storage	Cracks or other deterioration	Weekly

TABLE F.3
INSPECTION SCHEDULE
HAZARDOUS-WASTE UNLOADING AREA
LIMITED STORAGE FACILITY

Equipment	Type of Problem	Frequency
Material Transfer Pumps	Corrosion Leaks Malfunction Evidence of spills	Daily
Material Handling	Malfunction Damage Operator error Evidence of spills	Daily
Electrical	Malfunction Damage Operator error	Daily
Containment Structure	Erosion Cracks	Daily
Floor and Sumps	Leaks Malfunction Damage	Daily
Spill Transfer	Operator error Malfunction	Daily
Monitoring	Damage Operator error	Daily
Container Unloading Area	Damage Spills Damage	Daily
Security	Malfunction No access	Weekly
Safety/Emergency	Malfunction Out of place Replenish	Weekly

F-2b (ii) Container Inspection.

The hazardous-waste container storage and unloading areas are checked by an operator or assistant operator at the frequency specified in the inspection schedule. The number, condition, labeling, and spacing of each drum in the storage bays are noted. Each drum is also checked for corrosion, damage, excessive wear, and leakage. The container storage and unloading areas are inspected daily to determine if any releases have occurred. Potential types of problems that may be encountered in the container area are provided on the inspection form to help ensure a thorough inspection.

F-2 c Remedial Action

If inspections reveal that non-emergency maintenance is needed, a maintenance request will be submitted and it will be completed as soon as possible to preclude further damage and reduce the need for emergency repairs. If a hazard is imminent or has already occurred, as revealed during the course of an inspection or at any time between inspections, remedial action will be implemented immediately. If indicated by the situation, Gage Products Company personnel will notify the appropriate authorities as described in the Contingency Plan (Section G). In the event of an emergency involving the release of hazardous constituents to the environment, response efforts will be directed towards containing the hazard, removing it, and decontaminating the affected area according to the procedures outlined in the Contingency Plan.

During an inspection of the hazardous-waste storage tanks and container storage facility, if a tank or container holding hazardous wastes is found to be in poor condition (such as apparent structural defects or evident corrosion and leakage), the hazardous waste is transferred to another tank or container in good condition. In the case of a drum, the drum contents are transferred to, and contained within, another similar drum or suitable salvage or recovery drum.

F-2 d Inspection Log [40 CFR 264.15(d)]

The inspection logs for the hazardous-waste drum storage area, the associated tank farm, and ancillary equipment are kept at the facility per related work instructions. As required, records of inspections are kept for at least three years from the date of inspection.

F-3 WAIVER OF PREPAREDNESS AND PREVENTION REQUIREMENTS [40 CFR 270.14(b)(6)]

Gage Products Company does not wish to request a waiver of preparedness and prevention requirements under 40 CFR 264, Subpart C. Requirements of this subpart are primarily addressed in Sections D, F and G of this application.

SECTION H

PERSONNEL TRAINING

The information contained in this section outlines the personnel-training program for Gage Products Company Limited Storage Facility in accordance with the requirements of Michigan Act 451, Part 111 Rules 501and 605, which incorporates 40CFR 270.14 (b) (12) and 264.16 by reference.

SECTION H

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Tables

H-1 OUTLINES OF TRAINING PROGRAMError! Bookmark not defined.

Training is provided to Gage Products Company personnel in order to teach them to perform their duties in a way that ensures:

- Proper operational, maintenance and inspection procedures are routinely implemented to minimize the possibility of a release of hazardous waste or hazardous waste constituents, which would threaten human health to the environment.

- Facility personnel are familiar with the provisions of the Contingency Plan/Emergency Procedures and are able to respond efficiently in the event of an emergency to minimize hazards to human health or the environment.

The introductory and continuing training programs are directed by a trained person in hazardous waste management procedures and who is familiar with the facility, its operations, and the emergency procedures and equipment described in both the Preparedness and Prevention Plan (Section F) and the Contingency Plan. Table H.1 provides an outline of the hazardous-waste management training program for Gage Products Company. The training program is designed to ensure that personnel safely handle hazardous waste. This program will be continuously updated and provided to each new, temporary, or re-assigned employee.

H-1 a Job titles and Descriptions

Table H.2 provides the organization, names and positions of personnel actively involved with hazardous-waste activities at the limited storage facility, also an overall company organization chart is maintained at the facility.

H-1 b Training Content, Frequency, and Technique

The training program consists of instruction in the provisions of the Preparedness and Prevention Plan (Section F), the Contingency Plan (Section G), and with all applicable OSHA regulations. Instruction is supplemented with a written Spill Prevention Control and Countermeasures (SPCC)/Contingency Plan.

During the training program, employees are instructed on the hazardous nature of chemicals and chemical wastes in general, the purpose of RCRA and Michigan P.A. 451, and the importance of maintaining compliance with the hazardous waste regulations, the proper and safe handling and storage procedures of wastes, and emergency response procedures.

A walking tour of the facility, as part of the training program, identifies the location of all emergency equipment and structures available on the site that are specified in the SPCC/Contingency Plan.

The proper use and inspection of the numerous fire extinguishers located throughout the facility are addressed. Established procedures for the safe handling and use of the chemicals found at the facility are emphasized. On the job training is received by all personnel concerning activities appropriate to each job description.

Facility personnel complete their training within six months after the date of employment or assignment at the facility. New employees having hazardous-waste management responsibilities are supervised carefully until they have completed the training program. Review of the established training program is provided annually to all employees. Review may be more frequent if additional equipment or procedures are instituted prior to annual review.

Training records on current personnel are maintained at the facility until facility closure. Training records on former employees are kept for three years from the date the employee last worked at the facility.

Table H.1

Hazardous Waste Management Training Program for Gage Products Company

1. Safety and Health
   a. Health protection
   b. Safety Procedures

2. Emergency Response (including 29 CFR 1910.120)
   a. Emergency Evacuation and Emergency Control Program
   b. Contingency Plan
      (i) Emergency coordinator
      (ii) Emergency procedures
      (iii) Emergency communications/phone numbers and alarms
      (iv) Location, maintenance, inspections and use of emergency equipment
      (v) Waste feed cut off system
      (vi) Spill Response
      (vii) Fires and explosions

3. RCRA Standard for Hazardous Waste Management
   a. Introduction to RCRA and Michigan Act 451 Part 111
   b. Manifest Requirements
   c. Record keeping and Reporting

4. Hazardous Waste Identification
   a. General Properties of Hazardous Wastes
   b. Hazardous Wastes Recycled and Stored at Gage Products Company

5. Storage of Hazardous Waste
   a. Use and Management of Drums
   b. Use and Management of Tanks

6. Waste Handling Procedures
   a. Manifest System
   b. Other Records

7. Inspection
   a. General Inspection Requirements
   b. EP Toxicity Test & TCLP
   c. Chemical Analysis Test Method
   d. Inspection Logs

8. Analytical Procedures
   a. Representative Sampling Method
   b. Waste Analysis Plan

Table H.2

Outline of
Gage Products Company
Hazardous Waste Management Facilities Organization Chart

VICE PRESIDENT, OPERATIONS*
Anthony Stark

DIRECTOR, EHS*
Sharon Stahl

ENVIRONMENTAL MANAGER*
Julie Mileskiy

HEALTH & SAFETY SPECIALIST*
Roy Marvel

PRODUCTION COORDINATOR, REMANUFACTURING*
Scott Johnson

Remanufacturing Operators *
- Tim Gates
- Craig Honold
- Mike Emery
- Bruce Grenke
- Dave Meyer
- Ryan Rondan
- John Subcliff

Logistics Coordinator*
Mitch Withrow

---

*Indicates personnel directly involved with hazardous waste activities.

H-1 c Training Director

Ms. Sharon Stahl, Director of EHS directs the hazardous waste training program at Gage Products Company, with the assistance of her staff of trained professionals. Ms. Stahl is very knowledgeable about the facility's operations and is familiar with the hazardous waste management regulations. More specifically, Ms, Stahl has a B.S. degree in Chemical Engineering, has twenty six years chemical industry experience, and has attended various training seminars on hazardous waste management regulations, Department of Transportation regulations, OSHA regulations, and personnel supervision.

H-1 d Relevance of Training to Job Position

The hazardous waste training program is tailored to the specific job responsibilities of Gage Products Company personnel. While all personnel involved in hazardous waste management are informed about the general requirements for proper waste management at the facility, such as the prevention of and response to spills, only those personnel directly involved in certain aspects of waste management are specifically trained in the details of certain tasks. On the job training further emphasizes the relationship of the job position to the content, details, and relevance of the training on hazardous waste management.

H-1 e Training for Emergency Response

The training program covers both normal, everyday operating procedures plus emergency response procedures to be initiated in the event of a potential or actual spill, release, fire, or explosion that endangers public health or the environment. This training program addresses all the applicable sections of OSHA's Hazardous Waste operations and Emergency Response Standard (29 CFR 1910.120). The training program ensures that Gage Products Company personnel not only manage hazardous waste in a safe manner every day but also can respond appropriately to an emergency situation at the facility. Those training elements of the program that address non-routine and emergency situation (such as unscheduled shutdowns and start-ups related to storms, power outages, fires, explosions, and spills) include:

- Use of personal protective equipment.
- Procedures for locating, using, inspecting, repairing, and replacing facility emergency and monitoring equipment.
- Response procedures for fires and explosions.
- Response procedures for spills.
- Shut down of operations and power failure procedures.
- Procedures for facility evacuation and the evacuation of nearby areas.

H-2 IMPLEMENTATION OF TRAINING PROGRAM [40 CFR 264.16 (B) and 264.16 (D) (4)]

No employee who has been hired to work at Gage Products Company will work in an unsupervised position until that employee has received training on hazardous waste management procedures relevant to the job position held by that employee. All new employees will be trained in these procedures within six months of employment or assignment to the position. Employees are required to review the training program on an annual basis and sometimes more frequently whenever that program has been updated.

Records documenting the employees training are maintained for each employee with their department supervisor and include the name of the employee, description and date of the training received, name of the instructor, and signature or stamp of the employee demonstrating that training was received. In addition, training programs provided by the EHS team are maintained in the facility's EHS office and include the content of training and a sign-in sheet demonstrating participation. These training records will be kept until closure of the facility for current employees and for three years from the termination date for former employees.

SECTION G

CONTINGENCY PLAN

This Contingency Plan has been prepared in accordance with the requirements of 40 CFR 270.14(b)(7) and 264 Subpart D to establish the necessary planned procedures to be followed in the event of an emergency situation at the facility, such as fire, explosion, severe weather, or any unplanned sudden or non-sudden release of hazardous-waste constituents to the air, soil or surface water.

As required by 40 CFR 264.53, a copy of this Contingency Plan (and all amendments to the plan) is maintained at the facility and has been submitted to the local police department, fire department, and local emergency-response teams that may be called upon to provide emergency service (see Section G-6). The Contingency Plan is a portion of Gage Products Company's combined Spill Prevention Control and Countermeasures (SPCC) Plan and Pollution Incident Prevention (PIP) Plan.

SECTION G
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Tables

Figures

Appendix

G-1 GENERAL INFORMATION [R 299.9607, 40 CFR 264.51 and 264.53]

The plans and procedures described herein have been prepared in accordance with the applicable regulations and have been designed to minimize hazards to human health and the environment from any unplanned, sudden or non-sudden release of hazardous waste or hazardous-waste constituents to the air, soil or surface water. The procedures established in this plan have been developed to protect Gage Products Company employees, properties, and the general public and will be implemented by facility personnel in the event of a potential or actual release of hazardous waste or hazardous waste constituents which may threaten human health or the environment. The contingency plan is a portion of Gage's Spill Prevention Control and Countermeasures/Pollution Incident Prevention Plan (SPCC/PIPP).

Gage Products Company is located at 625 Wanda in Ferndale, Michigan. The facility recycles and stores certain hazardous-waste streams in tanks and in containers within its Limited Storage Facility on Parcel C. These wastes carry the codes authorized in for storage in the facility per the application. Gage Products also stores hazardous wastes, generated on-site, in containers and tanks prior to off-site disposal at designated facilities. The waste types handled are typically ignitable, and carry the D001 waste code, along with several others such as F003, F005, D0018 and D0035. In addition, small amounts of corrosive wastes carrying the D002 waste code are also managed. These tanks are located in a segregated concrete diked area adjacent to the Limited Storage Facility's tank farm. Figure G.1 contains a general site plan for the Gage facility, illustrating the Limited Storage Facility building and tank farm on Parcel C. These hazardous wastes are also stored in Limited Storage Facility but are identified and documented differently in the operating record.

G-2 EMERGENCY COORDINATORS [R 299.9607 and 40 CFR 264.52 and 264.55]

At all times there is at least one employee, either on the facility premises or on call and within a reasonable travel distance of the facility, with the responsibility for coordinating all emergency-response measures. The list of Emergency Coordinators is contained in Table G.1. Qualified persons have been designated as the primary and alternate Emergency Coordinators. Their names, addresses, telephone numbers (cellular and home) are arranged in the order in which they would assume the responsibilities of Emergency Coordinator.

If an emergency situation develops at the facility, the discoverer must immediately contact an Emergency Coordinator. The primary and alternate Emergency Coordinators are thoroughly familiar with all aspects of the facility's contingency plan, all operations and activities at the facility, the location and characteristics of wastes handled at the facility, the location of all records within the facility, and the facility layout. The Emergency Coordinators have complete authority to commit the resources of the company that may be needed to carry out the Contingency Plan.

Figure G-1

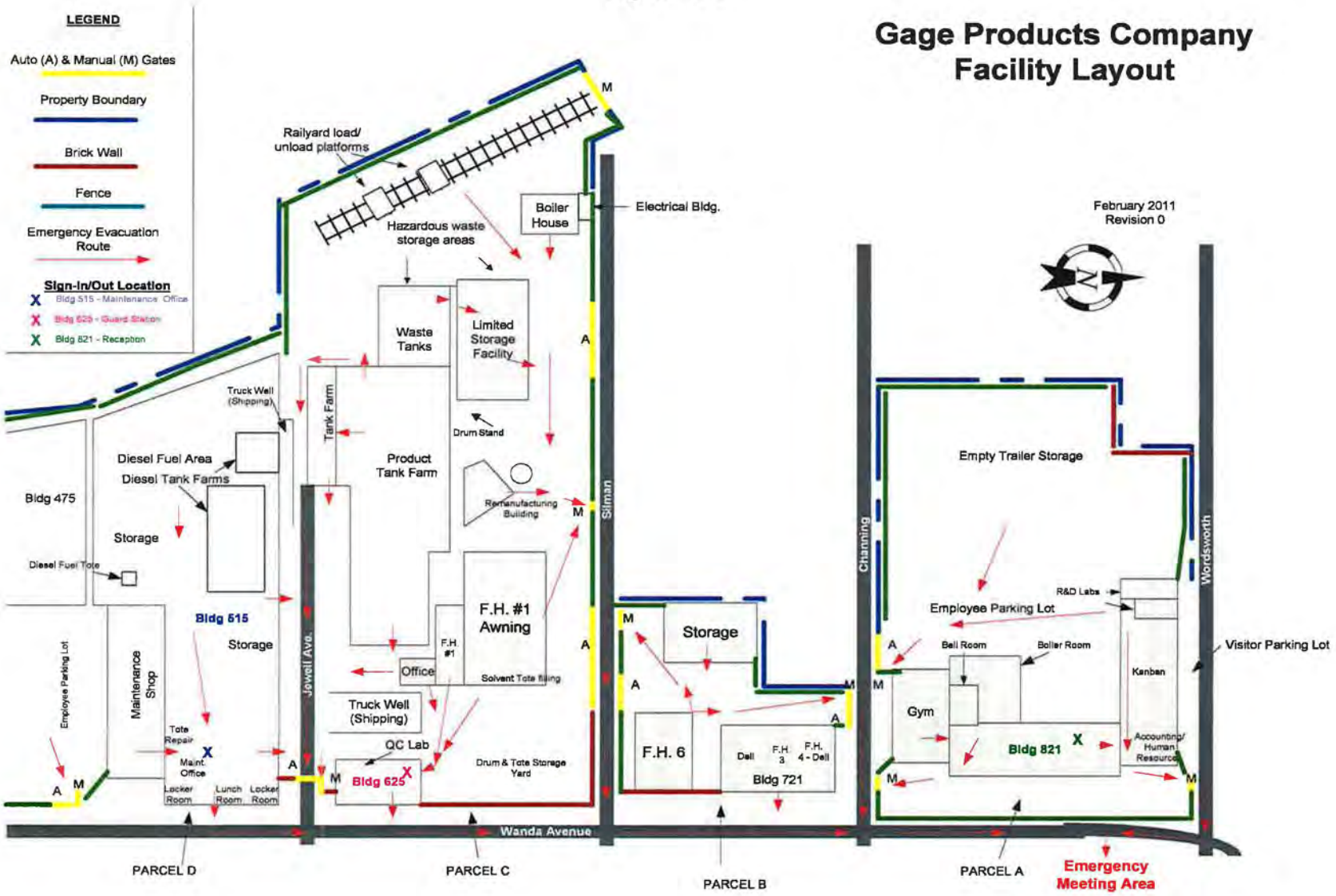

Gage Products Company
Facility Layout
LEGEND
Auto (A) & Manual (M) Gates
Property Boundary
Brick Wall
Fence
Emergency Evacuation Route
Sign-In/Out Location
X Bldg 515 - Maintenance Office
X Bldg 625 - Guard Station
X Bldg 821 - Reception
February 2011
Revision 0
Railyard load/ unload platforms
Boiler House
Electrical Bldg.
Hazardous waste storage areas
Waste Tanks
Limited Storage Facility
Tank Farm
Truck Well (Shipping)
Drum Stand
Product Tank Farm
Diesel Fuel Area
Diesel Tank Farms
Bldg 475
Storage
Diesel Fuel Tote
Remanufacturing Building
Silman
Empty Trailer Storage
Channing
Wordsworth
Employee Parking Lot
R&D Labs
Visitor Parking Lot
Bldg 515
Storage
Maintenance Shop
Employee Parking Lot
Tote Repair
Maint. Office
Locker Room
Lunch Room
Locker Room
Jewell Ave.
F.H. #1 Awning
F.H. #1
Office
Solvent Tote filling
Truck Well (Shipping)
QC Lab
Bldg 625
Drum & Tote Storage Yard
Storage
F.H. 6
Dell
F.H. 3
F.H. 4 - Dell
Bldg 721
Bell Room
Boiler Room
Kanban
Gym
Bldg 821
Accounting/ Human Resources
Wanda Avenue
PARCEL D
PARCEL C
PARCEL B
PARCEL A
Emergency Meeting Area

Table G.1
Emergency Notification Telephone Numbers

	Name/ Address	Office Phone	Evening Phone	Cell phone
1.	**U.S. Environmental Protection Agency**			
	National Response Center	800/424-8802		
	Local Office (Grosse Ile)	734/676-6500		
2.	**Emergency Coordinators/Qualified Individuals**			
	Tony Stark	248/691-6744	248/524-9679	248/298-6012
	Sharon L. Stahl	248/691-6718	586/677-3468	248/761-8511
	Rick Freeman	248/691-6728	248/624-9372	248/866-4533
	Paul Bialy	248/541-3824	734/284-0927	248/361-8055
	Scott Johnson	248/691-6754	248/546-4229	248/249-4045
	Marvin Geary (Afternoons)	***248/691-6751***	***248/388-7615***	***248/230-6086***
	John Subcliff (Midnights)	***248/691-6754***	***734/604-6155(c)***	***248/361-0185***
3.	**Spill Cleanup Contractors**			
	Marine Pollution Control EPA I.D. #: MID 049 277 718 8631 W Jefferson Detroit, MI 48209	313/849-2333 (24 hours)		
	Horizon Environmental (Consultation) 4771-50th Street S.E. Suite 1 Grand Rapids, MI 49512	616/554-3210		
4.	**Michigan Dept. of Environmental Quality**			
	Spill Response (PEAS) (24 hours)	800/292-4706		
	Environmental Assistance Division	800/662-9278		
	SE Michigan Field Office	586/753-3700		
	Lansing Office	517/373-2730		
5.	**Fire or Police**	**911**		
6.	**Ferndale Fire Marshall**	(248) 546-2510		
7.	**State Police**	(248) 584-5740		
8.	**Local Emergency Planning Committee**			
	Ms. Sara Stoddard 1200 North Telegraph Road Oakland County Office of Emergency Management, LEPC Pontiac, MI 48341	248\858-5080		

	Name/ Address	Office Phone	Evening Phone	Cell phone
9.	**Detroit Water & Sewerage Dept.**			
	Day Time Phone	313/224-4775 or 313/964-9400		
	System Control (Spill Reporting)	313/267-6000 or 313/267-9000		
	City of Ferndale, Water Department Leader (Dan Harper)	248/546-2513		248/867-0262
10.	**Weather Report** http://www.wunderground.com/US/MI/Detroit.html			
11.	**Local Television/Radio Station for Evacuation Notification**			
	WWJ	***(248) 945-9950***		
12.	**Medical Emergency**			
	William Beaumont Hospital 3601 West 13 Mile Road Royal Oak, MI 48072	248/898-2000		
	Concentra Medical Center 26185 Greenfield Rd Southfield, MI 48075	248/569-2040		
13.	**U.S. Coast Guard Captain of the Port**			
	Business Hours	313/568-9580		
	Evening Hours	313/568-9524		
14.	**Poison Control Center**	***800-222-1222***		
15.	**Railroad Contact:**			
	CN Police	***800-465-9239***		
16.	**Gage Products Company Technical Advisors:**			
	Mr. Stephen Summerfield, Chemist		586/226-1408	
	Mr. Clayton Bushmaker, Process Engineer		248/767-8888	248/361-1611
	Mr. Bob Patzelt, Chemist,			248/506-4135
	Mr. John Thomas, Operator		248/542-4564	248/330-2864
	Mr. Van Michaels, Boiler Operator		313/310-305	248/388-3587
	Mrs. Julie Mileskiy, Environmental Manager		248/350-3620	248/330-6969
	Mr. Roy Marvel, Health & Safety Specialist		734/591-3941	734/934-7606

G-3 IMPLEMENTATION OF CONTENGENCY PLAN [R 299.9607 and 40 CFR 264.51, 264.52 and 264.56]

The decision of the Emergency Coordinator to implement this plan depends upon whether or not the potential or actual incident could threaten human healthy or the environment. The following situations are provided as guidance to facility personnel as to the conditions or circumstances under which the plan must be implemented:

Fire and/or Explosion

- A fire causes the release of toxic fumes.
- The fire spreads and could possibly ignite materials at other locations on-site or could cause heat-induced explosions.
- The fire could possibly spread to off-site areas.
- The use of water or water and chemical fire suppressant could result in contaminated runoff.
- An explosion has occurred or an imminent danger exists that an explosion could occur, thereby releasing toxic material.

Spill or Release of Hazardous Waste during Unloading Operations

- The spill or release causes bodily injury or is an imminent threat to human health due to the evolution of reactive or toxic liquids, mist, or fumes or contact with reactive or toxic liquid or spray.
- The spill or release has the potential to, or actually does, overflow the secondary containment structures and exits the facility, either alone or in combination with storm water, potentially resulting in off-site soil contamination or water pollution.
- The spill or release is contained on-site but could cause either groundwater contamination or air pollution.

Spill or Release of Hazardous Waste within the Secondary Containment Structure

- The spill or release causes bodily injury or is an imminent threat to human health due to the evolution of toxic or reactive liquids, fumes, or mist or contact with toxic or reactive liquid or spray.
- The spill or release cannot be immediately transferred to an appropriate tank for container for storage.
- The spill or release threatens the integrity of storage tanks or other facility equipment or structures.

G-4 EMERGENCY PROCEDURES [R 299.9607 and 40 CFR 264.51, 264.52 and 264.56]

The following general procedures have been established for implementation by Gage Products facility personnel and the Emergency Coordinator in order to efficiently respond to the release of hazardous waste or hazardous-waste constituents that could threaten human health or the environment.

All emergencies require prompt and deliberate action. In the event of any major emergency, an established set of procedures will be followed. These procedures will be followed as closely as possible. In specific emergency situations, however, the Emergency Coordinator may deviate from established procedures to provide a more effective plan for bringing the situation under control.

Gage Products Company emergency-response personnel are trained in accordance with OSHA's Hazardous Waste Operations and Emergency Response; Final Rule, 29 CFR 1910.120 and with the applicable sections of 29 CFR Subpart I, Personal Protective Equipment.

G-4a Notification [R 299.9607 and 40 CFR 264.56]

The list of emergency contacts contained in Table G.1 provides a ready reference for facility personnel and Emergency Coordinators in the event of an imminent or actual emergency situation, the Emergency Coordinator will be notified first. All other facility personnel, local emergency-response agencies, and state and federal authorities will be promptly notified as directed by the Emergency Coordinator.

G-4b Identification of Hazardous Materials [R 299.9607 and 40 CFR 264.51

The Emergency Coordinator will immediately identify the type, exact source, amount, and extent of any released materials. The Emergency Coordinator is familiar with the facility and the types of wastes that are handled. The initial identification will be made by observation of the material involved, the source, and the location of the release. The tanks, piping, and containers are labeled to facilitate the identification of released materials. If visual identification cannot be made, samples of the released materials will be identified by chemical analysis.

G-4c Assessment and Evacuation [R 299.9607 and 40 CFR 264.51, 264.52 and 264.56]

The Emergency Coordinator will assess possible hazards, both direct and indirect, to human health or the environment that may result from the release of the identified material or from the fire or explosion. The assessment will consider the effects of any gases that may be generated, the effects of hazardous surface runoff from water or

chemical reagents used to control fire, and the effects of any chemical or physical reaction with equipment or structures.

If the Emergency Coordinator's assessment indicates that evacuation of local areas may be advisable, the appropriate local authorities will be immediately notified. Also, the Specialized Residential Care Group home directly across Wanda will be contacted, so that their evacuation procedure can be activated. The Emergency Coordinator will assist the authorities in deciding whether evacuation is indicated and what areas may need to be evacuated. The National Response Center (see Table G.1) will also be immediately notified, and the following information will be provided:

- Name and telephone number of reporting individual
- Name and address of the facility
- Time and type of incident (e.g., release, fire, explosion)
- Type and quantity of materials involved, to the extent known
- Extent of injuries, if applicable
- Possible hazards to human health or environment, outside of the facility

G-4d Control Procedures [R 299.9607 and 40 CFR 264.51, 264.52, 264.56, 264.227 and 264.200]

Whenever there is an imminent or actual emergency situation where the potential or actual release of hazardous materials may threaten human health or the environment, the facility will implement the following procedures:

The facility personnel who discover the situation will activate the emergency communication system, thereby alerting the Emergency Coordinator or designate who can then contact the Emergency Coordinator by telephone.

The Emergency Coordinator or designate will contact the appropriate spill-cleanup contractors and state or local agencies, if their assistance is needed.

In the event that an individual or individuals have come in contact with organic solvents, facility personnel will immediately assist the victim to the emergency eyewash or shower where the affected area will be rinsed with water. Other injured personnel will also receive immediate first aid and medical attention. If necessary, the hospital or clinic will be notified immediately. The safety of personnel and other individuals will be the first concern of the Emergency Coordinator.

- All emergency-response personnel will utilize personal protective equipment, including gloves, boots, goggles or face shields, aprons, and other equipment appropriate to the emergency.

- All nonessential personnel will be evacuated from the immediate area of the emergency. If total facility evacuation is indicated, the evacuation procedures summarized in Section G-7 will be followed.

- Any processes or operations that may interfere with emergency response will be stopped. Valves, pipes, and other equipment will be monitored for leaks, pressure build-up, gas generation or ruptures.

- The character, source, and extent of the emergency will be evaluated. The actual or potential release of hazardous wastes will be identified.

- Fire extinguishers will be utilized by trained personnel to contain the spread of fire, if appropriate. Upon the arrival of the fire department, the directions of the fire chief will be followed in handling the emergency. Foam trailers will be staged for use by the fire department to extinguish or prevent the spread of fires.

- All measures will be undertaken to prevent the contact of any released materials with incompatible materials, such as organic material with skin and eyes, and flammable materials with any spark-emitting sources or open flames.

- Released materials that are not contained will be prevented from entering any storm drains or sewers, through the use of oil booms or dams and inert absorbent materials suitable to the released materials. Spark-proof equipment will be used to remove flammable materials.

- If possible, the area will be sectioned-off with caution tape to limit access to the spill area (or hot zone) until the emergency has been cleared and the area cleaned.

- For emergency situations involving tanks, any materials released into the secondary containment system will be pumped out and disposed of according to applicable regulations. No materials will be placed into a defective tank or associated piping until repairs have been made to eliminate the potential for leakage, fire or explosion

- For emergency situations involving drums or other containers during storage, any materials released into the secondary containment system will be pumped out and disposed of according to applicable regulations. Leaking or potentially leaking drums and containers will be placed into recovery drums or other containers that will be properly labeled.

- The spill area will be washed with water and appropriate surfactants. After the spill area has been cleaned, the Emergency Coordinator will determine if the area is safe to return to normal use.

- All safety and emergency equipment will be decontaminated and thoroughly cleaned before being placed back into storage. Used spill-response materials and those materials that cannot be decontaminated will be appropriately disposed of and replaced with new emergency-response materials and equipment.

G-4e Prevent Recurrence or Spread of Fires, Explosions or Releases [R 299.9607 and 40 CFR 264.56(e)]

During an emergency, the Emergency Coordinator must take all reasonable measures necessary to ensure that fires, explosions or releases do not recur or spread to other areas of the facility site. Some actions which might be employed include:

- Shutting off pumps, valves, or lines (if required) to stop the release.
- Start sump pumps to transfer accumulated runoff into available tanks.
- Place portable pumps into service to transfer accumulated runoff.
- Deploy suitable containment materials to erect temporary dams in the path of the flow of released materials.

G-4f Storage and Treatment of Released Materials [R 299.9607 and 40 CFR 264.56(g)]

Immediately after an emergency, the Emergency Coordinator will make arrangements for the treatment, storage, or disposal of recovered wastes or any other contaminated materials. The treatment, storage, or disposal of recovered wastes and contaminated materials will be conducted in accordance with applicable regulations governing the management of these materials.

The Emergency Coordinator will determine the regulatory status of the released substance and associated spill-cleanup materials. This determination will be made according to the following guidelines:

- If the material is from a spill of a listed hazardous waste, then the cleanup materials, spill residues, ad other contaminated materials must be managed as hazardous wastes.
- If the material is from a spill of a commercial a chemical product that is listed under RCRA or Act 451, then the cleanup materials, spill residues, and other contaminated materials must be managed as hazardous wastes.
- If the material is from a spill of a waste that possesses hazardous-waste characteristics, the cleanup materials, spill residues, and other contaminated material

must be managed as hazardous wastes *if these materials also possess the hazardous-waste characteristics as defined under RCRA and Act 451* (i.e., corrosively, toxicity, ignitability, and reactivity). Analytical testing may have to be undertaken in order to make this determination.

G-4g incompatible Wastes [R 299.9607 and 40 CFR 264.56 (h) (1)]

The Emergency Coordinator will ensure that no wastes which are incompatible with the released materials are managed in that area until cleanup procedures are completed.

G-4h Post-Emergency Equipment Maintenance [R 299.9607 and 40 CFR 264.56]

After an emergency event, all emergency equipment listed in Section G-5 will be replaced or cleaned so that it is fit for use. Before operations are resumed, an inspection of all safety equipment will be conducted as discussed in Section F-2. The U.S EPA Regional Administrator, the MDEQ, and local authorities will be notified by the emergency Coordinator that post-emergency equipment maintenance has been performed and operations at the facility will be resumed.

G-4i Container Spills and leakage (40 CFR 264.171)

Refer to Section G-4d for a detailed description of the emergency response procedures for container spill and leakage. If a container holding hazardous waste is not in good condition or it begins to leak, the waste from this container will be transferred to a container in good condition. An entire leaking 55-gallon drum may also be placed within a larger recovery drum.

G-4j Tank Spills and Leakage (40 CFR 264. 194)

Refer to Section G-4d for a detailed description of emergency-response procedures for tank spills and leakage. Any spill or leak from the storage tanks will be contained within the secondary containment structure that has been provided.

G-4k Post-Spill Soil Sampling and Analysis

In the unlikely event that a spill or release occurs which contaminates soil, grab samples of the soil will be taken in order to determine the extent of contamination. Soil samples will be collected using ASTM Standard D 1452-65. The samples will be analyzed for appropriate parameters, to be determined by the spilled material (e.g. U.S. EPA method 8260 for ignitability or corrosivity). In all events, proper procedures will be followed , which will include those identified in the most current MDEQ's Environmental Response Division's Draft Guidance for Determining Adequacy of Soil Remediation, that will effectively characterize the nature and extent of the spill or release. Remediation of the affected area will be initiated based upon the results of the characterization.

G-5 Emergency Equipment (R 299.9606 and 40 CFR 264.32)

G-5a Internal Communication (40 CFR 264.32(a))

An internal alarm system and a voice communications system capable of providing immediate emergency signals to facility personnel are available on the site. The Facility is equipped with an emergency alarm actuator system that provides, when pulled, an alarm signal, which is audible throughout the facility. The location of the alarm actuators is indicated on emergency evacuation plans included in the SPCC/PIPP included in Section A. In addition the Limited Storage facility building is provided with a complete automatic, dry-pipe, sprinkler system. When activated, this system provides both an audible alarm at the facility as well as an alarm to alert the Ferndale Fire Department.

Internal voice communications is provided by means of the facility telephone system or cellular phones. Telephones/public address speakers are located in the office area, the material unloading/loading area, the filling building, remanufacturing building, and the limited Storage Facility building. In the even of an emergency, an alert will be sounded via this public address system alerting employees to the situation. In the event of an emergency at the Limited Storage Facility, a phone located at the unloading dock receiving area will be used to summon help. Depending upon the nature of the emergency, the call for help may be to the emergency coordinator or alternate, facility security (nights, weekends, and holidays), or to the local police or fire departments.

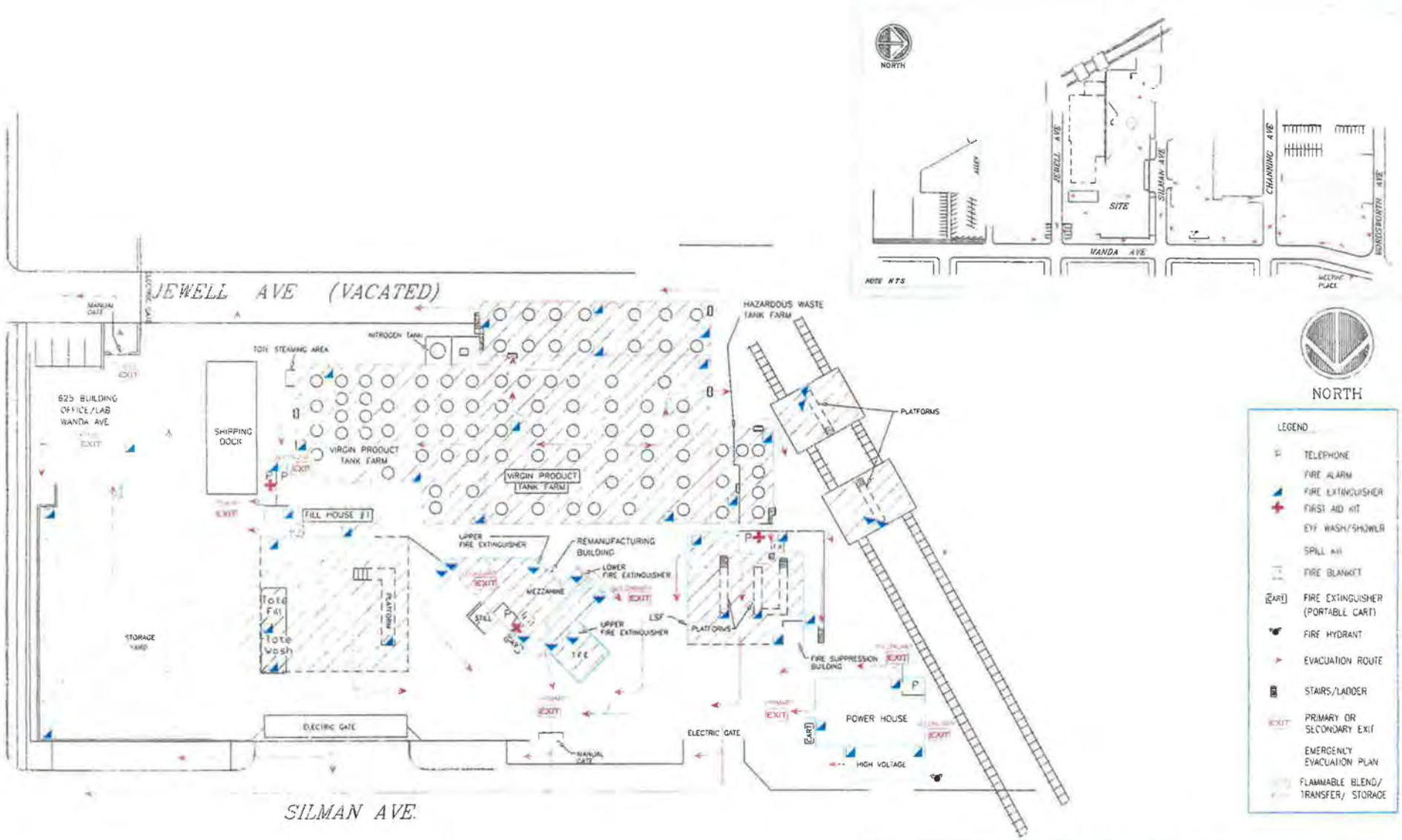
G-5b External Communication (40 CFR 264.32 (b))

External communication is also provided through the facility telephone system (as described in section G-5a above).

G-5c Access to communication and Alarm Systems (40 CFR 265.340)

All facility personnel involved in any transfer operations have immediate access to the internal alarm-system pull boxes and telephone system. The Alarm-actuator pull boxes and telephones are located in areas where personnel would be working during these operations. These alarm-actuator pull boxes and telephones are maintained free and cleat of obstructions.

In the even that there is only employee on the premises when the facility is in operation, this employee will have immediate access to the telephones which connect to the guard station and are equipped with outside lines.



Drawing of: EMERGENCY EVACUATION PLAN 625 WANDA AVENUE PRODUCTION AREAS			
Date: 11/2410	Drawing #: 6-A	Approved By:	REV: 2 OF 2
SCALE: NOT TO A SCALE	Drawn By: S. WITT	Sheet: 1 OF 1	SIZE: B

Table G.2

Emergency Equipment (40CFR 264.52)

Item	Location	Capabilities
Alarm Actuators		
1 Office area	downstairs hallway	All manual alarms are connected to an audible alarm, which sounds throughout the facility. The Alarm is also monitored by ADT Security System. ADT Security Systems alert the local fire or police departments
2 remanufacturing	southeast corner	
3 Limited Storage Facility	Northwest corner	
4 Boiler House	Northeast Corner	
Telephone/Cellular		Provide internal and external communication and also site wide paging capabilities.
1 Office area	downstairs hallway	
2 Fill House 1	south wall	
3 Fill House 2	Northwest wall	
4 Limited Storage Facility	south wall near truck well	

Fire Extinguishers		All fire extinguishers throughout facility are rated ABC and are capable of extinguishing wood, solvent, and electrical fires.
1 Office	north wall	
2 Office	central wall	
3 Fill House	near east door	
4 Fill House	south wall	
5 Fill House	northwest corner	
6 Remanufacturing	near north door	
7 Remanufacturing	southwest wall	
8 Remanufacturing	northwest wall	
9 Limited Storage Facility	near east door	
10Limited Storage Facility	near north door	
11Limited Storage Facility	Mezzanine	
12Limited Storage Facility	Mezzanine	
13Limited Storage Facility	near west door	
14 Boiler House	east wall	
15 Boiler House	west wall	
Foam Trailers	515 Warehouse	Two Titan Model 401 Tote Mule Foam Trailers with concentrated bulk foam for use on chemical fires

Water Supply for Fire Control

Fire Hydrants at the center of Jewell, at the southeast corner of Jewel and Wanda, at the southeast corner or Silman and Wanda, at the southeast corner of Channing and Wanda, and at the west end of Silman (near railroad), and at the southwest corner of Wordsworth and Wanda.

G-5d Emergency Equipment

Portable fire extinguishers are located throughout the facility. Each fire extinguisher is classified for Class A, B and C fires, has a capacity of 20 pounds, and is multipurpose for dry chemical uses. Their locations at the facility are illustrated in Figures G.2A and B and are summarized in table G.2.

Spill-response equipment for use in containing and cleaning up spilled hazardous wastes is stored throughout the facility. Primary spill-control and emergency response stations, as illustrate in Figures G.2 A and B, are located in the Tank Truck loading/unloading area, the remanufacturing area, the Limited Storage facility, and the Boiler House (see listing in table G.2)

Small first-aid kits are located throughout the facility, as indicated on Figures G.2A and B. A large first-aid kit is located in the main office, First aid kits contain:
Bandage materials
- band aids
- gauze pads and rolls
- adhesive tape
- butterfly bandages
- multi-trauma dressings
- Anti-bacterial ointments
- Splints
- Aspirin
- Emetic-Syrup of Ipecac
- Local and topical anesthetics
- Blood Borne Pathogens Kit
- Eyewash bottle and solution

Decontamination equipment and personal safety equipment are provided at the facility as follows: emergency showers and eyewash fountains located within the Limited Storage Facility, the solvent Laboratory, the boiler house, the Fill Houses, and the Remanufacturing area.

The drench shower and eye waste station are located on the east wall, immediately north of the southeast foot traffic entrance/exit to the Limited Storage Facility.

Protective clothing and equipment are provided to protect employees during normal and emergency operations. Hard hats, protective eyewear, and steel-toed boots or shoes are the minimum protective clothing required. Other protective clothing and equipment available on-site include:

Clothing
-Rubber and neoprene boots
-Short and long rubber gloves
-Solvent resistant suits
-Polyethylene gloves

Equipment
Face shield, goggles, and extra protective eyeglasses
Disposable dust respirators
Chemical cartridge respirators with cartridges for organic vapors and acid gases; half and full face types
Self-contained Breathing Apparatus (SCBA)

This clothing and the equipment are located in a storage area in the EHS department for easy access by personnel.

The Limited Storage facility building has a spill-control station which is located in the northwest corner of the unloading/loading area just west of the truck dock and is available to respond to spills of various characteristics within the Limited Storage Facility. The spill drum contains:

Absorbent pads, pillows, socks and loose
Stainless steel over-pack drum
Spill Stoppers designed for nearby drains
Plastic over-pack drum
Bucket, mop, and wringer
Spark resistant shovel

A portable pneumatic pump is also available to remove spills from the containment sumps.

G-5e Water for Fire Control [R 299.9606 and 40 CFR 264.32 (d)]

Water is provided to the facility from the City of Ferndale water supply mains, which provide a waster flow of 57 static, 48 residual, with 1460 gallons per minute flowing. Water supply is available to the facility at the location indicated on Figure G.2

The Limited Storage facility building is equipped with an automatic, dry pipe, sprinkler system that is supplied by an eight-inch waster main with waster pressure less than 60 psi. Capacity is 0.37 gpm over the most remote 2500 square feet and 1000 gpm for hose demand. A flow switch and an electric alarm bell, located on the building's exterior, are connected with the automatic, dry-pipe, sprinkler system.

G-5f Aisle Space Requirements

Access into the facility and movement within the facility is maintained free and clear of obstructions in order to allow movement of personnel, fire protection equipment, and spill-control and decontamination equipment within the facility. Aisles and walkways between tanks and equipment in both the storage and process areas are maintained free and clear of obstructions in order to project unobstructed movement of personnel and portable emergency equipment within these areas.

G-5g Emergency Equipment Inspection and Maintenance [40 CFR 264.33]

All facility alarm systems, fire-protection equipment, spill control equipment, and decontamination equipment are inspected, tested, and maintained on a regular basis to ensure proper operation during an emergency. (Section F provides more detail regarding inspection schedules and procedure).

G-6 COORDINATION AGREEMENTS [40 CFR 264.52 AND 264.37]

Copies of the Contingency Plan have been submitted to the various local emergency-response agencies. These agencies were asked to review and comment on the plan. In addition, the spill cleanup contractor has been provided with copies of the plan.

This information has been provided to emergency-response agencies in order to familiarize them with the facility layout, the properties of the hazardous waste handled, the location of working area, access routes into and within the facility, the possible evacuation routes from the facility, and the types of injury or illness which could result from releases of material at the facility.

This information has been submitted to:

Ferndale Fire Department
1635 Livernois
Ferndale, MI 48220
(313) 541-3600

Ferndale Police Department
310 E. Nine Mile Road

Ferndale, MI 48220
(313) 541-3650

City of Ferndale
300 East 9-Mile Rd
Ferndale, Mi 48220

Oakland County LEPC
Bldg. 47 West
1200 Telegraph Rd.
Pontiac, MI 48341

Marine Pollution Control, Inc.
8631 W. Jefferson
Detroit, MI 48209
(313) 849-2333

The local hospital and clinic have been contacted to familiarize each with the properties of hazardous waste and other materials which are handled at Gage Products Company. Material safety data sheets, outlining potential hazards of these materials, have been submitted to:

Emergency Plan Reviewer
Beaumont Hospital
3601 West 13 Mile Road
Royal Oak, MI 48072
248/898-2000

Concentra Occupational Medical Center
26185 Greenfield
Southfield, MI
248/569-2040

Documentation that these organizations have received copies of this Contingency Plan can be found in Appendix G.1.

G-7 EVACUATION PLAN [40 CFR 264.52(F)]

All emergencies require prompt and deliberate action. In the event of any major emergency, an established set of procedures will be followed. These procedures will be followed as closely as possible; however, in specific emergency situations, the Emergency Coordinator may deviate from the procedures to provide a more effective

plan for brining the situation under control. The Emergency Coordinator is responsible for determining which emergency situations require facility evacuation.

The telephone system, paging system, or runners will be used as the warning system to notify key facility personnel as to the nature of the emergency and recommended plan of action. Total facility evacuation is initiated only by the Emergency Coordinator. The public address system is the primary means of initiating a facility evacuation. The fire-alarm system provides a back-up evacuation signal.

A fire-alarm system has alarm boxes located at critical areas throughout the facility. The fire alarms can also be used to summon aid in other emergency situations. All applicable employees are familiar with alarm box locations. The alarm system is an audible horn which can easily be heard in all parts of the facility.

- In the event that all reasonable measures fail to control the emergency or if human health or the environment outside the facility is threatened, the Emergency Coordinator will:

- Commence the signal for facility evacuation and notify employees, contractors, and visitors to evacuate the facility through any of the exits determined to be safe at the time of the emergency (see Figure G.2A&B for evacuation routes and designated assembly areas).

- Immediately open the gates and direct that no further entry of visitors, contractors, or trucks be permitted. All vehicle traffic movement within the facility will cease in order to allow the access of emergency equipment.

- Not allow any persons to remain or re-enter the facility unless specifically authorized by the Emergency Coordinator. The Emergency Coordinator will then direct and assume responsibility for those persons remaining or re-entering the facility.

- Maintain communication with evacuated supervisors to determine if all employees, contractors, and visitors are present and accounted for in the designated assembly areas. Accounting for the presence of visitors will be the responsibility of the employees they are seeing and contractors will be the responsibility of those personnel supervising them. Truck drivers will be the responsibility of the supervisor where the truck is loading or unloading.

- Receive the final tally of persons not accounted for in the evacuation assembly areas. No attempt will be made to locate persons not accounted for unless it can be done without endangering others and the search has been directed by the Emergency Coordinator.

- Determine whether evacuation of the areas surrounding the facility should be initiated. If required, the Specialized Residential Care Group home located directly across Wanda from the facility will be contacted to allow them extra time to be evacuated promptly and safely. Local emergency-response agencies will be immediately contacted, and the Emergency Coordinator will assist these agencies if it is determined to be necessary to initiate evacuation.

- Give a signal or other notification to indicate that the facility is safe and cleared for re-entry.

G-8 REQUIRED REPORTS [40 CFR 264.56(i) and (j)]

In the event of an emergency situation that requires implementation of the contingency plan, the Emergency Coordinator must make the following notifications:

- Record in the facility's operating record the time, date, and description of any incident that requires the implementation of this plan.

- Notify the EPA Regional Administration and the MDEQ director that the facility has complied with the following provisions:

  No waste that may be incompatible with the released material has been (or will be) stored or recycled until cleanup procedures have been completed.

  All emergency equipment listed in this plan has been (or will be) cleaned and fit for its intended use prior to resumption of operations.

- Within 15 days after the incident, submit a written report to:

  USEPA – Region V
  203 S. Dearborn Street
  Chicago, IL 60604

  Director
  Michigan Department of Environmental Quality
  Box 30028
  Lansing, MI 48909

  This report must include the following information (See Form G.3):

  Name, address, and telephone no. of the facility and the owner or operator
  Date, time, type of incident.
  Type and quantity of the materials involved.
  Extent of injuries, if any.

Assessment of actual or potential hazards to human health or the environment, as applicable

Estimated quantity and disposition of recovered material that resulted from the incident

Figure G.3

REPORTING FOR EMERGENCY EVENTS

Name, Address and phone number of owner of operator

Name, Address and phone number of owner of operator

Date, time and phone number of owner or operator

Name and quantity of material (s) involved

Extent of injuries (if any)

Assessment of actual or potential hazards to human health or the environment (if applicable)

Estimated quantity and disposition of material recovered from the incident

Send to:

1) USEPA, Region V
Regional Administrator
230 S. Dearborn Avenue
Chicago, Illinois 60604

2) Director
MDEQ
P.O. Box 30028
Lansing, MI 48909

G-9 AMENDMENT FO THE CONTINGENCY PLAN (40 CFR 264.54)

This contingency Plan will be reviewed and amended whenever:

- The facility permit is revised.
- Applicable regulations are revised.
- The plan fails in an emergency.
- The facility changes in design, construction, operation, maintenance or other circumstances in a way that materially increases the potential for fires, explosions, or releases of hazardous waste or hazardous waste constituents, or changes the response necessary in any emergency.
- The list of emergency coordinators changes.
- The list of emergency equipment changes
- The plan will be reviewed every five years as required by SPCC regulations

APPENDIX G.1

Signing below, you acknowledge that you have received an updated electronic copy of Gage Product Company's Oil Spill Control & Countermeasures Plan (SPCC) and Pollution Incident Prevention Plan (PIPP), dated Jan 2012, which also includes the facility Contingency Plan. A hard copy will be provided at your request, by indicating below.

This information is being provided to familiarize emergency response personnel with our facility, including: layout, the types and hazards of materials handled, the names and numbers of emergency coordinators, the location of working areas, access routes into and within the facility, possible evacuation routes from the facility, and the types of injuries or illness which could result from a release of material at the facility.

In the Contingency portion of the SPCC/PIPP, Gage has established procedures to be followed to minimize hazards to human health or the environment resulting from fires or explosions, spills or releases, or natural disasters. Please review and provide comments on the plan, as necessary, to Sharon Stahl at sstahl@gageproducts.com or (248) 691-6718.

It is Gage Product Company's intent that through prevention and planning, potential incidents will not occur, and that those that do will be properly handled and minor.

Organization	Printed Name	Signature	Date	Hard Copy? Number of Copies
Ferndale Fire Department	SGT Ken Kleman	Sgt Ken Kleman	4-20-12	☐ YES ☒ NO
Ferndale Police Department	LT. GARY WHITNEY		4/20/12	☐ YES ☒ NO
City of Ferndale-Community Development Department	Derek L. Delacourt		4/20/12	☐ YES ☒ NO
Concentra Medical Center	Donald W. Sipe		4/24/12	☒ YES ☐ NO Delivered to Capitol Council
Oakland County LEPC	Tricia Smith	Tricia Smith	4/24/12	☐ YES ☒ NO

Mailed - Return Receipt to Manor Pollution Control & D.O Beaumont Hospital

Office: 248_541_3824
Fax: 248_541_8970

821 Wanda Avenue
Ferndale, MI 48220

gageproducts.com

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Emergency Plan Reviewer
Beaumont Hospital
3601 W 13-Mile Rd.
Royal Oak, MI 48072

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Nancy Bates ☐ Agent ☐ Addressee

B. Received by (Printed Name) Nancy Bates, Agent
C. Date of Delivery 3511, 3577, 3711, 3811, 3911

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No
13 Mile Rd
Royal Oak, MI 48073

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☒ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label) 7010 2780 0000 2895 7644

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Marine Pollution Control
8631 W. Jefferson
Detroit, MI 48209

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X ☐ Agent ☐ Addressee

B. Received by (Printed Name) Walter Putman
C. Date of Delivery 4/23/12

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

APR 23 2012

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☒ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label) 7010 2780 0000 2895 7637

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

SECTION I

CLOSURE PLAN, POST-CLOSURE PLAN, AND FINANCIAL REQUIREMENTS

This section is submitted in accordance with the requirements promulgated pursuant to Part 111 of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, Section 299.9504 which incorporates 40 CFR 270.14(b)(13-18), 264.110 through 120, 264.178, and 264.197 by reference. This plan identifies all steps necessary to completely close the limited hazardous waste storage area operated by Gage Products Company, Ferndale, Michigan, at the end of its intended operating life. A post-closure plan is not required because this is not a disposal facility and all wastes will be removed at closure.

Gage will maintain an on-site copy of the approved closure plan and all revisions of the plan until the certification of closure completeness has been submitted and accepted by the Michigan Department of Environmental Quality (MDEQ). Gage will notify the Director at least 180 days prior to the date final closure is expected to begin. Upon completion of closure, Gage will submit to the Director a certification by both Gage and an independent registered professional engineer that the facility has been closed in accordance with the specification in the approved closure plan as is required by Michigan Rule 299.9613.

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I-1 CLOSURE PLAN [40 CFR 270.14(B)(13)]

I-1a Closure Performance Standard [R 299.9613 and 40 CFR 264.111].

This closure plan has been designed to eliminate the need for post-closure maintenance and control activities, and to minimize or eliminate threats to human health and the environment, and avoid the escape of hazardous wastes, hazardous waste constituents, leachate, contaminated rainfall, or waste decomposition products to the ground or surface waters or to the atmosphere. The following sections describe the specific activities which will be performed by Gage to satisfy the closure performance standard.

I-1b Partial and Final Closure Activities [40 CFR 264.112(a)(1) and (4) and 264.197].

No closure activities, partial or final, are planned at this time. When final closure of the limited hazardous waste storage area is initiated, it will follow the procedures outlined in this closure plan which can be implemented at any point during the active life of the storage area. If hazardous waste storage activities in some way change during the life of the facility, the closure plan will be modified accordingly.

I-1c Maximum Waste Inventory [40 CFR 264.112(a)(2)].

The maximum inventory of hazardous wastes expected to be in storage at any given time during the operating life of limited storage area is tabulated below. While the quantity of waste stored at any one time is usually much less, these quantities have been used to estimate the cost of closing the facility.

<u>Container Storage Building</u>	
Container Storage Area	50, 55-gallon drums (2,750 total gallons).
<u>Limited Storage Facility Tank Farm</u>	
Hazardous Waste Bulk Storage Tanks	3, 6,000-gallon tanks 1, 3,250-gallon tank 1, 1,000-gallon tank (22,250 total gallons). Total (combined) 25, 000 gallons

I-1d Inventory Removal, Disposal and Equipment Decontamination [40 CFR 264.112(a)(3), 264.114, 264.178, and 264.197]

As part of the work necessary to close the plant, contractual arrangements will be made with outside contractors for hazardous waste disposal as well as clean-up and decontamination of the storage area. This work will be supervised by qualified Gage personnel. It will be required that all contractors involved with removal, disposal and/or decontamination activities be properly equipped with solvent-resistant coverall, boots, and gloves; head protection; and full-face respirators with solvent gases filter cartridges or self-contained breathing apparatus (SCBA), as appropriate. All personnel engaged in work associated with closure of the limited storage facility at the Gage site must be certified as having received and maintained up to date training pursuant to 29 CFR 1910.120. Health and Safety Protocols stipulated by Gage's Site Health and Safety Plan, February, 2012 will be followed at a minimum. Site-specific training will be limited to initial site orientation briefings and periodic safety meetings as deemed necessary by Gage's Project Coordinator or the contractor's field team leader (Project Foreman) during the course of closure activities. The contractor's Project Foreman will be responsible for ensuing worker training certification of all site workers and for ensuring that workers are trained for the specific tasks to be performed. Transporter personnel entering the site will be notified to remain with their vehicle in a designated loading area to limit site traffic for security and safety reasons. All waste sample collection will be performed by trained field crew workers under the direction of the Project Foreman and Gage's Project Coordinator. All sampling activities and analysis will be performed in accordance with the requirements of 40 CFR Part 261, Appendix I, II, and III. All samples that are collected will be preserved in a manner consistent with the analytical procedures stipulated under SW-846 and chain-of-custody documentation will be employed. Representative samples will be analyzed for parameters consistent with the wastes stored within the facility, as necessary to characterize the waste for proper treatment/disposal.

The following procedures will be taken to ensure the clean closure of the bulk tank and container storage areas.

All liquid hazardous waste remaining in the bulk storage tanks and containers (25,000 gallons) will be shipped off-site for treatment and/or disposal. To reflect a worst case scenario for closure cost estimation purposes, the facility closure plan will assume that the maximum inventory amount possible for stored wastes is present on-site at the time of closure. During closure of the facility, wastewaters acceptable for discharge will be released to the Detroit Water and Sewerage system, as they have been during the normal operation of the facility. For closure cost estimation purposes however, the closure plan will reflect that any wastewaters generated during closure activities will need to be disposed of off-site at an appropriately licensed treatment and/or disposal facility, at a cost to

Gage. The sludge remaining in the tanks, estimated to be 3.5 cubic yards, will be dewatered on-site and shipped by a licensed hazardous waste transporter to a licensed hazardous waste facility for disposal at a cost to Gage. Gage will provide appropriate analytical results (e.g., characteristics of waste - ignitable, corrosive, ...) of all wastes removed for disposal at final closure using the detection limits as specified in 40 CFR Part 261 for characteristic wastes. Any additional analytical requirements of the accepting disposal facility will also be met by Gage. All waste solids, including contaminated debris and used personal protective equipment which cannot be decontaminated, will be characterized and place in properly labeled containers for disposal off-site. Federal, state and local manifesting, transportation and disposal regulations will be complied with during handling and disposal of these wastes.

All hazardous wastes present on-site will be disposed of in accordance with the Resource Conservation and Recovery Act (RCRA), Part 111 and Part 121 of Michigan Public Act 451 of 1994, the Hazardous Waste Management Program and Liquid Industrial Waste Programs, respectively, as appropriate. All hazardous waste shipments to treatment/disposal facilities will follow standard waste manifesting, labeling, and transportation requirements. Any non-hazardous wastes shipped off-site will also be handled in accordance with Part 121, as appropriate. Liquid wastes contained within the bulk tanks will be loaded using existing piping into tanker trucks that will transport the materials to an appropriately licensed treatment/disposal facility. Containerized materials (55 gallon drums) will be loaded onto trucks using a lift truck for transport to a treatment/storage/disposal facility.

Following liquid removal from the bulk storage tanks and associated piping and pumps, the following procedures will be used to decontaminate and close the storage tanks, pumps, connected piping and secondary dike containment area:

Empty tanks, pumps and piping will be pressure washed using a portable hotsy-type sprayer unit using alconox or a similar detergent. Access to the tank interiors for cleaning will be gained through existing hatches/man-ways. Cleaning methods will include pressure washing, scraping, use of a detergent and triple rinsing to accomplish removal of all waste residual from the tank walls, sides and bottom. Sludge and sludge-water materials will be removed from the tanks using pumps and flexible hosing already on-site or through use of a vac-truck for containment and transportation of the waste materials to a treatment/storage/disposal facility. All ancillary equipment (e.g., piping, pumps, and hoses) used during decontamination activities will be decontaminated following use. All wash water generated will be bulked and transported to a treatment/storage/disposal facility. If possible, cleaning of the tanks will be conducted without entering the tanks. If, however, tank entry is required to thoroughly clean the interior, the confined space entry procedures provided as Appendix I-1 will be followed.

The bulk tank concrete dike pad will be cleaned and triple-rinsed with a portable hotsy-type pressure sprayer with detergent. All materials in the dike area will be washed toward the blind sump to aid in collection of the wash waters using a pump or vac-truck for containment and transportation to a treatment/storage/disposal facility. The collection spill containment sumps will also be cleaned and triple-rinsed with the water being collected using pumps or a vac-truck for containment and transportation to a treatment/storage/disposal facility.

All rinse water will be discharged to the city sanitary sewer system provided that the rinse water meets the restrictions of the Detroit Water and Sewerage Department Discharge Limits. If the rinse water does not meet the restrictions, it will be shipped off-site by a licensed hazardous waste transported to an approved treatment/storage/disposal facility. For purposes of estimating the cost of site closure, it is assumed that all wash waters generated during closure activities will be transported off-site for treatment/disposal at a cost to Gage.

Following removal of all containers (drums) from the container storage area for transportation to a treatment/storage/disposal facility, the container storage area and loading/unloading area will be cleaned and triple-rinsed by use of a floor sweeper equipped with hydro-blasting and scouring attachments. Surfactants (alconox or similar detergent) will be used in the wash water. Rinse waters will be directed to blind sumps for collection using a pump or vac-truck for containment and transportation to a treatment/storage/disposal facility.

All rinse waters generated from the cleaning of the container storage, loading/unloading area, and bulk tanks and dike area will be tested for hazardous constituents specific to materials stored at the site (refer to sampling parameters listed in Appendix I-2) to ensure that these areas are adequately decontaminated.

Any liquids in the sumps in the container storage and loading/unloading area will be removed. The sumps will be cleaned and triple-rinsed with a portable hotsy-type pressure sprayer with detergent. The rinse water will be collected using pumps or a vac-truck for containment and transportation to a treatment/storage/disposal facility.

Following the removal of all wastes, the concrete pads at the bulk tank area, container storage building and loading/unloading area will be inspected for major cracks, deterioration, and pad integrity. The pads are sealed with materials compatible to the wastes being stored (refer to manufacturers specification sheets for coating materials in Section D, Appendix D.2). The pads are presently in good condition and there is no record that spills have occurred in these storage areas. Therefore, it is highly unlikely that it will be necessary to sample the concrete or the underlying soil. Because the tank trailer loading/unloading

area is also paved it is unlikely that it will be necessary to sample the concrete or the underlying soil in this area. If, however, any of these pads have been significantly structurally compromised so as to have provided questionable protection against, or possible leakage of material into the soil beneath the pads, sampling of the underlying soil in questionable areas will be performed.

At closure, tanks and connected piping equipment is not intended to be removed from the site. Following cleaning, the tanks and equipment present at the facility are intended to be left intact for utilization in other productive processes. Sampling of the soil, if deemed necessary because of suspect integrity of pad(s), will be conducted by coring the concrete using a six-inch diameter drill according to applicable ASTM standards. The concrete will be pulverized and packaged into plastic containers. The soil samples will be obtained with a hand auger form a depth of one foot, using the procedures outlined in ASTM D1452-80, "Standard Practice for Soil Investigation and Sampling by Auger Borings". The soil and concrete samples will be analyzed for the parameters listed in Appendix I-2, based on the types of wastes that were stored in these areas. In the event that sampling will be necessary and contamination is found at any of the sample locations, the MDEQ will be contacted for guidance prior to proceeding with site closure activities.

The analytical methods used for analysis of soil and wash water samples will be those listed in Appendix I-2. All contaminated wash waters generated will be disposed of at an appropriately licensed hazardous/liquid industrial waste treatment/storage/disposal facility.

Prior to leaving the clean-up site location, decontamination of personal protective clothing will be conducted by removing all loose materials from the boots and spraying, washing and scrubbing with an alconox detergent solution all outside protective clothing materials as well as exposed skin surfaces (i.e., facial areas). Contaminated equipment and solid residues to be disposed of will be loaded and transported to an appropriately licensed disposal facility.

I-1e Schedule for Closure

The closure date of the limited hazardous waste storage area is unknown at this time. Based on this, the following open-ended schedule has been prepared listing the approximate timetable to be used for closure.

Gage will amend this closure plan whenever changes in operating plans or facility design will affect the closure plan. If a permit modification is requested to authorize a change in operating plans of facility design, a modification to this closure plan will be made at the same time. If a permit modification is not needed to authorize the change, a request for closure plan modifications will be made within 60 days after the change in plans or design takes place.

Time Period	Description of Activity
Week 1: Day 0-7	Plant termination of hazardous waste activity.
Week 2: Day 7-14	
3 days	Removal of containerized waste from the hazardous waste drum storage areas.
4 days	Removal of waste from bulk storage tanks.
Weeks 3 & 4: Day 14-28	
14 days	Sampling and analysis of bulk tank sludge.
Week 5: Day 28-35	
7 days	Removal and disposal of bulk tank sludge.
Weeks 6, 7, & 8: Day 35-56	
21 days	Decontamination of the bulk tank and container waste storage areas and the loading/unloading area.
Weeks 9, 10, & 11: Day 56-77	
21 days	Analysis and removal for disposal of all wash waters (wash water from all site decontamination activities).
Weeks 12, 13, 14, 15, 16, 17, & 18: Day 77-126	
49 days	Time required for soil sampling, analysis, and disposal, if required. This represents the contingency portion of the schedule.
Weeks 19, 20, 21, & 22	
28 days	Certification of closure by an independent licensed professional engineer and by Gage Products Company Project Coordinator for submittal and approval by MDEQ. Although an extension for completion of site closure activities is not anticipated, if for some reason

additional time is required to complete site closure, Gage's Project Coordinator will request an extension (listing amount of time needed, reason for extension request, and new anticipated completion date) in writing to the MDEQ prior to exceedance of the above scheduled closure activity time limits. A clean closure certification will be submitted to the Director by registered mail within 60 days of completing final closure activities.

I-1f Extensions for Closure Time [40 CFR 264.113(a) and 264.113(b)]

Gage does not anticipate needing an extension for closure time. If a site closure extension is required, the extension request procedure (stated above) will be implemented.

I-2 POST-CLOSURE PLAN [40 CFR 270.149b)(13)]

Post-closure care will not be needed for Gage because it is not a disposal facility.

I-3 NOTICE IN DEED AND NOTICE TO LOCAL LAND AUTHORITY 40 CFR 270.14(b)(14) and 264.120]

Because Gage is a limited hazardous waste storage facility only, and not a disposal facility, notation in the deed to the facility property informing potential purchasers of restrictions associated with a disposal site is not necessary.

I-4 CLOSURE COST ESTIMATE [40 CFR 270.14(b)(15) and 264.142]

Table I-1 outlines the determination of the total cost of closure. This cost estimate will be updated annually to reflect the cost of site closure as adjusted for inflation in accordance with 40 CFR 264.142(b). Specifically, the closure cost estimate will be adjusted to account for inflation by using an inflation factor derived from the most recent Implicit Price Deflator for Gross Domestic Product published by the U.S. Department of Commerce in its Survey of Current Business. The inflation factor is the result of dividing the latest published annual Deflator by the Deflator for the previous year.

The assumptions made in the cost estimate are as follows:

1. Removal of final waste inventory. The final waste-solvent inventory (25,000 gallons - in bulk storage tanks and containers) will be taken off-site for disposal by a contracted third party at a cost to Gage. The estimated

volume of solids from the container storage pad is one (1) drum. The estimated volume of solids from the bulk storage area pad is four (4) drums. The estimated volume of sludge wastes remaining in the bulk storage tanks for disposal is fifteen (15) drums (maximum of 50-gallons in each drum). The cost of removal and disposal for these drums is $157.75/drum. Dismantling and disposal of the bulk storage tanks, the container storage building and the loading/unloading area are not being planned for as these facilities and structures will remain once decontaminated for continued productive utilization as appropriate by Gage, or other party interested in the facility.

2. Decontamination of container storage building, bulk storage tanks and loading/unloading area containment pads. Decontamination costs have been determined to be $0.82/sq.ft. The container storage building and loading/unloading areas have a storage area which measures 62.8' x 66' or 4,144.8 sq. ft. (4,145 x .82 = $3,398.90 - cost of pad cleaning). The bulk tank storage area measures 49' x 36' or 1,764 sq. ft. (1,764 x .82 = $1,446.48 - cost of dike pad cleaning). Costs for disposing of bulk quantities of wash water generated from the cleaning procedures are estimated to be $0.80/gal.

3. Analytical Costs. The waste characterization estimate is included to cover costs which would be incurred in the event that drums of unknown content are found upon closure. If this should happen, samples will be taken from the drums and analyzed for hazardous constituents and characteristics by approved EPA methods so that appropriate disposal of the drums can be determined. Although it is unlikely that there will be drums of unknown content, 5 analyses (one for each bulk tank) at $400 per analysis have been added to the estimated closure costs. All analysis will be conducted for characteristics of wastes stored on site based upon Gage's knowledge as obtained from their waste acceptance criteria. Gage routinely conducts pre-shipment screening of all materials in their laboratory prior to acceptance to eliminate unacceptable/unknown materials.

   The estimated cost of wash water analysis is based upon analysis of four samples, two from the container storage building and loading/unloading area and two from the bulk tank storage area, at a cost of $150 per sample using the site specific parameters and detection limits listed in Appendix I-2.

4. Supervision. All closure activities will be supervised by the Project Foreman of the contracted third party work crew at a labor rate of $95/hour. Gage's Project Coordinator will also oversee all activities conducted by the contractor as an additional work-quality control mechanism.

5. Closure Certification. The cost of certification of site clean closure by an independent third party professional engineer is estimated on the basis of a labor rate of $134/hour. A clean closure certification will be submitted to the Director by registered mail within 60 days of completing final closure.

6. Total Cost. Total closure costs were calculated by adding 20% for contingencies.

I-5 FINAL ASSURANCE MECHANISM FOR CLOSURE [40 CFR 270.14(b)(15) and 264.143]

Financial assurance for closure costs is provided by a letter of credit to guarantee the availability of closure funds. Appendix I-3 contains a copy of the letter of Financial Assurance.

I-6 POST CLOSURE ESTIMATE [40 CFR 270.14(b)(16) and 264.145]

Post closure care will not be necessary for this facility as it is not a disposal facility.

TABLE I-1
CLOSURE COST WORKSHEET
(Costs Include Labor)

Container Storage and Loading/Unloading Areas:

Inventory removal and disposal will be completed by the contracted services of a third-party work crew at a cost to Gage.

Items	Amount/Unit Price	Transportation	Total Price
Disposal of Corrosives	12 drums @ $142/drum	12 drums @$20/drum	$ 1,944
Disposal of Drummed Liquids	38 drums @ $125/drum	38 drums @$20/drum	$5,510
Cleaning of Pads	4,145 sq. ft. @ $0.82/sq. ft.		$3,398
Bulk Disposal of Wash Waters	2,000 gals. @ $0.80/gallon	$250	$1,850
Analysis of Wash Waters	2 samples @ $150.00/sample		$300
Disposal of Drummed Solids	1 drum @ $157.75/drum	1 drum @$20/drum	$178
	Subtotal		**$13,180**

Bulk Tank Storage Area:

Inventory removal and disposal will be completed by the contracted services of a third-party work crew at a cost to Gage.

Items	Amount/Unit Price	Transportation	Total Price
Disposal of all Bulked Liquids	22,250 gal. @ $0.45/gallon	Included	$ 10,013
Labor for Cleaning Inside of Bulk Storage Tanks (Level A Personal Protective Equipment and Confined Space Entry)	40 hours @$195/hr.		$7,800
Cleaning of Pads	1,764 sq. ft. @ $0.82/sq. ft.		$1,446
Bulk Disposal of Wash Waters	2,000 gals. @ $0.80/gallon	$250	$1,850
Analysis of Wash Waters	2 samples @ $150.00/sample		$300
Disposal of Drummed	4 drums @	4 drums	$711

Solids	$157.75/drum	@$20/drum	
Disposal of Drummed Sludges	15 drums @ $157.75/drum	15 drums @$20/drum	$2,667
	Subtotal		**$24,787**

Miscellaneous Costs:

Items	**Amount/Unit Price**		**Total Price**
Waste Characterization Costs	5 samples	@ $400/sample	$2,000
Supervision and Gage Certification	50 hours	@ $95/hour	4,750
Closure Report Preparation	20 hours	@ $134/hour	2,680
Independent PE Certification	10 hours	@ $134/hour	1,340
Project Management/Coordination	24 hours	@ $134/hour	3,200
Expenses	$2,000 unit cost		2,000
	Subtotal		**$15,970**

SUBTOTAL CLOSURE COST (June 2007) $53,937

TOTAL CLOSURE COST (Including 20% Contingency) $64,725

Estimates adjusted for annual inflation:
Revised January 2013

	2007	2008	2009	2010	2011	2012
(GDP IPD)	1.5	2.2	1.0	1.1	2.7	2.2
$53,937	$54,746	$55,950	$56,510	$57,132	$58,388	$59,673.03

	2007	2008	2009	2010	2011	2012
(GDP IPD)	1.5	2.2	1.0	1.1	2.7	2.2
$64,725	$65,695	$67,140	$67,812	$68,558	$70,066	$71,607.64

I-7 FINANCIAL ASSURANCE FOR POST CLOSURE [40 CFR-270.14(b))16) and 264.145]

Financial assurance for post closure is not necessary for this facility as it is not a disposal facility.

I-8 CLEAN CLOSURE CERTIFICATION [R 299.9613]

Within 60 days of completing final closure, a clean closure certification will be submitted to the Director by Registered mail. This certification will state that the container storage area and bulk storage tanks were closed in accordance with the specifications in the approved closure plan. The certification will be signed by a responsible corporate officer of the owner/operator (40 CFR 270.11) and by an independent registered engineer.

The following documentation will also be included with the closure certification:

- Manifests or waste removal summaries (for non-hazardous wastes) which indicate how much waste was shipped off-site and to where.
- A summary of any procedures that deviated from the approved closure plan.
- Field reports of closure activities, including a daily time table, weather conditions, and other relevant observations.
- Results of all analytical results used to certify clean closure (lab sheets, chain-of-custody reports, QA/QC report, and summary tables).
- A copy of the approved closure plan and letter of closure approval.
- Summary of decontamination procedures (pressure wash, stream cleaning, etc.) and how waste water was disposed.
- Summary analysis (including conditions of haul roads, time table, soil and ground water results, weather conditions, runoff controls, equipment decontamination, etc.

The following documentation may be included, depending upon the extent of testing required:

- Statistical comparisons on sampling results compared to background. This should include full computations on background and statistical analysis).
- Sampling and analysis procedures (specify references).
- Final depth and evaluations of excavations of wastes and soils.

- Properly labeled and easily identified sampling grid stations (map): including background stations.
- Ground water data (and statistical evaluation) used to determine if ground water degradation has occurred (usually four sets of replicate analysis compared to sampling event after closure activities). Monitor well construction details and sampling and analysis procedures may be required if documentation is not in the file.
- Summary of final restoration of excavated area, including information on fill material used and/or future land use outline. If clean closure cannot be achieved this summary item will be used to address the post closure program and/or corrective action.

I-9 LIABILITY INSURANCE [40 CFR 270.14 (b)(17) and 264.147]

I-9a Sudden and Accidental Occurrences

Gage Products Company is insured for liability arising from sudden and accidental occurrences in the amount of $1 million per occurrence and $2 million annual aggregate exclusive of legal defense costs. Financial responsibility for this liability coverage is demonstrated by Gage's insurance policy (see Appendix I-3).

I-10 STATE ASSUMPTION OF RESPONSIBILITY

Gage does not plan to request State assumption of the legal or financial responsibilities at this time.

APPENDIX I-1

A confined space shall never be entered unless under controlled entry conditions supervised by the Project Foreman and/or Gage's Project Coordinator. Any mechanical equipment in the confined space shall be turned off and disconnected from its power source or locked out so that it cannot be mistakenly turned on while the space has been entered. All feed or supply lines to the vessel shall be blanked off unless the line is supply water for cleaning. All waste materials shall be removed as much as possible from the confined space before allowing entry.

A competent person must certify in writing that the space is free from hazard and must also certify that it will remain free from hazard for the duration of the work to be performed, or determine what protection must be employed to protect workers from expected hazards. Continuous or periodic monitoring shall be performed having regard to the nature and duration of the entry and the work to be performed and records of all monitoring shall be submitted for retention by Gage's Project Coordinator.

Any confined space which contains or may contain hazardous gas, vapor, dust or fumes or an oxygen content of less than 19.5 percent or greater than 23.5 percent at standard atmospheric pressure shall be purged and ventilated to provide a safe atmosphere before entering. If the space cannot be purged, it shall not be entered unless the worker entering is using a suitable breathing apparatus (EPA Level B PPE) and a safety harness, the free end of which is held by a worker equipped with an alarm who is keeping watch outside the confined space. A person adequately trained in artificial respiration shall be available on-site.

When the gas or vapor in a confined space is explosive or flammable or may become that way during the entry to such an extent that the concentration exceeds 20 percent of the lower explosive limit of the gas or vapor, no worker shall be permitted in the confined space, except if required to reduce the hazard with approval of the Foreman and Gage's Project Coordinator. If the concentration does not exceed 20 percent of the lower explosive limit of the gas or vapor, then any work of such a nature that does not create any source of ignition, such as cleaning or inspecting, may be performed. Hot work may be performed only if the concentration does not exceed 10 percent of the lower explosive limit of the gas or vapor and oxygen concentration is less than 23.5 percent. A copy of each completed confined-space-entry permit shall be submitted to Gage's Project Coordinator for retention. Contractor-specific permits may be used, provided they document the requirements listed above and meet MIOSHA standards as a minimum (Rules 3301,. 3302, and 3303).

The buddy system provides the safest way to protect confined-space-entry workers. A safety monitor (back-up person) is assigned to each entry person. The safety monitor's job is to watch over and protect his assigned entry person. The entry person must

respond to the direction and communications of the safety monitor. Each buddy must respect the duties and responsibilities of the other and work as a team. If the entry person gets confused or thinks that signals are getting crossed, they should exit the confined space, talk over and resolve the problems with his safety monitor prior to resuming work.

APPENDIX I-2

TEST METHODS FOR DETERMINATION OF DECONTAMINATION COMPLETENESS

TEST METHODS FOR DETERMINATION OF DECONTAMINATION COMPLETENESS

Based upon Gage's waste acceptance screening criteria, the wastes removed from site for didsposal at site closure will be analyzed for the following parmeters in accordance with U.S. EPA Method SW-846 or any equivalent method approved by the MDEQ.

Parameter	Test Method
Flashpoint	1010 or 1020 (Pensky-Martens Closed Cup Method or Setaflash Closed Cup Method for determining ignitability) or equivalent. [1].
Corrosivity	9040 (Electrometric)[1].

References:

(1) SW-846, U.S. EPA, "Test Methods for Evaluation of Solid Wastes – Physical/Chemical Methods," 1986

* Any equivalent method proposal will be pre-approved by MDEQ.

SECTION D
PROCESS INFORMATION

The information provided in this section is submitted in accordance with the requirements of R 299.9614 of the administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451); R 29.4101 to R 29.4505 promulgated pursuant to the provisions of the Michigan Fire Protection Act, PA 207, as amended (Act 207); and Title 40 of the Code of Federal Regulations (CFR) §§270.14(d), 270.15, and Part 264, Subpart I, establish requirements for the use and management of containers. Also in accordance with R 299.9615 and R 299.9627 of the administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451); R 29.4101 to R 29.4505 promulgated pursuant to the provisions of the Michigan Fire Protection Act, PA 207, as amended (Act 207); and Title 40 of the Code of Federal Regulations (CFR) §§270.14(d), 270.16, 270.24, and 270.27 (Part 264, Subpart J and Part 60, Appendix A) establish requirements for tank systems. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003. This section discusses specific process information used by Gage Products Company to store hazardous wastes in the bulk tank and container storage areas.

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D-1 PROCESS INFORMATION

Gage stores hazardous wastes in bulk storage tanks and containers in the limited storage facility, which has been specifically designed for this purpose. All wastes are stored for less than 90 days. The containers that are stored in the facility are 55-gallon drums, but other DOT containers of lesser volume may also be accepted. At no time will the total volume in small containers exceed 2,750 gallons. Most wastes are stored in bulk vertical tanks. The wastes are stored at the facility until treated on-site or shipped off-site for disposal.

Gage Products Company operates a solvent blending, packaging and remanufacturing facility. Products include: custom solvents, paint-related products and cleaners, and calibration and test fuels. In the production of these specialty-blended solvents, Gage Products Company is a leader in sustainable manufacturing and solvent remanufacturing processes. Solvent remanufacturing includes either thin film evaporation, distillation, or both.

Hazardous-waste activities at the Gage facility can be segregated into two categories: (1) hazardous wastes generated on-site from the remanufacturing of "spent" solvent wastes and other manufacturing wastes, and (2) hazardous-waste solvents received for recycling or transfer off-site for disposal. This application for a limited storage facility covers only those wastes received from offsite generators for recycling or transfer off-site.

The offsite waste coming to Gage is characterized according to the procedures in the Waste Analysis Plan, which is located in Section C of this application.

Accepted wastes are either stored in drums within the container storage building or in vertical bulk tanks in the adjacent bulk tank storage area. Accepted wastes may also be off-loaded directly from the tank trailer to the recycle process. The Limited Storage Facility has a maximum capacity of 25,000 gallons. This storage reflects the potential total combined capacities of the container storage area plus the capacity of the bulk storage tanks in the tank farm. The facility has been designed to contain flammable liquids, in accordance with applicable BOCA, NFPA, and NEC for Class I, II, and III liquids.

Appendix D-1 contains engineering drawings for each storage area. The drawings obtained in Appendix D-1 include the Following:

Drawing A-1: Floor Plan
Drawing A-2: Building Elevations
Drawing A-3: Building Detail Sections
Drawing A-4: Roof Plan and Sections
Drawing A-5: Stair Details
Drawing C-1&2: Site Plans Civil
Drawing S-1: Foundation Plan
Drawing S-2: Sections & Details
Drawing S-3: Catwalk Plan & Details
Drawing S-4: Tank Farm Plan
Drawing S-5: Tank Farm Concrete Details
Drawing S-6: Roof Framing Plan Details
Drawing M-1: Tank Farm Piping Plan
Drawing M-2: Tank Farm Piping Details

Appendix D-2 provides the basis of design for each storage area, and Appendix D.3 provides a demonstration for secondary containment for the bulk-tank storage area. In summary, the container storage building and bulk-tank storage portion of the Gage facility are designed as follows:

- The container storage building measures approximately 62.8 feet by 66 feet. There are two main sections of this building: the container storage area and the tank truck loading/unloading area. The container storage area is located along the western side of the building and measures approximately 50 feet 4 inches x 20 feet 7 inches. It has room for six rows of containers, and the floor slopes toward a sump, which measures 2 feet by 6 feet by 3 feet and has a 695-gallon capacity. The container storage area has a maximum capacity of 2,750 gallons, or fifty 55-gallon drums. The storage area is enclosed with panels to allow for natural ventilation. There are four loading/unloading pump stations within the container storage building, located along the south wall. The floor of the loading/unloading area slopes towards the center of the building, where there is a sump measuring 6 feet by 24 feet by 5 feet with a 9,000-gallon capacity.

- The bulk-tank storage area consists of five vertical tanks. Three tanks have volume capacities of 6,000 gallons each, the fourth tank has a 3,250-gallon capacity, and the fifth tank has a 1,000-gallon capacity. All tanks are located within a sheltered secondary containment structure consisting of a sloped concrete floor, concrete walls of sufficient height to contain 300 percent of the largest tank (18,000 gallons), and a structural-steel-framed roof shelter. The tank storage area has sealed concrete floors and walls, and there are overfill protection devices on the storage tanks.

D-2 CONTAINERS

D-2a Description and Condition of Containers [R 299.9614 and 40 CFR 264.171]

The container storage building is on the west end of Parcel C, west of the remanufacturing building. The container storage area of the building is used for storage of D001, D002, D005, D006, D007, D008, D011, F001, F002, F003, and F005 wastes. The container storage area is designed to have a maximum capacity of 2,750 gallons (maximum of fifty 55-gallon drums).

Hazardous wastes are shipped in DOT-approved and labeled containers. These containers are tested and certified by the manufacturer to meet DOT specifications.

In the event repackaging is necessary, based on the inspection criterion of the containers, 85-gallon recovery drums are used. Following this inspection, the leaking or corroded 55-gallon drum is placed inside the recovery drum, and sealed tightly, or the material is recycled on-site or transferred to another DOT approved container.

D-2b Container Management Practices including: Compatibility of Waste with Containers, Inspections, Containment, Requirements for Ignitable and Incompatible Wastes, and Closure [R 299.9614 and 40CFR 264.172-178 and 270.15]

All containerized liquid hazardous wastes scheduled for temporary storage at the Gage Products Company's Limited Storage Facility are received and stored in metal containers meeting the packaging requirements of the Department of Transportation regulations as specified in Volume 49 of the Code of Federal Regulations, Parts 172, 173 and 178.

Containers temporarily stored within the confines of the Gage Products Limited Storage Facility container storage area are stored in accordance with the Specification 4-6 of the National Fire Prevention Association (NFPA) Standard – 30 (see Appendix D.2). In relation to the Class categories specified in Table 4-6 (a) of NFPA 30, those hazardous wastes meeting liquid Class definitions IB, and II are temporarily stored within the Gage Products Company Limited Storage Facility container storage area. Specification 4-6 states that containers storing flammable and combustible liquids may be stored in the quantities and arrangements specified in Table 4-6.1 (a), provided the storage is in accordance with 4-6.2. Section 4-6.2, simply stated, says that such a storage area must have an automatic sprinkler system installed in accordance with NFPA 13.

The Gage Products Company Limited Storage Facility container storage area is protected with a dry-type sprinkler system designed per NFPA Standard 13. Its hydraulic capability has been calculated to provide extra hazard, Group II protection with a density of 0.37 gallons-per-minute over the most remote 2500 square-foot-area and 1000 gallons-per-minute for hose demand.

According to Table 4-6.1(a), a storage area with the above protection allows the storage of a maximum of 5,000 gallons per pile, a maximum of 15,000 gallons for the area and a maximum storage height of 6.5 feet.

The maximum volume of the flammable/combustible liquids to be stored in the Gage Products Company Limited Storage Facility container storage area is 2,750-gallons or approximately fifty (50) 55-gallon drums.

Containers are loaded and unloaded in the Limited Storage Facility by means of a "grabber" high-lo. This device had bracketed arms capable of moving four 55-gallon drums at a time. Aisle space in the container storage area is sufficient to allow for unobstructed movement of the high-lo.

Incoming hazardous wastes destined for temporary storage at the Gage Limited Storage Facility are characterized to ensure that the wastes can be safely stored, handled, mixed, and made acceptable to Gage for their recycling-process waste-management facilities. A detailed description of the compatibility testing procedures and characterization scheme is contained in Section C-Waste Analysis Plan. Rejected waste shipments are handled in accordance with the procedures identified in Appendix B-1. Accepted containers are placed in storage where they will remain sealed until they are recycled or removed for shipment, unless unusual circumstances require that they are opened again. The containers in storage are not opened, handled, or stored in a manner that could cause a leak, spill, or rupture. All containerized waste stored at the Gage facility is handled as if it contains free liquids; therefore, 40 CFR 264.175and 40 CFR 270.15 (b)(2) do not apply.

In the container storage area, the drums are arranged in single rows of pallets. A 24-inch aisle is maintained between each row, allowing for inspection access. A center aisle measuring no less than 12 feet is maintained to allow for the access of emergency equipment, if necessary. As

described in Section D-1, the containers are arranged so that, in the event of a spill or rupture from a drum that is stored at an elevation higher than the secondary containment level, the waste will be contained.

Drums containing D002 wastes are segregated from the other containers by means of a concrete curb. This segregation is to prevent the mixing of any leaked incompatible wastes. There is room for a maximum of 12 drums in this portion of the container storage area.

In accordance with the container inspection requirements of subpart CC of Part 264, all containers are inspected upon receipt and at least weekly thereafter, to ensure that they are in sound structural condition, closed tight and not leaking. All containers are handled with extreme caution to prevent rupture of the containers. While in storage, containers are opened only under unusual circumstances; thereby preventing spills, leaks, or emissions. These containers are equipped with a closure device that is secured in a closed position, and only opened when necessary to sample or remove the material from the container. Afterwards, the device is closed, within 15 minutes of completion, or if the operator leaves the vicinity of the container, whichever occurs first. The usual circumstances when containers would be opened include the rare instance when an additional sample of the waste must be obtained for analytical verification.

To minimize the potential of an accidental spill or discharge during the movement of containerized waste on site, only pallets in good condition and only main aisle-ways will be used. All transportation routes on the Gage property are paved and the potential for spillage onto unpaved areas is considered remote.

Emergency-response equipment, including absorbent material, absorbent booms, Visqueen, and spark resistant hand tools are available for each container storage area. In the event that a spill occurs outside in an area without a spill collection sump, immediate actions will be taken to contain and control the spill as per operational plans described in Section G, "Contingency Plan".

Disposal or recycle of the hazardous waste at a licensed hazardous waste facility is arranged soon after storage begins. The first option for the material is to recycle it at the Gage Facility. When that is not possible, a treatment or disposal facility is selected. When an appropriate facility to treat, recycle, recover, or dispose of the containerized hazardous wastes has approved the wastes, the containers are removed from the storage area by trained Gage personnel, transferred to licensed vehicles, and manifested to the next licensed waste facility according to state and federal regulations.

The container storage area pad is constructed of reinforced concrete and is free of cracks or gaps. It is sufficiently impervious to contain any leaks and spills until the material is detected and removed. A protective coating has been applied to the concrete floor and curbs. This coating provides an impervious barrier that is an abrasion-resistant sealant appropriate for all materials and wastes stored in this area. All drums stored in this area are stored on pallets, thereby preventing the drums from contacting the concrete or any accumulated liquids. The tank truck loading/unloading area of the container storage building is comprised of three separate "bays". The floor area slopes toward the center of the area, to secondary containment, a blind sump. Appendix D-1 contains engineering drawings of the limited storage facility.

The loading/unloading bay sump measures 6 feet by 24 feet by 5 feet. The lowest point of the bay area (the floor level grating) is 9 inches below the outer edges of the bay. The containment volume of the bay is 9,000 gallons. The 9,000-gallon capacity of the bay well exceeds the requirement that the secondary containment be able to contain 10 percent of the volume of waste stored in the area. Appendix D-3 contains the calculations of the volume of the secondary containment system.

Run-on is prevented from entering the container storage area by the roof of the building (which extends over the drum storage area) and by the concrete sloping away from the container storage area. The concrete area outside of the storage building provides for drainage away from the drum storage area and towards the storm sewer.

The containment area is inspected daily and, in the unlikely event that any accumulated liquids are present, these liquids will be removed within 24 hours. If the source of the liquids is known to contain hazardous waste constituents, the liquids will be drummed and stored in the area until arrangements have been made for disposal at a licensed hazardous waste disposal facility. If the source of the liquid is not known, or if it is suspected that the liquid does not contain hazardous waste constituents, the liquid will be analyzed for hazardous constituents as described in Table C.3, Section C, of this application. If no hazardous constituents are detected in the analysis, the water is pumped to the combined storm/sanitary sewer which go to the City of Detroit's treatment plant prior to release to the Detroit River. If the accumulated liquid is found to contain hazardous constituents, the liquid is drummed and stored in the area until arrangements have been made for disposal at a licensed hazardous waste disposal facility.

If the facility is undergoing closure, the Closure Care Plan described in Section I will be followed to ensure that all hazardous waste and hazardous waste residues will be removed from the container storage area and the area's containment system. All residues will be decontaminated of removed in accordance with the plan.

D-3 TANKS

D-3a Design & Installation of Bulk Tank Storage Area [R 299.9615 and 40CFR 264/192]

The bulk tank area used for the temporary storage of hazardous wastes at Gage measures approximately 48 feet by 15.5 feet and has a maximum storage capacity of 22,250 gallons, with secondary containment of 300 percent (18,000 gallons) of the largest tank within the tank storage area. Table D.1 contains a summary of the regulated tanks. The bulk tank waste storage area consists of five vertical tanks. Three tanks have volume capacity of 6,000 gallons each, the fourth tank has a 3,250-gallon capacity, and the fifth tank has a 1,000-gallon capacity. All tanks are located within a diked area with sealed cement flooring and pitched roof to prevent precipitation from entering the area. Drawings S-4 through S-6, M-1 & M-2, in Appendix D-1 show the design details and tank layout for the bulk storage area. Appendix D-2 provides the basis of design for the bulk-tank storage area.

Appendix D-5 contains a written assessment, reviewed and certified by an independent, qualified registered professional engineer, attesting that the tank system has sufficient structural integrity and is acceptable for the storing of hazardous waste.

A certification sealed by licensed professional engineer verifying that construction of the LSF proceeded according to plans, was submitted upon completion of the facility in June of 1995.

The tanks are in compliance with all installation, inspection, certification, and testing requirements as specified in 40 CFR 264.192(b), (d), and (e).

D-3b Containment and Detection of Releases [R 299.9615 and 40 CFR 264.193]

The bulk tank storage pad is constructed of concrete and is free of cracks or gaps. It is sufficiently impervious to contain any spills until the material is detected and removed. A micro silica fill concrete floor and retaining wall is used. (See Appendix D-2). This impervious barrier provides a barrier appropriate for all materials and wastes to be stored in this area. The secondary containment volume of the bulk tank area is 18,000 gallons. This represents 300 percent of the largest tank's volume within the bulk tank storage area.

Appendix D-3 contains the volume calculations of the secondary containment system. The containment areas are inspected daily to detect any leaks or spills. In the unlikely event that any accumulated liquids are present, these liquids will be removed within 24 hours. If the source of the liquids in known to contain hazardous waste constituents, the liquids will be drummed and stored in the area until arrangements have been made for disposal a licensed hazardous waste disposal facility. If the source of the liquid is not known, or if it is suspected that the liquid does not contain hazardous waste constituents, the liquid will be analyzed for hazardous waste constituents, as described in Table C.4, Section C, of this application. If no hazardous constituents are detected in the analysis, the waste is pumped to the City of Detroit's treatment plant for treatment prior to release to the Detroit River. If the accumulated liquid is found to contain hazardous constituents, the liquid is drummed and stored in the area until arrangements have been made for disposal at a licensed hazardous waste disposal facility.

D-3c Bulk-Tank Storage Facility Operating Procedures [R 299.9515 and 40 CFR 264.194]

Incoming Hazardous wastes destined for temporary storage at the Gage Limited Storage Facility are characterized to ensure that the wastes can be safely stored, handled, mixed, and made acceptable to Gage for their recycling process facilities. D002 wastes are not accepted for storage in the bulk tanks (D002 wastes are accepted for storage in containers of 55-gallon size or smaller); therefore, there is no potential for mixing incompatible wastes. A detailed description of the compatibility testing procedures and characterization scheme is contained in Section C, "Waste Characteristics", of this application.

Trucks entering the tank truck loading/unloading area are properly grounded prior to loading/unloading. If the waste in the trucks is to be pumped directly into the recycle process, the truck is connected to unloading Pump Nos. 93 or 94. If the waste is to be pumped into one of the hazardous waste storage tanks, the truck is connected to unloading Pump Nos. 91 or 92. The majority of the wastes received at Gage are immediately pumped directly into the tanks before going to the recycle process. In the event that a spill occurs in the unloading area, the material will accumulate in the blind sump area that is located in the center of the loading/unloading area.

Engineered controls are utilized to prevent spills and overflows from the bulk storage tanks. Each tank is equipped with a high-level alarm. At 90% of tank capacity, an audible alarm is activated for operators to take action to stop the flow of material into the tank. However, if the level continues to increase, the pump and tank inlet valve actuator are automatically closed, stopping the flow of material into the tank before it reaches 95%.

In addition, each bulk waste tank has a separate dedicated liquid level transmitter. The transmitter provides continuous indication of actual tank liquid levels. For operating purposes, predetermined values are assigned to provide high liquid level alarm signals to the operator. Upon seeing the high level achieved, the operator would immediately cease filling the tank.

D-3d Inspection [R 299.9615 (1) and 40CFR 264.195(a)]

Gage Products conducts regular inspections of the Limited Storage Facility, including its associated tank farm and all ancillary equipment. The facility's structures and equipment, including monitoring equipment, safety and emergency equipment, security devices, and operating and structural equipment, are inspected routinely by plant personnel so as to identify malfunctions, deterioration, operator errors, and any other situation which may lead to the release of hazardous materials or be a threat to human health or the environment. Several forms have been developed to facilitate facility inspections. The forms show the areas to be inspected, the frequency of each type of inspection, and the type of issues for which to look. The inspector, when identifying an issue, is required to specify the type of issue identified and any actions taken to remedy the issue. Completed inspection report forms and the frequency of inspections are kept at the facility. The types of issues for which personnel look during the inspection in each area of the facility are outlined in Tables F.1, F.2, and F.3. Copies of current inspection forms can be found in Appendix F.

D-3e Information for Air Emission Controls [R 299.9634 and 40 CFR 270.27 "Subpart CC"]

Part 270 Subpart B requires specific information regarding the facility's program for compliance with Part 264 Subpart CC, "Air Emissions Standards". Gage's tank storage operations are governed by Section 264.1084, "Standards for Tanks".

Eight tanks at the Gage facility are subject to Subpart CC requirements. Three tanks, Numbers 66, 68, and 77, store waste to be shipped offsite for disposal. Five tanks, associated with the Limited Storage Facility, Numbers 72, 73, 74, 75, and 76, store incoming waste.

Gage has determined that Level 1 controls are applicable to tanks and containers at the facility. The compliance program for containers consists of visual inspections of DOT approved containers, and container management procedures and documentation. The compliance program for tanks includes visual inspection of tank covers, as well as monitoring all tank covers and other openings using an appropriate monitor per EPA Test Method 21, annually. All inspection and testing results are documented and records are kept at the facility. Procedures specify that repair of any observed tank defect will commence within 5 days of discovery, and will be complete no later than 15 days after initial discovery.

D-3f Response to Leaks or Spills [R 299.9615(1) and 40 CFR 264.196]

The containment is inspected daily and, in the unlikely event that any accumulated liquidsare present, these liquids are analyzed for hazardous waste constituents. If no hazardous constituents are detected in the analysis, the liquid is pumped to the City of Detroit's combined storm water/sanitary sewer line where it would flow to the City of Detroit's wastewater treatment plant for treatment prior to discharge into the Detroit River. If the accumulated liquid is found to contain hazardous constituents, the liquid is drummed and stored in the area until arrangements have been made for disposal at a licensed hazardous waste disposal facility. Emergency response equipment is located in the immediate area to facilitate immediate cleanup and response activities in the unlikely event of a material release.

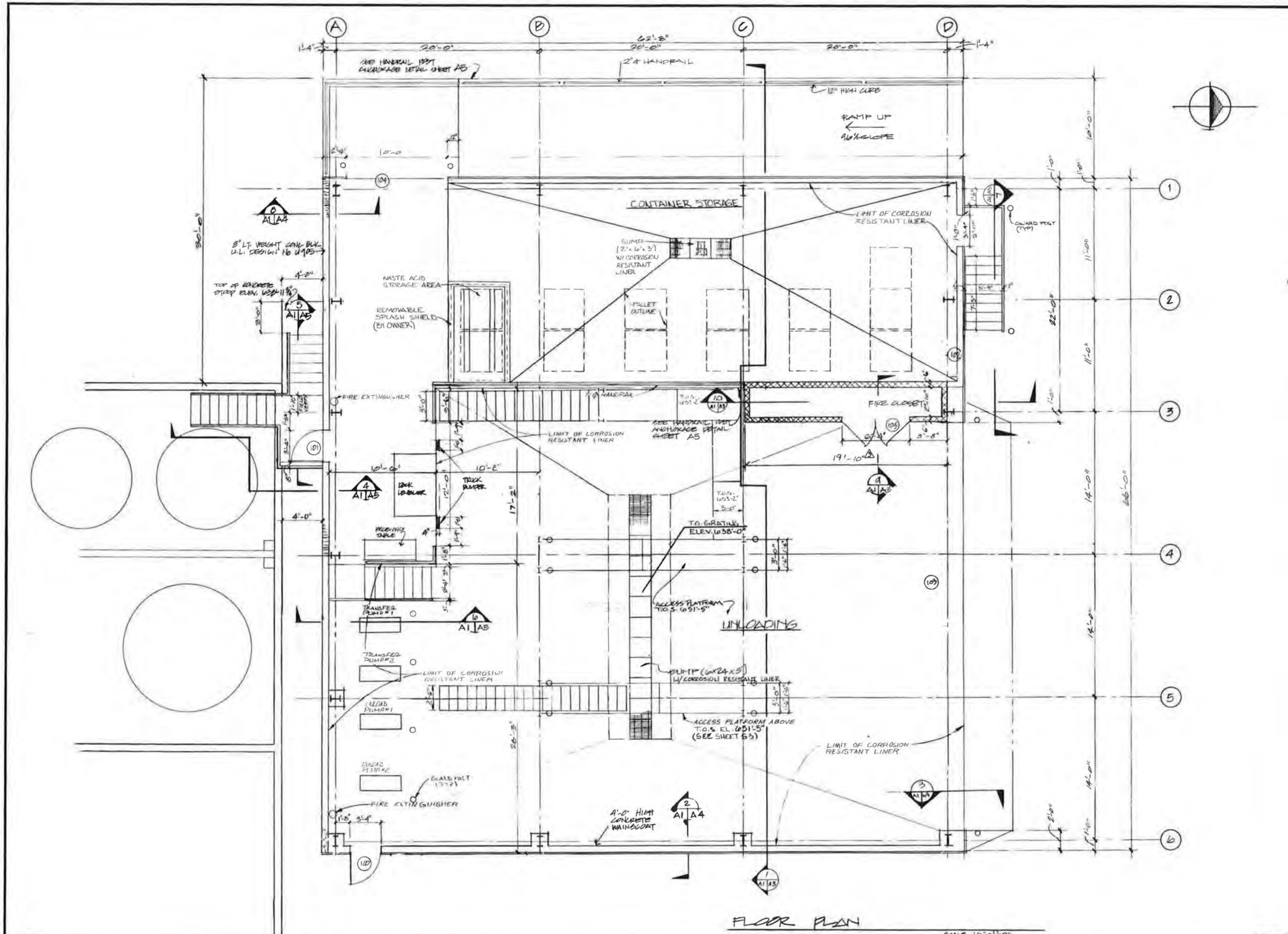
TABLE D.1

SUMMARY DESCRIPTION OF LSF REGULATED TANKS

Tank Number	Volume (Gallons)	Dimensions	Construction Materials	Usage	Date Installed	Fill, Return & Vapor Recovery	Safety Cutoff	Shell Thickness	Pressure Control
SWT72	6,000	108" OD X 12 6" H	Stainless steel	Temporary storage (hazardous waste)	1991	Carbon steel	High level alarm	3/16" (shell)	Pressure relief valve & vacuum breaker
SWT73	6,000	108" OD X 12' 6" H	"	"	1991	"	"	"	"
SWT 74	6,000	108' OD x 12' 6' H	"	"	1991	"	"	"	"
SWT 75	3,250	90" OD X 10' H	"	"	1991	"	"	"	"
SWT 76	1,000	60" OD X 78" H	"	"	1991	"	"	"	"

D = Diameter, H = Height

APPENDIX D



WW Facilities Group
Engineering and Construction Management
5555 Glenwood Hills Parkway, SE • Grand Rapids, MI 49508 • (616) 942-9600

NO	REVISIONS	BY	DATE	NO	REVISIONS	BY	DATE
	ASBUILTS 5/95						
	BIDS 11/27/93						

REVISED IN ACCORDANCE WITH CONSTRUCTION RECORDS

HAZARDOUS WASTE UNLOADING & LIMITED STORAGE FACILITY

FLOOR PLAN

GAGE PRODUCTS, CO. FERNDALE, MICHIGAN

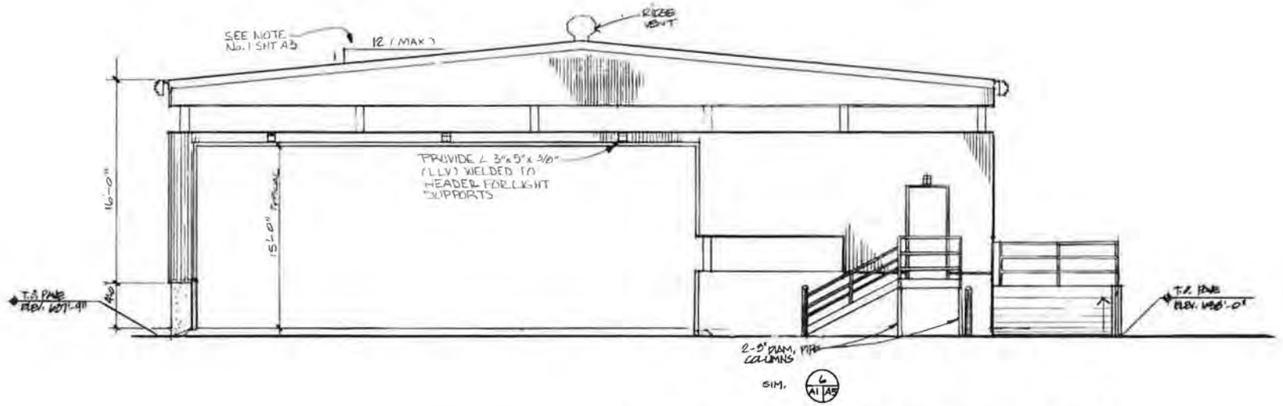
APPROVED BY | DATE
DRAWN BY JMN | DATE 8-4-93
CHECKED BY | DATE

SCALE As Shown HORIZONTAL
VERTICAL

PROJECT 83651

A1

SHEET NO.



NORTH ELEVATION

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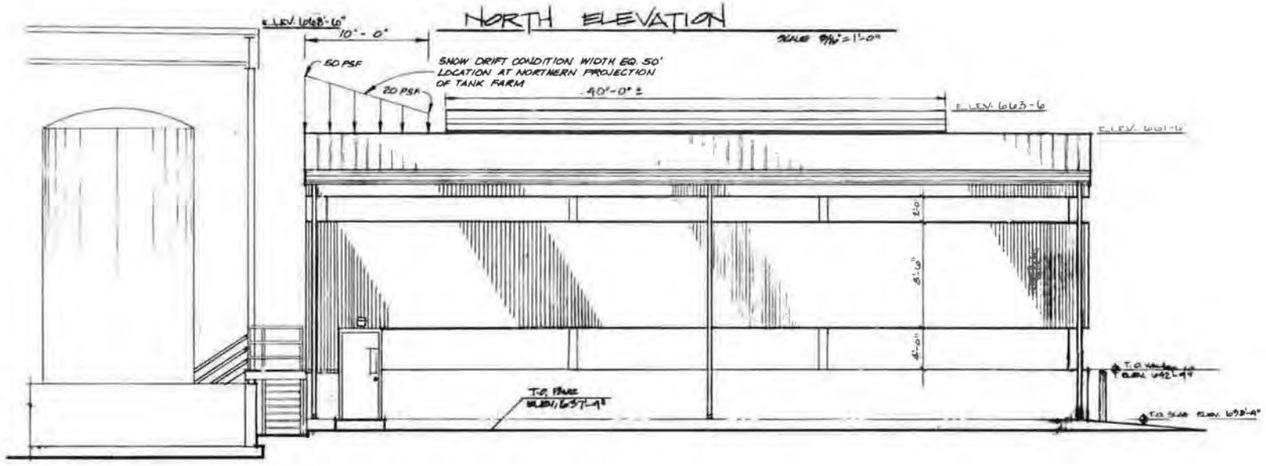

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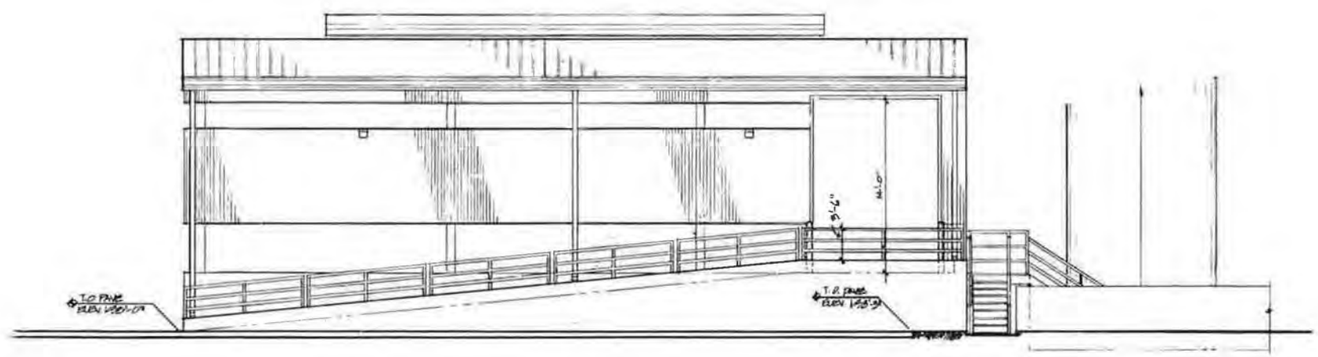

WEST ELEVATION

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NO	DATE	BY	REVISIONS	DATE	BY
1	11/29/93	BLM	REVISED IN ACCORDANCE WITH CONSTRUCTION RECORDS		

HAZARDOUS WASTE UNLOADING & LIMITED STORAGE FACILITY

BUILDING ELEVATIONS

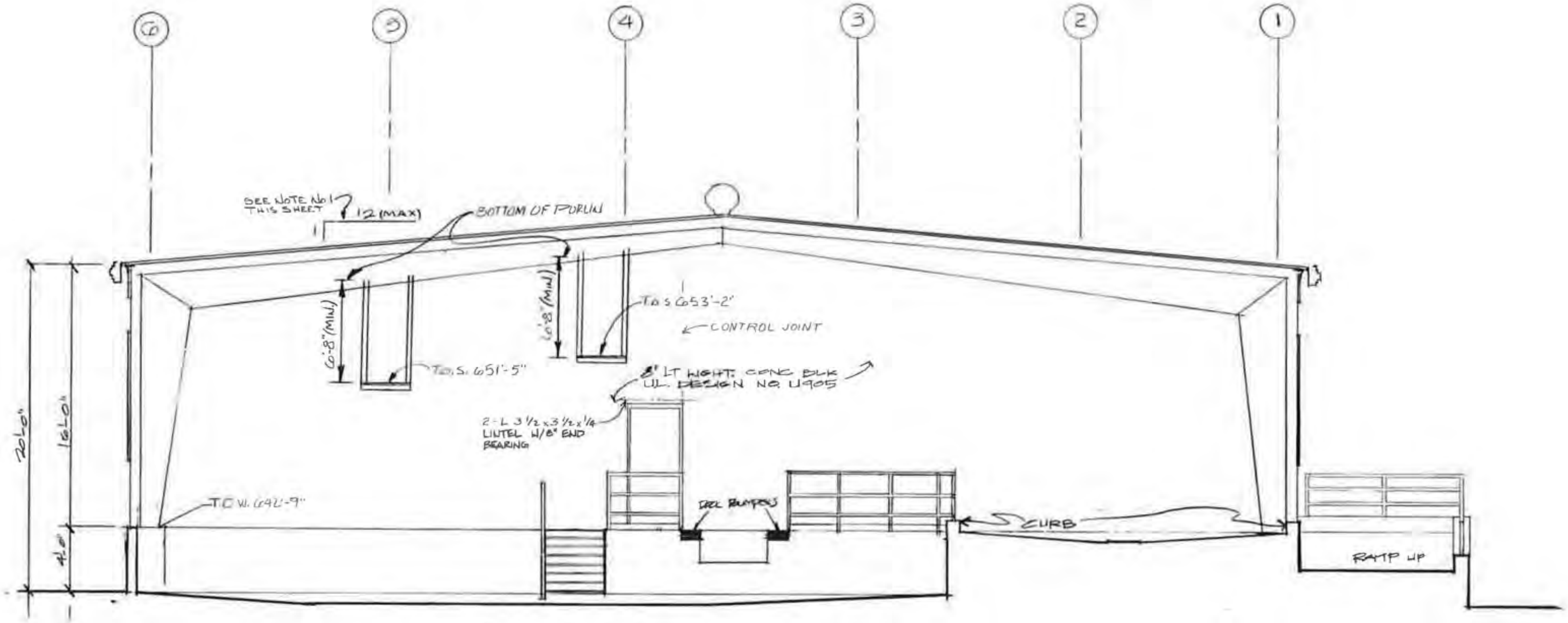
GAGE PRODUCTS, CO. FERNDALE, MICHIGAN

DESIGNED BY	DATE
DRAWN BY GEEK	DATE 8-93
CHECKED BY	DATE
SCALE AS SHOWN HORIZONTAL AS SHOWN VERTICAL	
PROJECT 6208B	

A2

SHEETING

DCT070390



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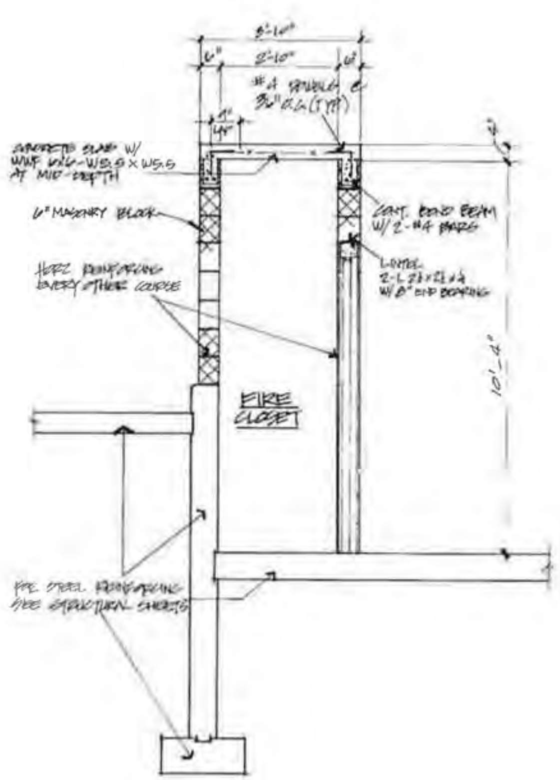

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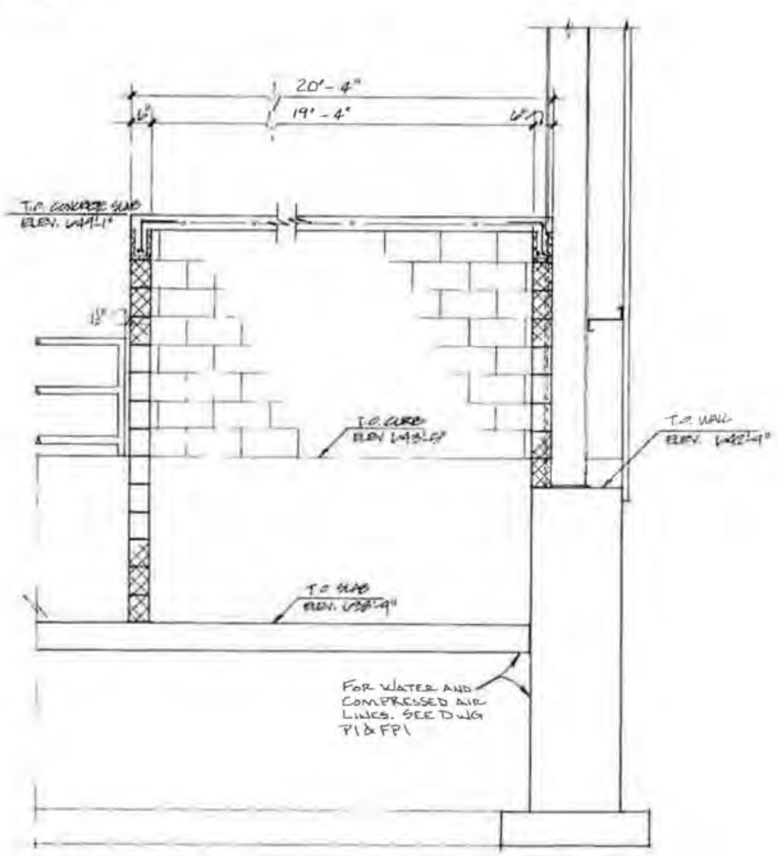
A1/A3



SECTION 10
A1/A3

NOTES

1. THE ROOF SLOPE MAY BE STEEPER THAN 1 ON 12 DUE TO STRUCTURAL BUILDING FRAME MANUFACTURE REQUIRMENTS FOR CLEARANCE ABOVE CATWALKS AND PLATFORMS.

CJF 11c494

WW Facilities Group
Engineering and Construction Management

NO	REVISIONS	BY	DATE
	ASBUILTS 5/95		
	BIDS 11/29/93		

REVISED IN ACCORDANCE WITH CONSTRUCTION RECORDS

HAZARDOUS WASTE UNLOADING & LIMITED STORAGE FACILITY

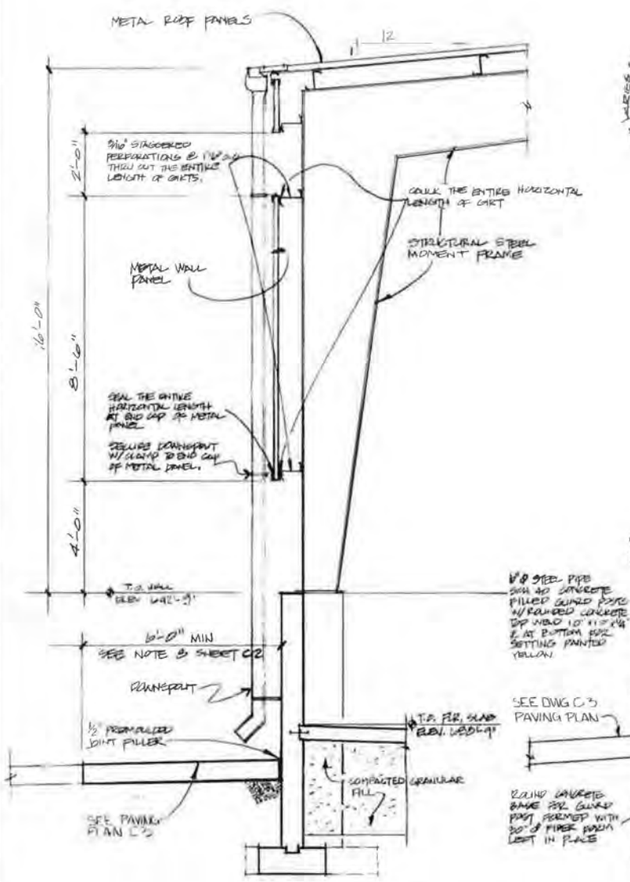
BUILDING SECTIONS

GAGE PRODUCTS, CO. FERNDALE, MICHIGAN

DRAWN BY: DMN DATE: 8-4-89

PAGE: 63038

A3



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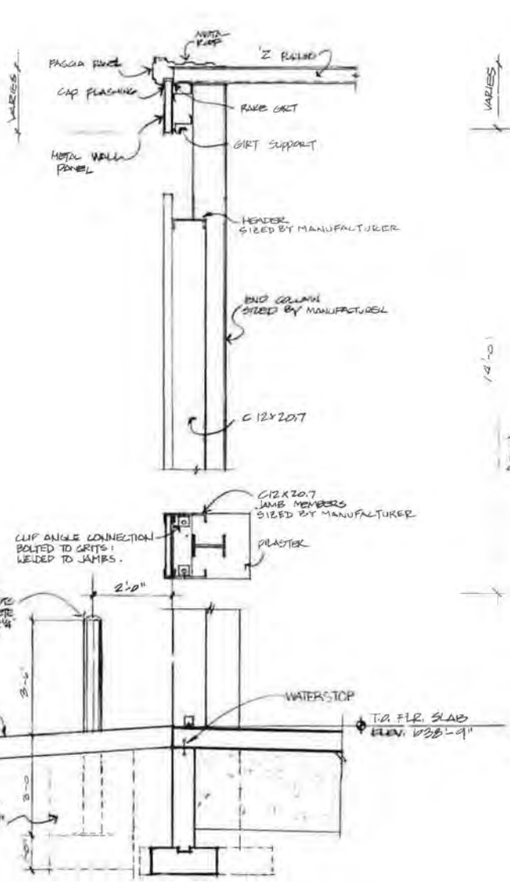

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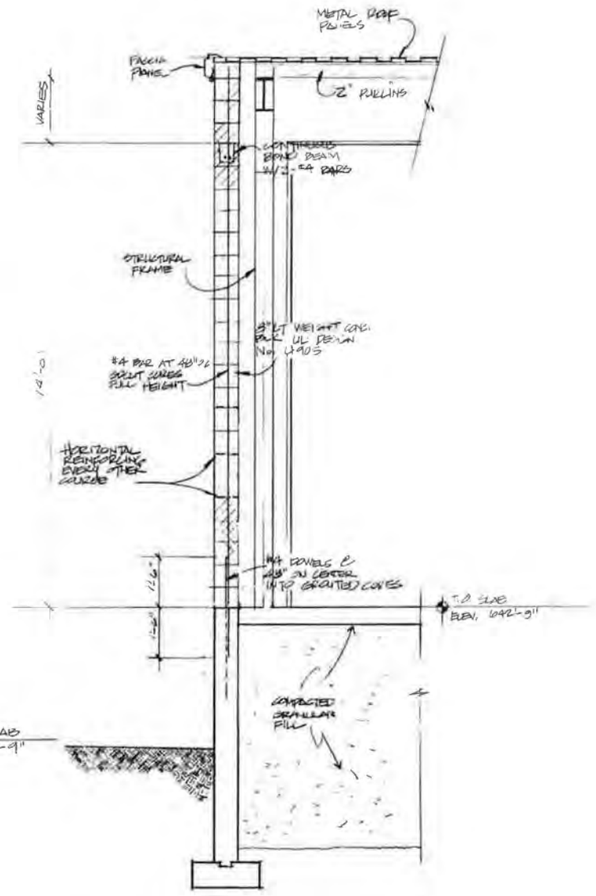

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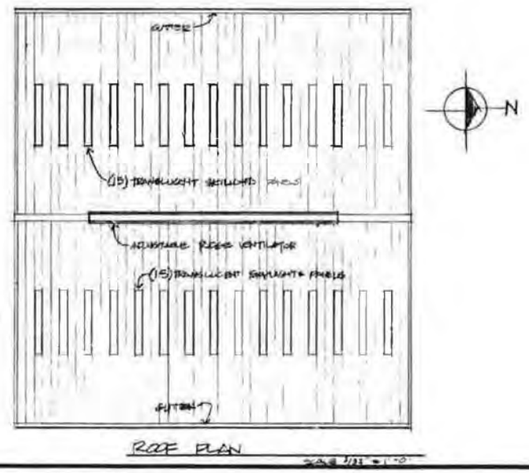


ROOF PLAN
SCALE 1/32" = 1'-0"

DOOR SCHEDULE

No.	MATER.	WIDTH	HEIGHT	THICK.	TYPE	FRAME	SILL	HARDW.	RATING	REMARKS
100	STEEL	3'-0"	7'-0"	—	H.M.	STEEL	N.A.	1	NONE	
101	STEEL	3'-0"	7'-0"	—	H.M.	STEEL	N.A.	1	2 HOUR	
102	N.A.	3'-0"	7'-0"	—	N.A.	—	N.A.	—	—	DOOR OPENING ONLY.
103	N.A.	40'-0"	15'-0"	—	N.A.	—	N.A.	—	—	DOOR OPENING ONLY.
104	N.A.	10'-0"	14'-0"	—	N.A.	—	N.A.	—	—	DOOR OPENING ONLY.
105	STEEL	PR 6'-0"	7'-0"	—	H.M.	STEEL	N.A.	2	NONE	

WW Facilities Group

BY	DATE	REVISIONS
		AS BUILT
	5/95	ADDENDUM
	11/29/93	BID

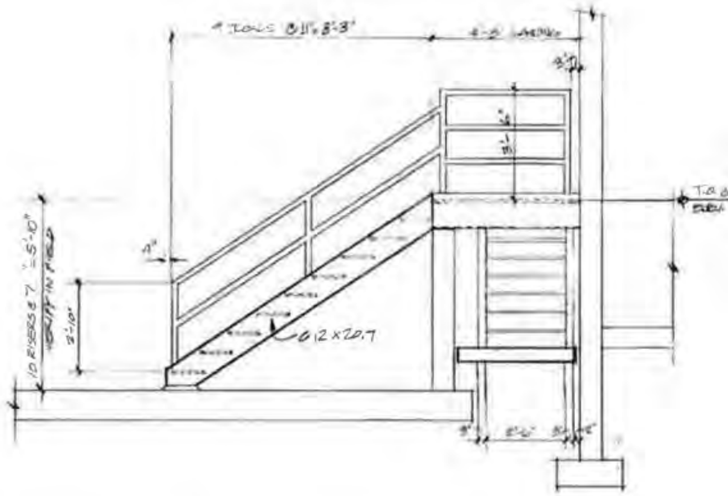
HAZARDOUS WASTE UNLOADING & LIMITED STORAGE FACILITY

ROOF PLAN & SECTIONS

GAGE PRODUCTS, CO. FERNDALE, MICHIGAN

DRAWN BY: WDW	DATE: 10/89
CHECKED BY: DDR	DATE: 12/89
SUPERVISED BY: WDW	DATE: 10/89
AS BUILT BY: AS BUILT	
PROJECT NO. 8651	

A4



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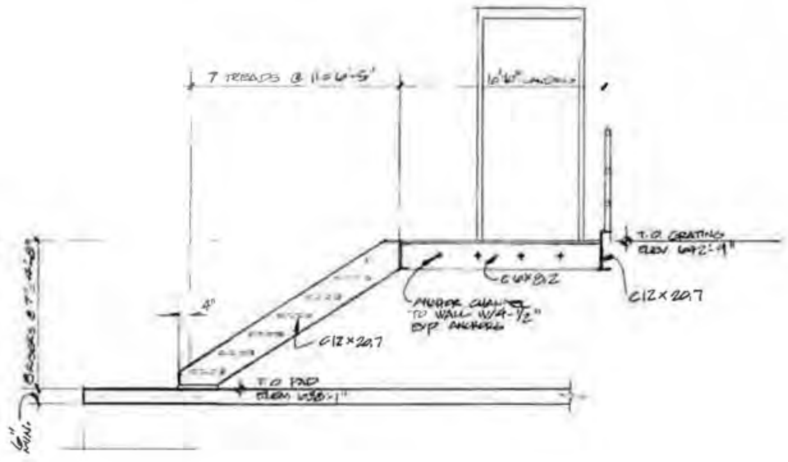

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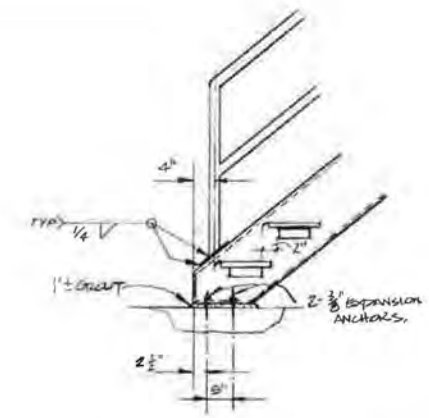

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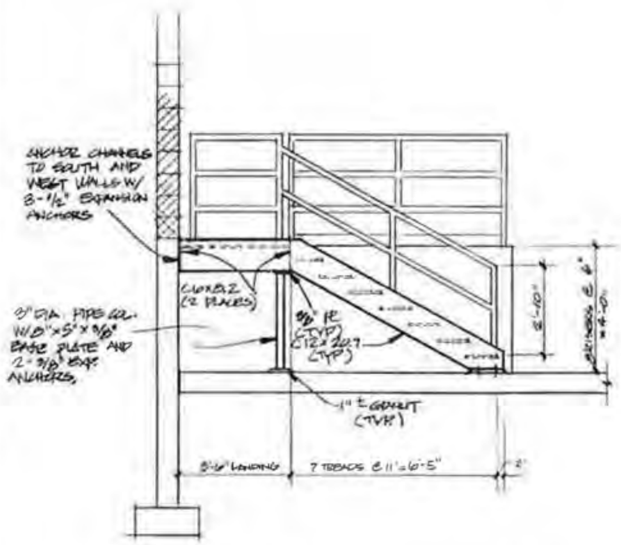
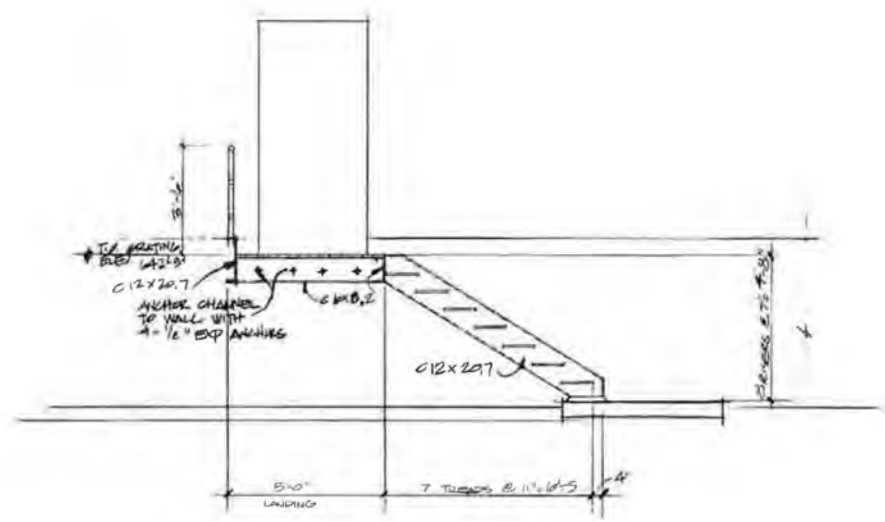
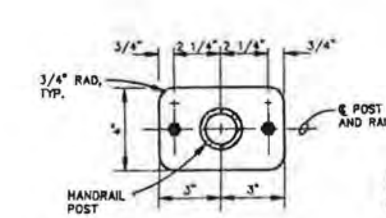


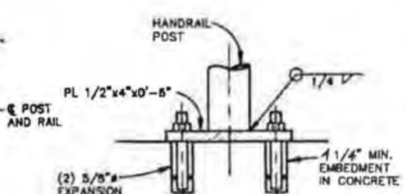
SECTION (6 / A5)
SCALE 3/8"=1'-0"



SECTION (7 / A5)
SCALE 3/8"=1'-0"



PLAN



ELEVATION

HANDRAIL POST ANCHORAGE TO CONCRETE
SCALE: 3" = 1'-0"

WW Facilities Group
Engineering and Construction Management

NO	REVISIONS	BY	DATE
	BIDS 11/29/93		

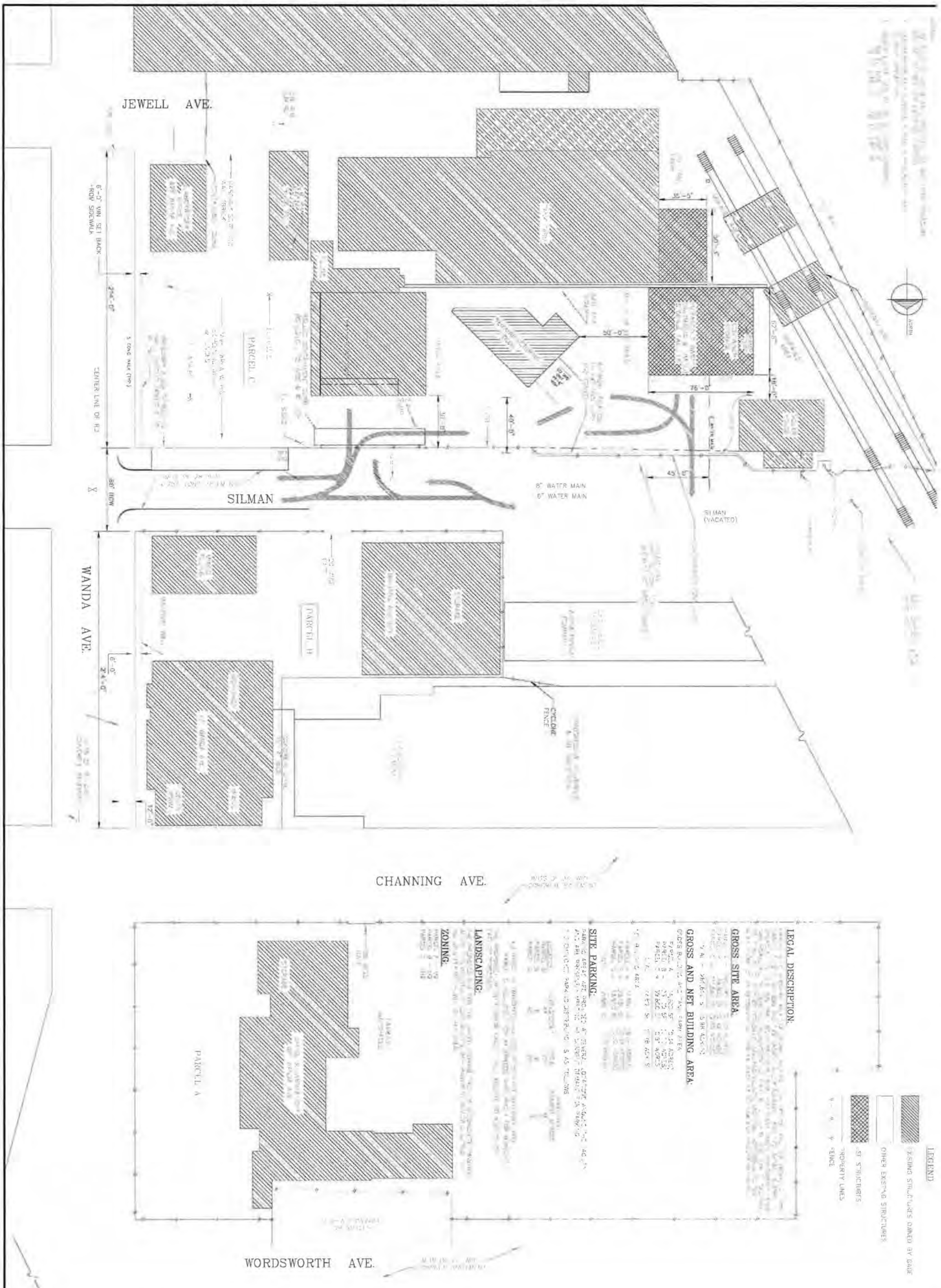
HAZARDOUS WASTE UNLOADING & LIMITED STORAGE FACILITY

STAIR DETAILS

GAGE PRODUCTS, CO. FERNDALE, MICHIGAN

DESIGNED BY D.N.	DATE 10/89
DRAWN G.B.	DATE 10/89
CHECKED W.D.W.	DATE 10/89
SCALE AS SHOWN HORIZONTAL	
AS SHOWN VERTICAL	
63088	

A5



HAZARDOUS WASTE UNLOADING & LIMITED STORAGE FACILITY

LOCATION PLAN

GAGE PRODUCTS, CO. FERNDALE, MICHIGAN

NO	REVISIONS	BY	DATE
	ASPHALT 5/95		
	PLAN COMMISSION COMMENTS 1/21/14		
	SITE 11/26/13		

REVISED IN ACCORDANCE WITH CONSTRUCTION ACCESS

W W Engineering & Science
A Summit Company
Suite 210 · 4449 Stanton Blvd · Plymouth, MI 48170 · (313) 416-3878

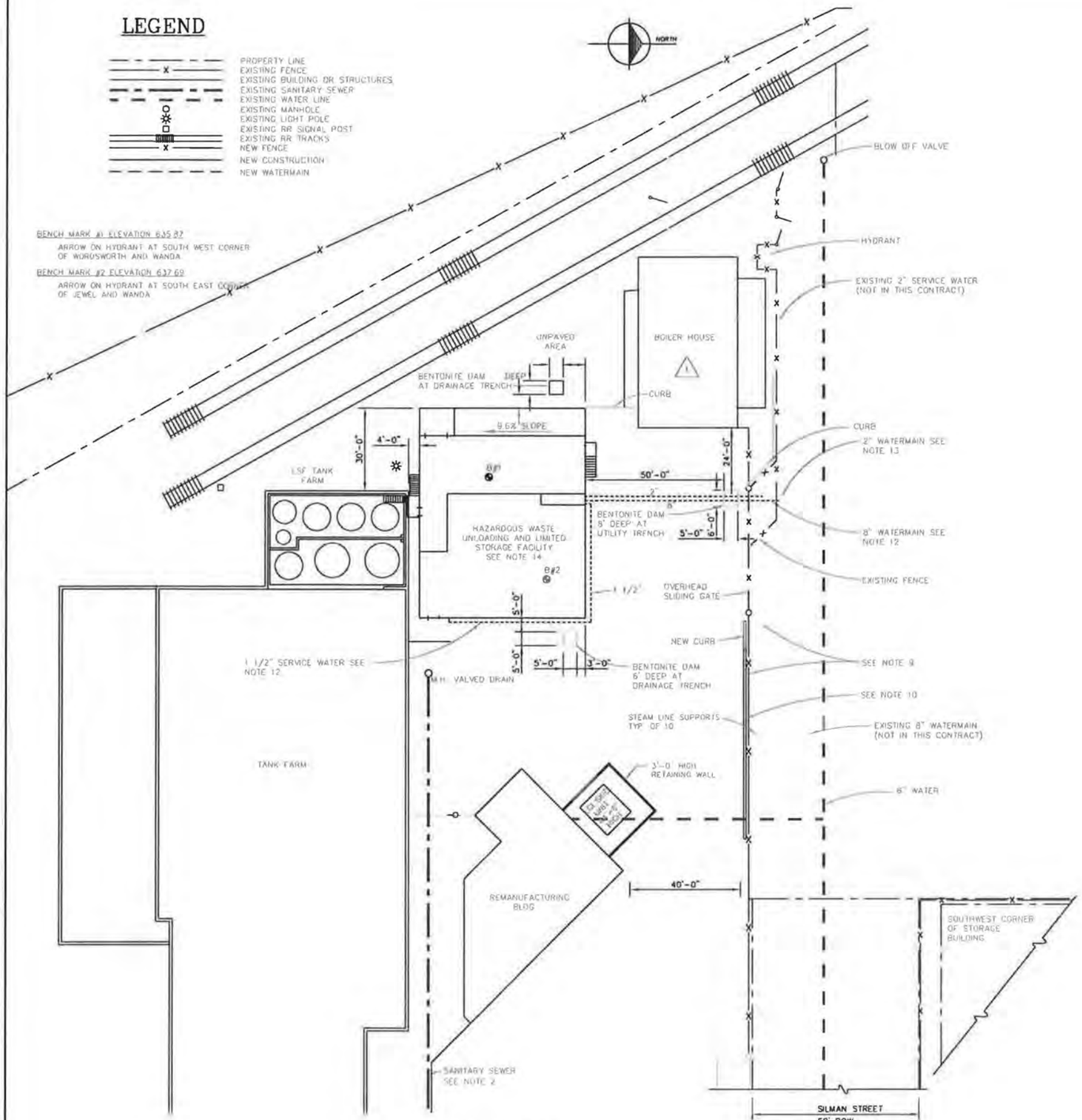
C1

LEGEND

PROPERTY LINE
EXISTING FENCE
EXISTING BUILDING OR STRUCTURES
EXISTING SANITARY SEWER
EXISTING WATER LINE
EXISTING MANHOLE
EXISTING LIGHT POLE
EXISTING RR SIGNAL POST
EXISTING RR TRACKS
NEW FENCE
NEW CONSTRUCTION
NEW WATERMAIN

BENCH MARK #1 ELEVATION 635.87
ARROW ON HYDRANT AT SOUTH WEST CORNER OF WORDSWORTH AND WANDA

BENCH MARK #2 ELEVATION 637.69
ARROW ON HYDRANT AT SOUTH EAST CORNER OF JEWEL AND WANDA

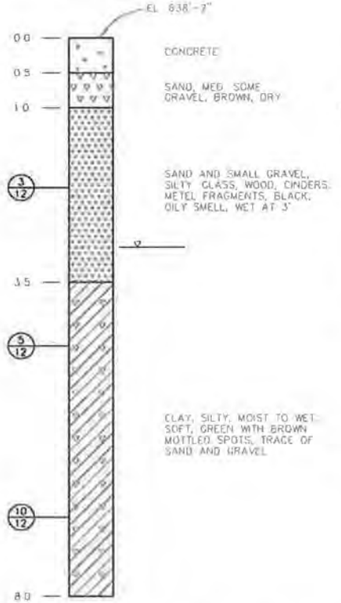


SITE PLAN

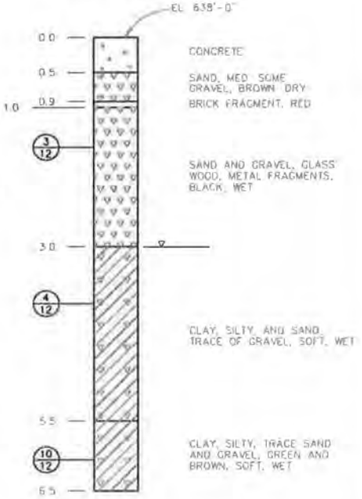
NOTES

1. ELEVATIONS AND DIMENSIONS OF EXISTING STRUCTURES AND PLANT UTILITIES HAVE BEEN BASED ON THE BEST INFORMATION AVAILABLE AT THE TIME OF DESIGN AND MUST BE VERIFIED IN THE FIELD BY THE CONTRACTOR. THE CONTRACTOR WILL BE RESPONSIBLE TO VERIFY ALL DIMENSIONS AND ELEVATIONS BEFORE PROCEEDING WITH ANY WORK. IMMEDIATELY NOTIFY THE OWNER OF ANY CONFLICTS WHICH WILL EFFECT THE PROGRESS OF THE WORK.
2. THE EXACT LOCATION OF THE SANITARY SEWER IS NOT GUARANTEED. CONTRACTOR SHALL DETERMINE THE ACTUAL LOCATION PRIOR TO STARTING WORK AND NOTIFY OWNER IF THE ACTUAL LOCATION WILL INTERFERE WITH THE PROSECUTION OF THE WORK. WHERE THE UTILITIES SAFELY PASS UNDER THE FOOTING, ENCASE IN CONCRETE. THE DEPTH OF THE SANITARY SEWER IS ESTIMATED TO BE 9.5' FEET.
3. FOUNDATIONS SHALL BE PLACED ON UNDISTURBED NATURAL SOIL WITH AN ALLOWABLE SOIL BEARING PRESSURE OF 2000 PSF. IF UNACCEPTABLE SOIL CONDITIONS ARE ENCOUNTERED, THE ENGINEER SHALL BE CONSULTED FOR DIRECTION WITH REGARD TO FOUNDATION CONSTRUCTION.
4. THE FLOOR SLAB SUB-BASE SHALL BE PLACED ON NATURAL SUBGRADE MATERIAL AFTER THE CONCRETE HAS BEEN STRIPPED, AND THE SUBGRADE PROOFROLLED. IF UNDERCUTTING IS REQUIRED TO REMOVE UNSUITABLE SUBGRADE MATERIAL OR IF THE NATURAL SUBGRADE IS BELOW THE DESIGN LEVEL, COMPACTED GRANULAR FILL SHALL BE USED TO ACHIEVE THE DESIRED SUBGRADE ELEVATION. MATERIAL MEETING THE GRADATIONAL REQUIREMENTS FOR MDOT CLASS II MATERIAL SHALL BE USED FOR FILL, AND SHALL BE COMPACTED TO 95% OF THE MAXIMUM DRY DENSITY AS DETERMINED IN ACCORDANCE WITH ASTM STANDARD D-1557 (MODIFIED PROCTOR).
5. TESTING OF FOUNDATION SUBGRADE, FOUNDATION AND FLOOR SLAB CONCRETE, GRANULAR BACKFILL, AND OTHER TESTING REQUIRED WILL BE BY A CONSULTANT SELECTED BY, AND AS DIRECTED BY, THE OWNER.
6. OWNER'S REPRESENTATIVE TO BE ON-SITE DURING PERFORMANCE OF ALL WORK. CONTRACTOR SHALL NOTIFY OWNER'S REPRESENTATIVE AT LEAST 24 HOURS BEFORE THE PERFORMANCE OF ANY WORK.
7. REMOVE EXISTING CATCH BASIN, GRAVITY DRAINAGE LINE AND 4 Ww 8'Lx 5'D CONCRETE VAULT. CATCH BASIN HAS BEEN FILLED WITH CONCRETE. INSTALL NEW TERMINAL MANHOLE 20'-0" EAST OF BUILDING WALL.
8. REMOVE CONCRETE PAVEMENT A MINIMUM OF 6 FEET FROM THE BUILDING FACE OR AS REQUIRED TO MATCH EXISTING CONCRETE GRADES. VERTICAL SAW CUT ALL PAVEMENT AT RIGHT ANGLES OR PARALLEL TO BUILDING FACES. COMPACTION OF SUBBASE SHALL MEET REQUIREMENTS AS STIPULATED IN NOTE 4 ABOVE.
9. REMOVE EXISTING FENCE AND GATE AS REQUIRED. INSTALL NEW FENCE AS SHOWN.
10. REMOVE EXISTING CONCRETE CURB FLUSH WITH EXISTING CONCRETE PAVEMENT. INSTALL NEW CURBS AND PAVEMENT IN UNPAVED AREAS.
11. CONTRACTOR SHALL COORDINATE WITH THE OWNER A SCHEDULE FOR REMOVAL AND ERECTION OF NEW FENCE TO PROMOTE CONTINUOUS SECURITY FOR THE FACILITY.
12. REFER TO GAGE PRODUCTS COMPANY, MICHIGAN – WATERMAIN IMPROVEMENTS SILMAN ROAD CONTRACT DRAWINGS FOR DETAILS REGARDING THE 8" WATERMAIN AND 2" SERVICE LEADS. COPIES AVAILABLE UPON REQUEST OF ENGINEER.
13. COORDINATE PAVEMENT REMOVAL AND REPLACEMENT FOR ELECTRICAL CONDUITS WITH ELECTRICAL CONTRACTOR. REFERENCE SHEET NUMBER E1.
14. SOILS AND GROUND WATER IN VICINITY OF THE PROPOSED LIMITED HAZARDOUS STORAGE WASTE FACILITY MAY POSSESS UNKNOWN QUANTITIES OF ORGANIC COMPOUNDS. SOIL REMOVED FROM THIS AREA SHOULD BE SEGREGATED AND CHARACTERIZED FOR PROPER DISPOSAL, AND NOT USED AS BACKFILL MATERIAL. SUBSURFACE WATER REMOVED FROM AREA SHOULD BE CONTAINED, CHARACTERIZED, AND DISPOSED OF PROPERLY. SUBSURFACE CONTRACTORS ARE RESPONSIBLE FOR PROVIDING APPROPRIATE HEALTH AND SAFETY MEASURES TO MINIMIZE WORKER EXPOSURE TO AIR, SOIL, AND GROUND WATER POTENTIALLY IMPACTED BY ORGANIC COMPOUNDS IN THIS AREA.

BORING #1



BORING #2



NOTES:
1. THE SOIL BORING LOGS REPRESENT POINT INFORMATION. PRESENTATION OF THIS INFORMATION IN NO WAY IMPLIES THAT SUBSURFACE CONDITIONS ARE THE SAME AT ALL LOCATIONS OTHER THAN THE EXACT LOCATION OF THE SOIL BORING.

W.W. Engineering & Science
A Sunnitonkpany
Suite 210 44498 Sheldon Road Plymouth, MI 48170 (313) 416-3678

NO	DATE	BY	REVISIONS	DATE	BY
			ADDED EXISTING BUILDING		
			ADDED TANK FARM		

REVISED IN ACCORDANCE WITH CONSTRUCTION RECORDS

HAZARDOUS WASTE UNLOADING & LIMITED STORAGE FACILITY

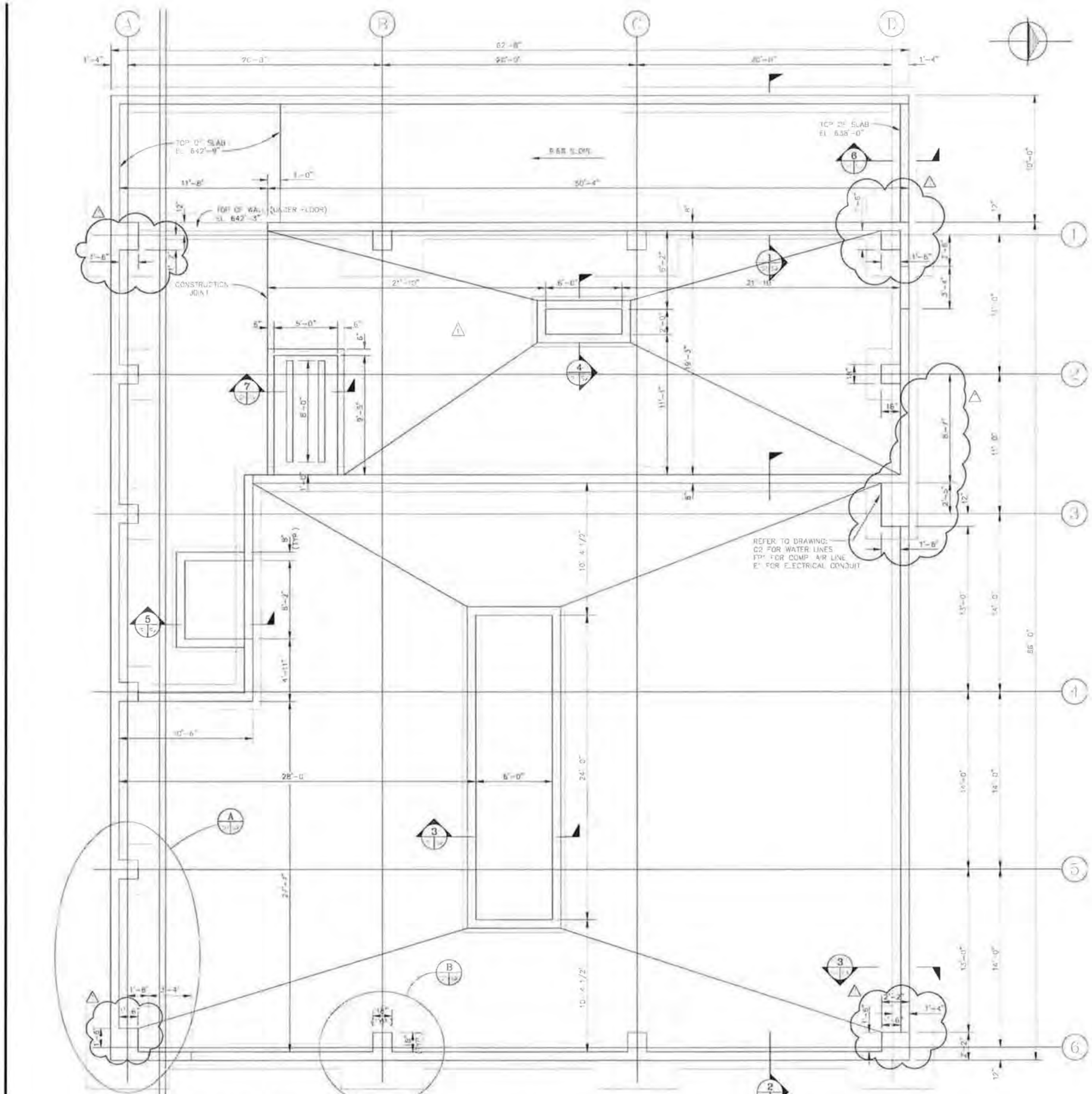
SITE PLAN – CIVIL

GAGE PRODUCTS, CO. FERNDALE, MICHIGAN

DESIGNED BY: W.D.W.	DATE: AUG. '89
DRAWN BY: A.B.D.	DATE: AUG. '89
CHECKED BY: D.L.W.	DATE: DEC. '89
FILE: 83651-C2	EDIT: CURRENT
SCALE:	1"=20'
DRAWING:	1:240
PLOT:	
PROJECT:	83651

C2

SHEET NO



FLOOR / FOUNDATION PLAN
SCALE: 1/4" = 1'-0"

GENERAL NOTES

1. ELEVATIONS AND DIMENSIONS OF EXISTING STRUCTURES AND PLANT UTILITIES HAVE BEEN BASED ON THE BEST INFORMATION AVAILABLE AT THE TIME OF DESIGN AND MUST BE VERIFIED IN THE FIELD BY THE CONTRACTOR. THE CONTRACTOR WILL BE RESPONSIBLE TO VERIFY ALL DIMENSIONS AND ELEVATIONS BEFORE PROCEEDING WITH ANY WORK. IMMEDIATELY NOTIFY THE OWNER OF ANY CONFLICTS WHICH WILL EFFECT THE PROGRESS OF THE WORK.
2. FOUNDATIONS SHALL BE PLACED ON UNDISTURBED NATURAL SOIL WITH AN ALLOWABLE SOIL BEARING PRESSURE OF 2000 PSF. IF UNACCEPTABLE SOIL CONDITIONS ARE ENCOUNTERED THE ENGINEER SHALL BE CONSULTED FOR DIRECTION WITH REGARD TO FOUNDATION CONSTRUCTION.
3. THE SLAB SUB-BASE SHALL BE PLACED ON NATURAL SUBGRADE MATERIAL AFTER THE CONCRETE HAS BEEN STRIPPED AND THE SUBGRADE PROOFROLLED. IF UNDERCUTTING IS REQUIRED TO REMOVE UNSUITABLE SUBGRADE MATERIAL OR IF THE NATURAL SUBGRADE IS BELOW THE DESIGN LEVEL, COMPACTED GRANULAR FILL SHALL BE USED TO ACHIEVE THE DESIRED SUBGRADE ELEVATION. MATERIAL MEETING THE GRADATIONAL REQUIREMENTS FOR MDOT CLASS I MATERIAL SHALL BE USED FOR FILL AND SHALL BE COMPACTED TO 95% OF THE MAXIMUM DRY DENSITY AS DETERMINED IN ACCORDANCE WITH ASTM STANDARD D-1557 (MODIFIED PROCTOR).
4. TESTING OF FOUNDATION SUBGRADE, FOUNDATION AND FLOOR SLAB CONCRETE, GRANULAR BACKFILL, AND OTHER TESTING REQUIRED WILL BE BY A CONSULTANT SELECTED BY THE OWNER.
5. COORDINATE ALL BUILDING DIMENSIONS WITH PRE-ENGINEERED BUILDING SUPPLY. COORDINATE ALL WALL AND ROOF OPENING DIMENSIONS WITH MECHANICAL AND ELECTRICAL CONTRACTORS.

CAST-IN-PLACE CONCRETE NOTES

6. ALL REINFORCING IN CONCRETE WALLS FOOTINGS SHALL BE CONTINUOUS UNLESS DETAILED OTHERWISE. LAP SPLICES SHALL MEET THE REQUIREMENTS OF ACI CLASS "B" TOP SPLICES EXCEPT AS DETAILED OTHERWISED.
7. ALL CONSTRUCTION JOINTS SHALL HAVE CONTINUOUS KEYWAYS AS DETAILED. REINFORCING SPLICED AT THESE LOCATIONS SHALL HAVE ACI CLASS "C" TOP SPLICES UNLESS APPROVED OR DETAILED OTHERWISE. ALL CONSTRUCTION JOINTS EXCEPT THOSE DETAILED SHALL HAVE ENGINEER APPROVAL. SEE SPECIFICATIONS FOR OTHER CONSTRUCTION JOINT REQUIREMENTS.
8. ALL REINFORCING IN FOOTINGS AND WALLS SHALL BE CONTINUOUS AROUND CORNERS AND INTERSECTIONS.
9. PROVIDE 2-#5 BARS EXTRA AT TOP, BOTTOM AND SIDES OF ALL OPENINGS IN CONCRETE WALLS UNLESS OTHERWISE NOTED. EXTEND BARS 30 BAR DIAMETERS BEYOND EACH SIDE OF OPENING WHERE POSSIBLE.
10. PROVIDE 3/4" BEVELED EDGES ON ALL PERMANENTLY EXPOSED CONCRETE CORNERS.
11. COORDINATE WITH PRE-ENGINEERED BUILDING SUPPLIER ALL FOOTING AND ANCHORAGE DETAILS AND SPECIAL EMBEDMENTS.

DESIGN DATA:

CONCRETE 28-DAY STRENGTH	
GROUT AND FILL	f'c = 6000 PSI
SLABS ON GRADE	f'c = 4000 PSI
ALL OTHER CONCRETE	f'c = 3500 PSI
STRUCTURAL STEEL	fy = 36,000 PSI
REINFORCING STEEL	fy = 60,000 PSI
SUPERIMPOSED DESIGN LOADS	
BUILDING ROOF	
SNOW L.L.	20.0* PSF
ROOF D.L.	5.0 PSF
MISC. MECH. & ELEC. D.L.	20.0 PSF
TOTAL	45.0 PSF
ALLOWABLE SOIL BEARING CAPACITY	
Q'S	2,000 PSF

* SEE SHT. A2 "EAST ELEVATION" FOR DRIFT CONDITION

EXCAVATION NOTE:

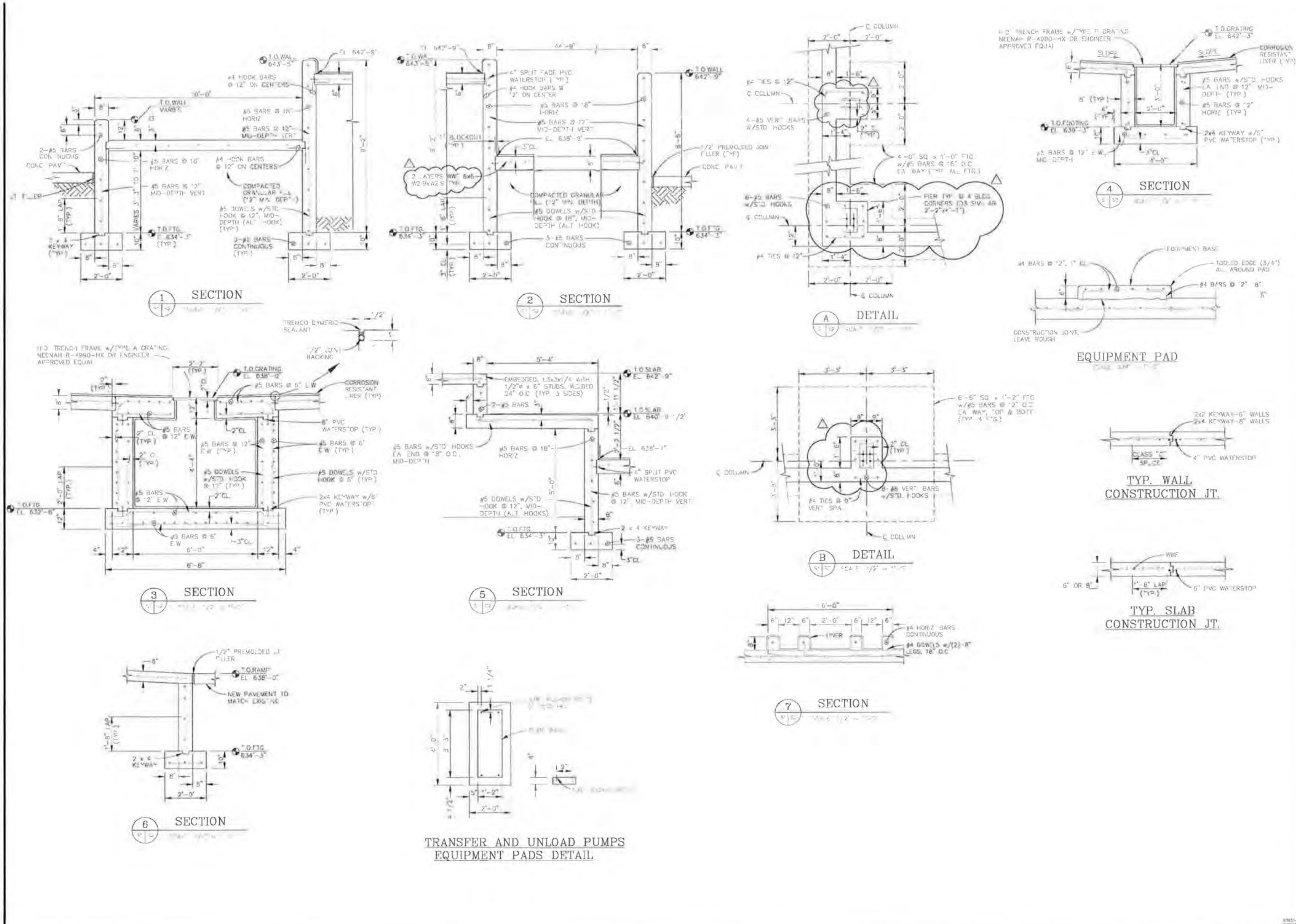
1. SOILS AND GROUND WATER IN VICINITY OF THE PROPOSED LIMITED HAZARDOUS STORAGE WASTE FACILITY MAY POSSESS UNKNOWN QUANTITIES OF ORGANIC COMPOUNDS. SOIL REMOVED FROM THIS AREA SHOULD BE SEGREGATED AND CHARACTERIZED FOR PROPER DISPOSAL, AND NOT USED AS BACKFILL MATERIAL. SUBSURFACE WATER REMOVED FROM AREA SHOULD BE CONTAINED, CHARACTERIZED, AND DISPOSED OF PROPERLY. SUBSURFACE CONTRACTORS ARE RESPONSIBLE FOR PROVIDING APPROPRIATE HEALTH AND SAFETY MEASURES TO MINIMIZE WORKER EXPOSURE TO AIR, SOIL, AND GROUND WATER POTENTIALLY IMPACTED BY ORGANIC COMPOUNDS IN THIS AREA.

WW Engineering and Construction Management

REVISED IN ACCORDANCE WITH CONSTRUCTION RECORDS

HAZARDOUS WASTE UNLOADING & LIMITED STORAGE FACILITY
FOUNDATION PLAN
GAGE PRODUCTS, CO. FERNDALE, MICHIGAN

SCALE: AS NOTED
SHEET NO. S1



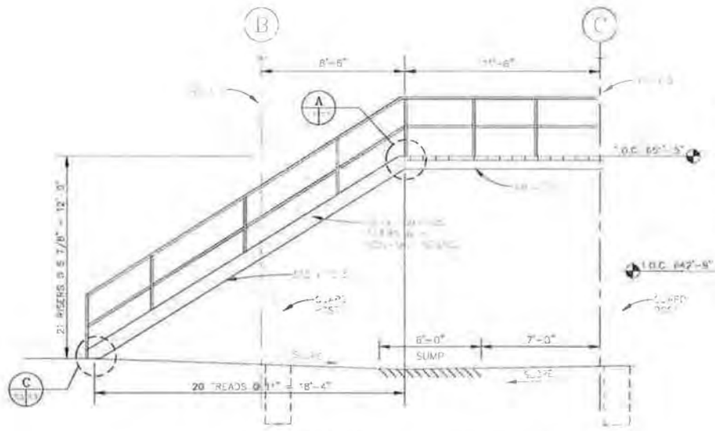
HAZARDOUS WASTE UNLOADING & LIMITED STORAGE FACILITY

SECTIONS & DETAILS

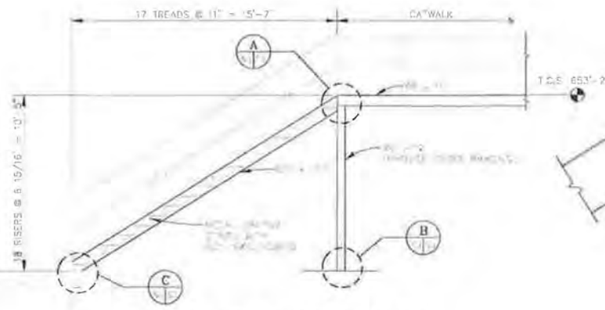
GAGE PRODUCTS, CO. FERNDALE, MICHIGAN

SCALE AS NOTED

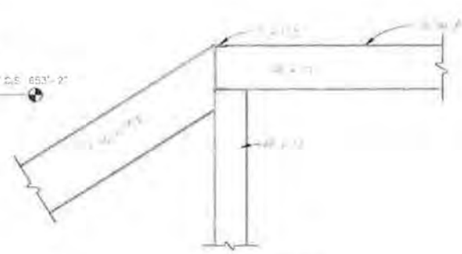
S2



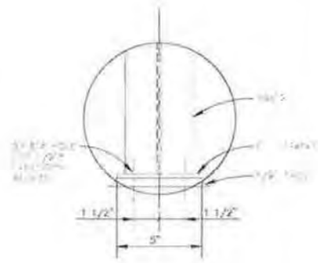
STAIRS & PLATFORM No. 1 — ELEVATION



STAIRS & CATWALK TO PLATFORM No. 2 — ELEVATION



A DETAIL



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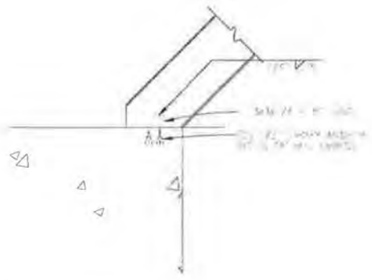
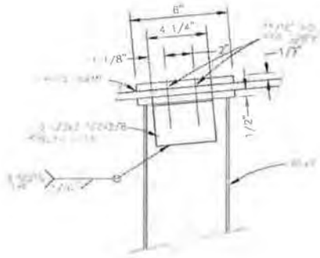
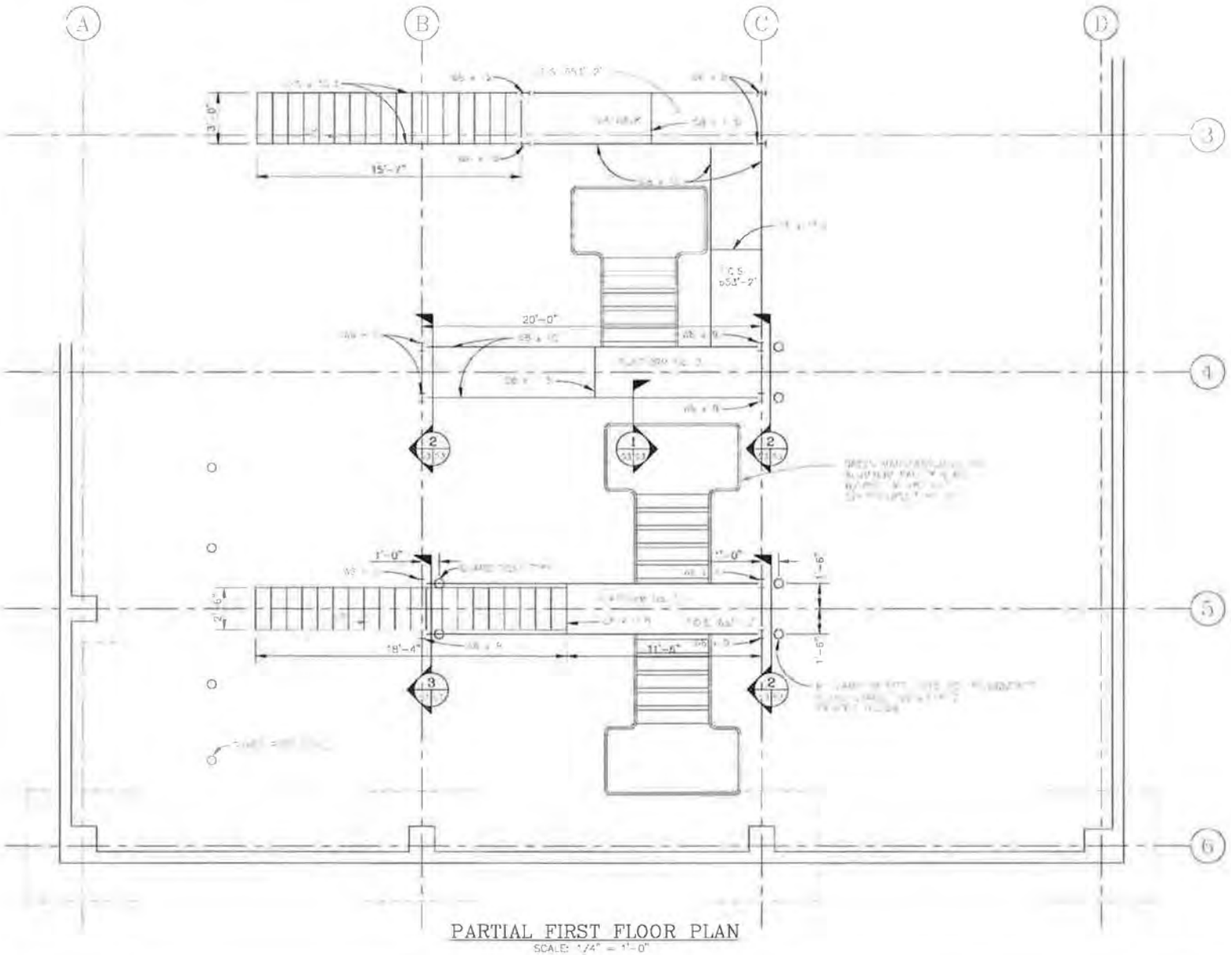


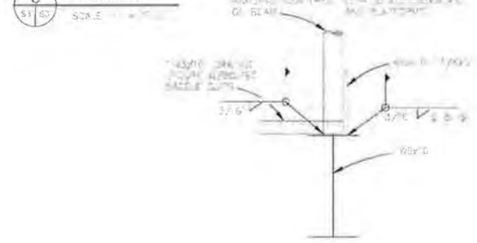
C DETAIL



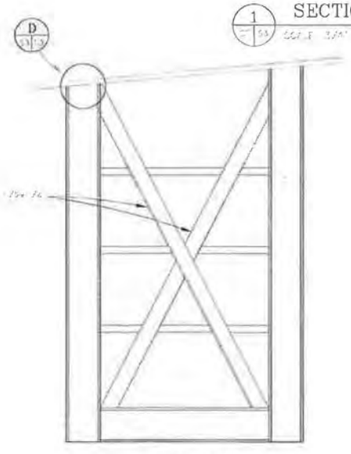
D DETAIL



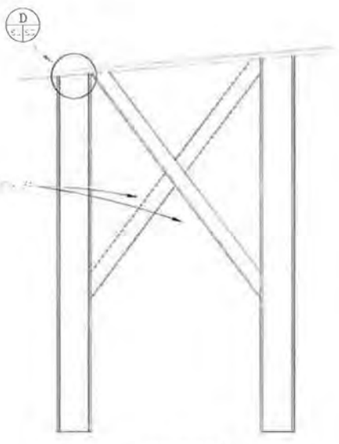
PARTIAL FIRST FLOOR PLAN
SCALE: 1/4" = 1'-0"



1 SECTION



2 SECTION

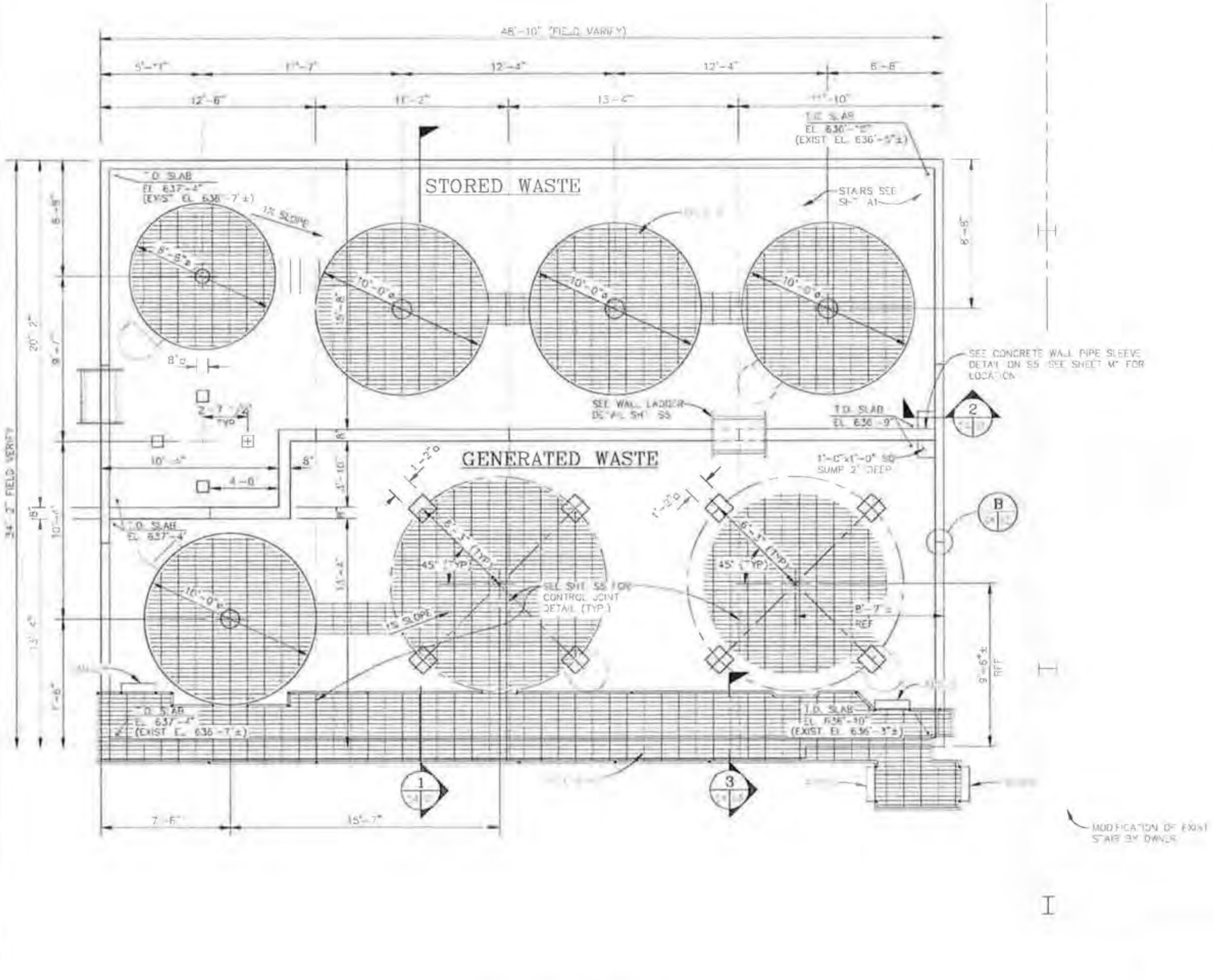


3 SECTION

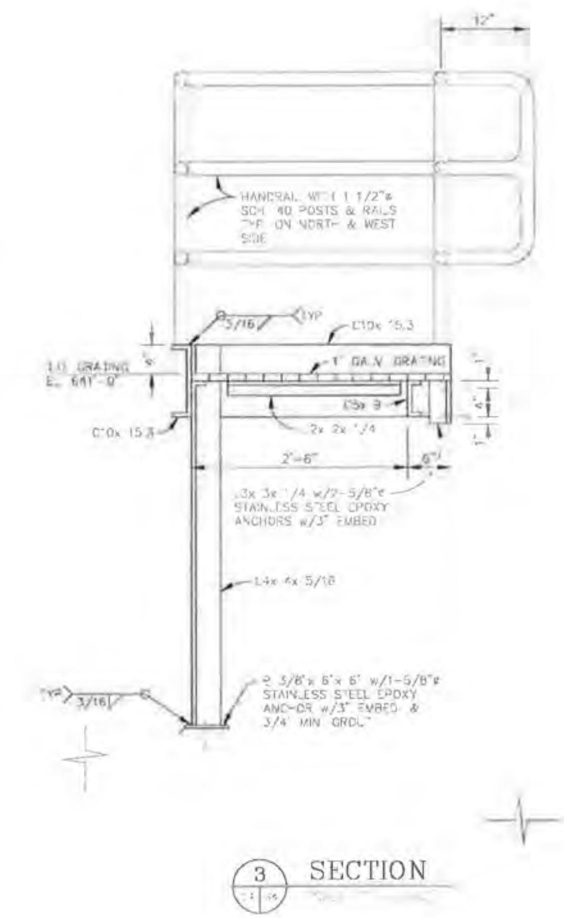
WW Hatfield Group
Engineering and Construction Management
5550 Glenwood Hills Parkway, SE • Grand Rapids, MI 49508 • (616) 942-1810

HAZARDOUS WASTE UNLOADING & LIMITED STORAGE FACILITY
CATWALK PLAN & DETAILS
GAGE PRODUCTS, CO. FERNDALE, MICHIGAN

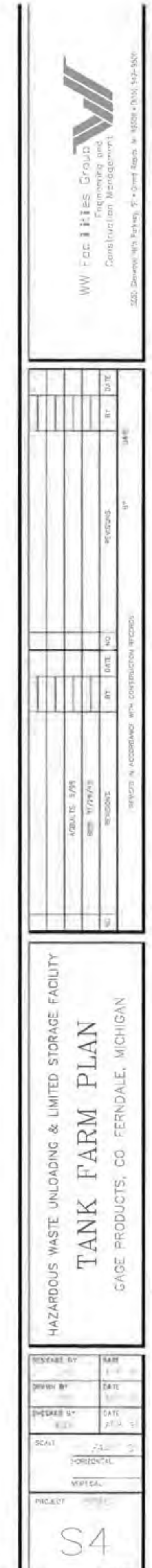
DESIGNED BY
DRAWN BY
CHECKED BY
SCALE
HORIZONTAL
VERTICAL
PROJECT
S3
SHEET NO.

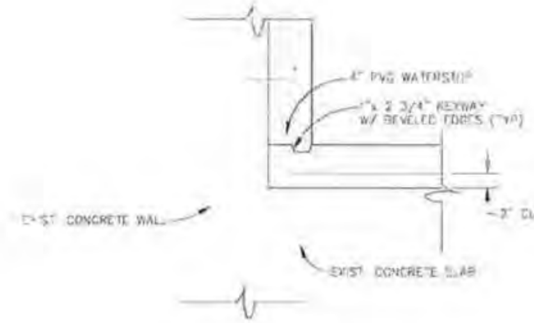


TANK FARM PLAN

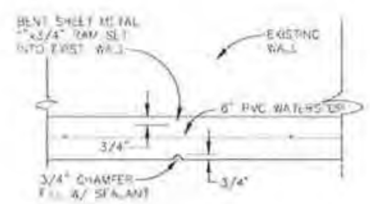


3 SECTION

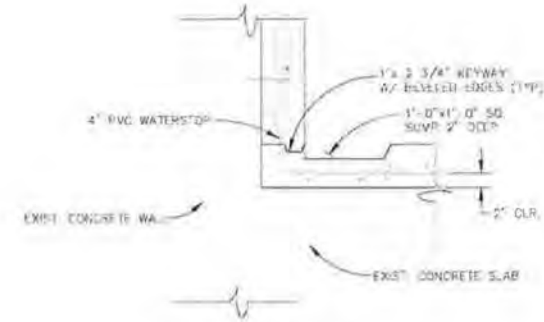




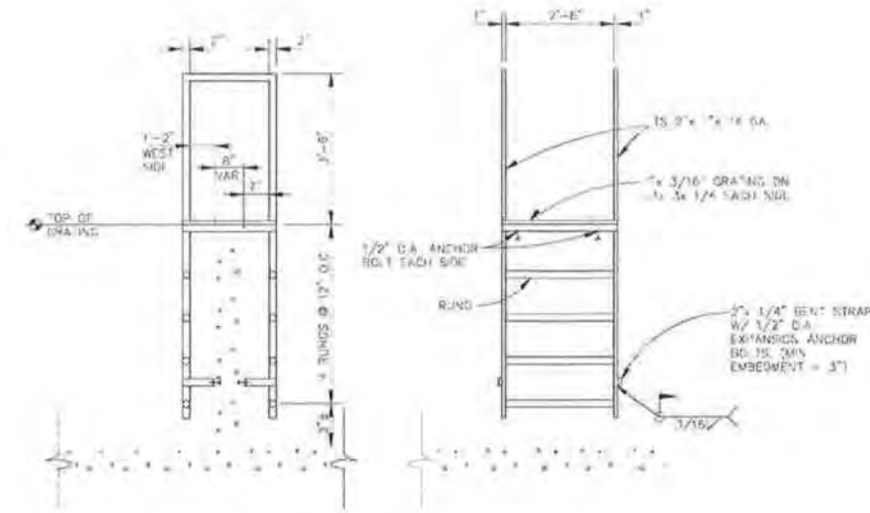
A DETAIL



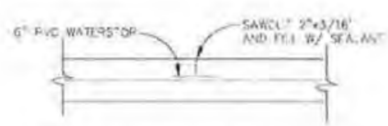
B DETAIL (TYPICAL 16 LOCATIONS)



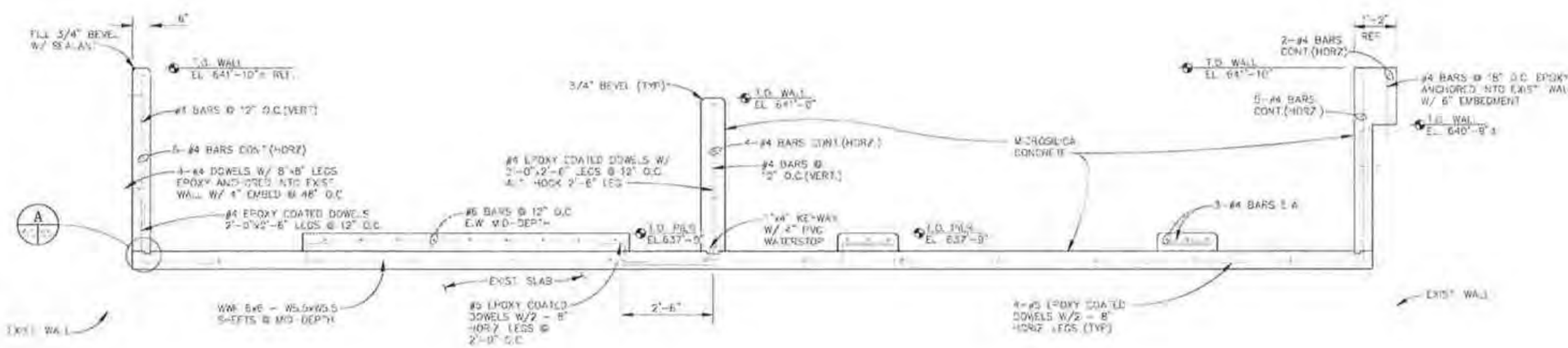
2 SECTION



WALL LADDER DETAILS



CONTROL JOINT DETAIL



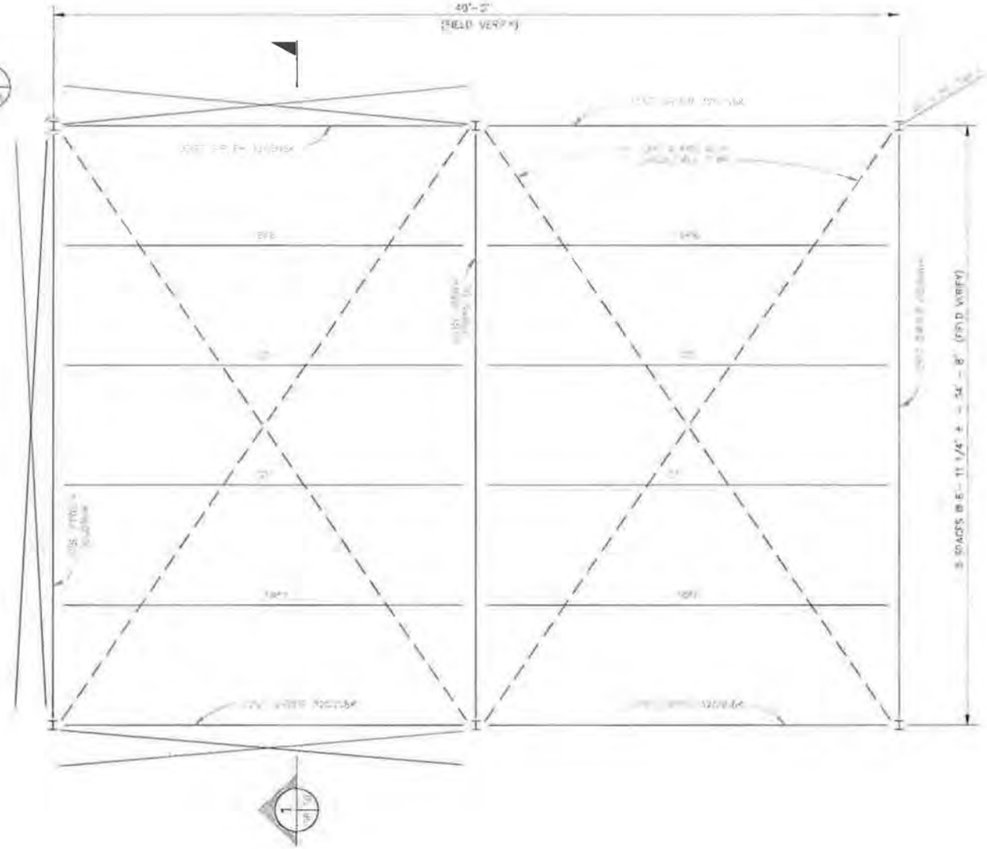
1 SECTION

HAZARDOUS WASTE UNLOADING & LIMITED STORAGE FACILITY

TANK FARM CONC. DETAILS

GAGE PRODUCTS, CO FERNDALE, MICHIGAN

S5



WW Fox Hines Group
Engineering and Construction Management
1553 Donald Kelly Parkway, SE • Grand Rapids, MI 49508 • (616) 942-0900

NO	DATE	BY	REVISIONS

HAZARDOUS WASTE UNLOADING & LIMITED STORAGE FACILITY

ROOF FRAMING PLAN DETAILS

CAGE PRODUCTS, CO. FERNDALE, MICHIGAN

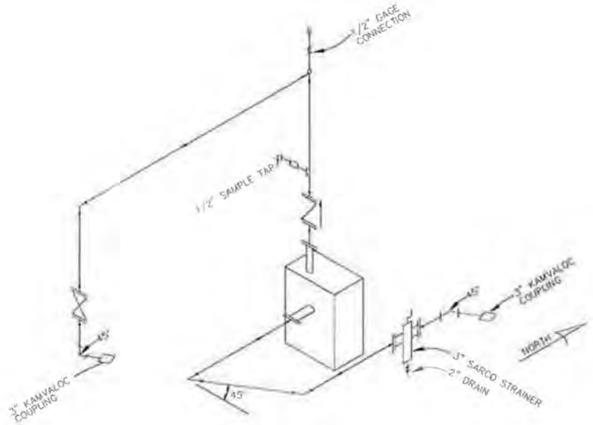
DESIGNED BY
DRAWN BY
CHECKED BY
SCALE
VERTICAL
PROJECT NUMBER

S6

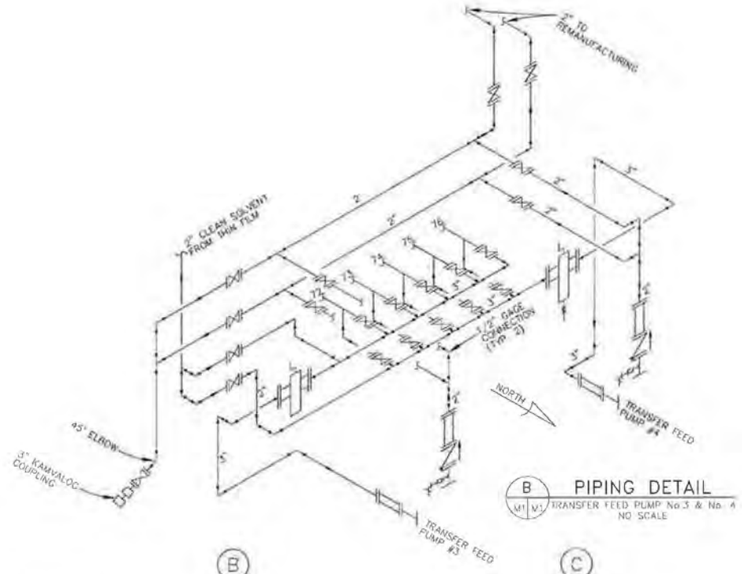
SHEET NO.

GENERAL NOTES

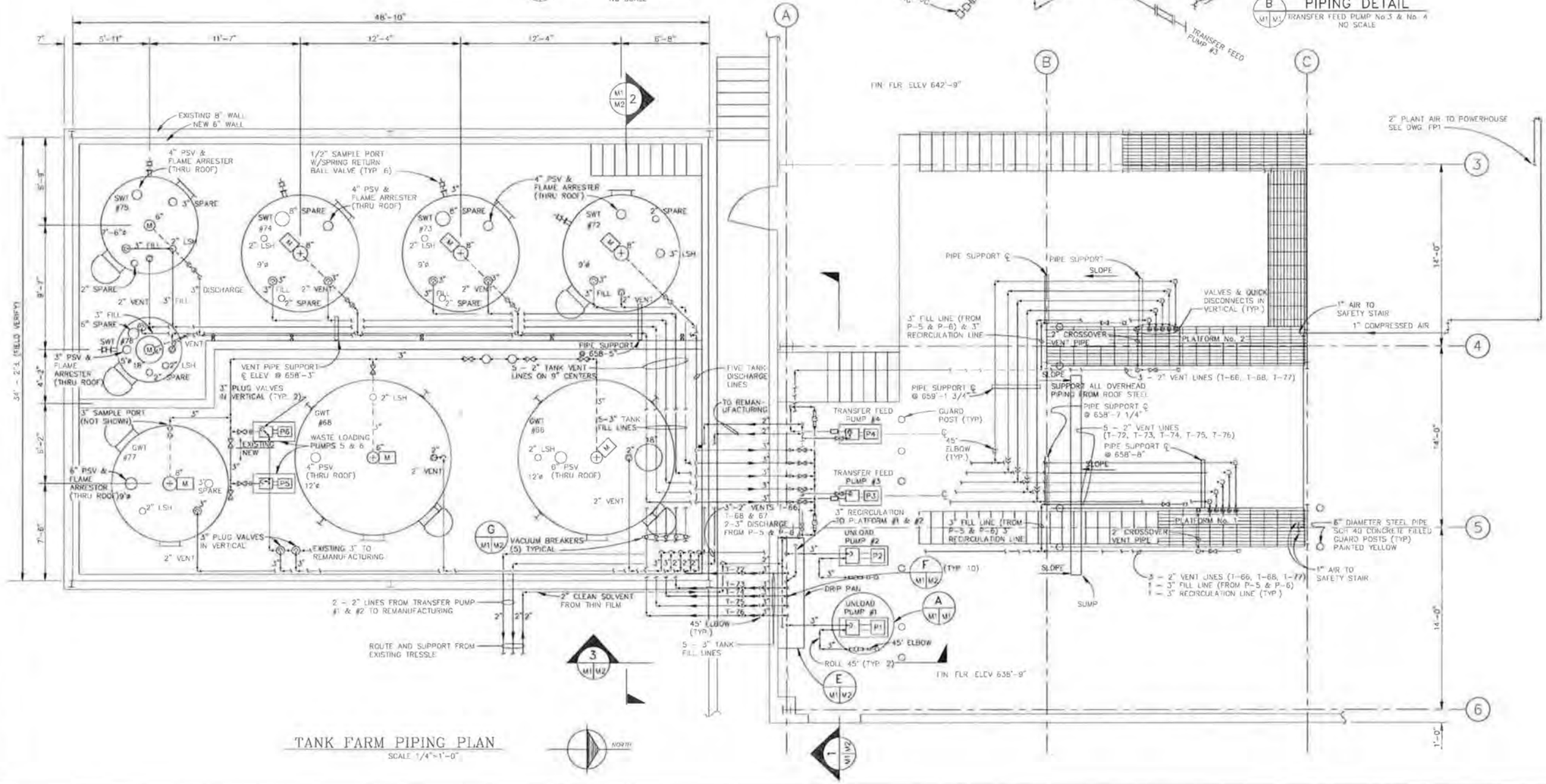
1. ALL TANKS TO BE PURCHASED AND SET BY OWNER
2. OWNER HAS PRE-PURCHASED TRANSFER PUMP NO. 1
3. CONTRACTOR TO FURNISH ALL OTHER EQUIPMENT, MATERIALS PIPE, VALVES, AND MISC. FITTINGS
4. CONTRACTOR TO VERIFY ALL PROPOSED PIPE ROUTINGS AND DIMENSIONS PRIOR TO ANY FABRICATION OR INSTALLATION IMMEDIATELY NOTIFY OWNER OF ANY CONFLICTS
5. ALL EQUIPMENT AND MATERIALS SHALL BE COMPATABLE AND SUITABLE FOR INTENDED SERVICE
6. ALL EQUIPMENT AND MATERIALS SHALL BE INSTALLED AND/OR APPLIED IN ACCORDANCE WITH MANUFACTURER'S RECOMENDATIONS
7. SUBSTITUTION OF ANY EQUIPMENT AND/OR MATERIALS SHALL NOT BE ALLOWED, UNLESS PRIOR APPROVAL IS OBTAINED FROM OWNER
8. CONTRACTOR SHALL ENSURE SAFE PASSAGE OF PERSONS AROUND THE AREA OF CONSTRUCTION
9. INSTALLATION AND ERECTION TO BE PREFORMED IN A MANNER THAT WILL NOT DAMAGE EXISTING EQUIPMENT, STRUCTURES, AND/OR UTILITIES
10. INSTALLATION SHALL BE IN ACCORDANCE WITH ALL GOVERNING LOCAL, STATE, AND FEDERAL CODES
11. CONTRACTOR TO FURNISH AND INSTALL EMERGENCY VENTS ON STORED WASTE TANKS #72 THROUGH #76. VENT LINES SHALL BE ADEQUATELY BRACED, SUPPORTED AND FLASHED AT ROOF PENETRATION. VENT PIPES TO EXTEND TO ELEVATION 679'-0". FIVE 6" VENTS, ONE 4" VENT ARE REQUIRED



A M1 M1 PIPING DETAIL
UNLOAD PUMPS 1 & 2 (2 REQ'D)
NO SCALE



B M1 M1 PIPING DETAIL
TRANSFER FEED PUMP No.3 & No. 4
NO SCALE



TANK FARM PIPING PLAN
SCALE 1/4"=1'-0"

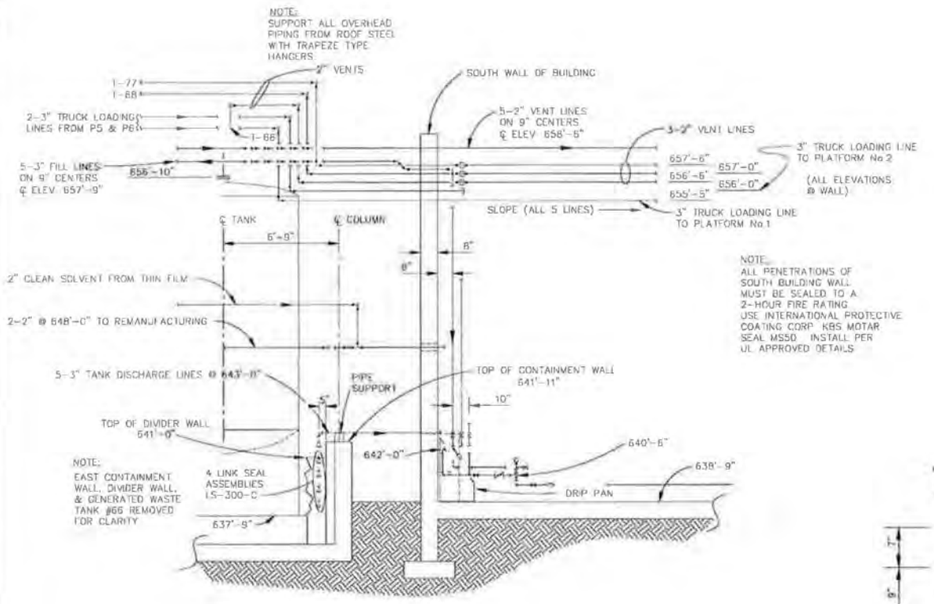
NORTH

WW Practices Group
Engineering and Construction Management
3955 Drexel Hills Parkway SE • Grand Rapids, MI 49508 • (616) 942-3881

NO	DATE	REVISIONS
1	11/26/93	ADDENDUM #1
2	3/4/93	ADDENDUM #2

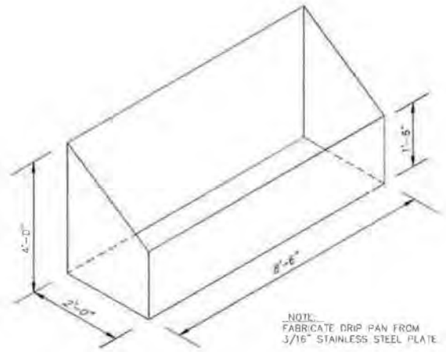
HAZARDOUS WASTE UNLOADING & LIMITED STORAGE FACILITY
TANK FARM PIPING PLAN
CAGE PRODUCTS, CO. FERNDALE, MICHIGAN

DESIGNED BY: DLW	DATE: MAR '91
DRAWN BY: ALK	DATE: MAR '91
CHECKED BY: RJD	DATE: JUN '91
SCALE: 1/4=1'-0" HORIZONTAL NA VERTICAL	
PROJECT: 83651	
M1	SHEET NO



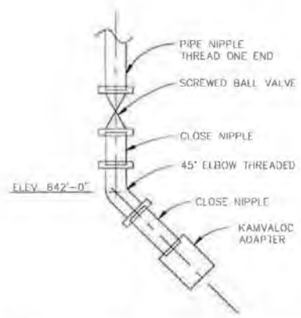
3 M1 M2 SECTION
SCALE: 1/4" = 1'-0"

NOTE:
ALL PENETRATIONS OF SOUTH BUILDING WALL MUST BE SEALED TO A 2-HOUR FIRE RATING USE INTERNATIONAL PROTECTIVE COATING CORP. KBS MOTAR SEAL MS50. INSTALL PER UL APPROVED DETAILS

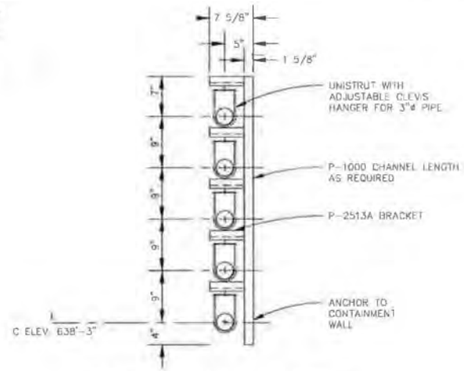


NOTE:
FABRICATE DRIP PAN FROM 3/16" STAINLESS STEEL PLATE.

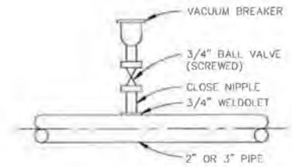
E M1 M2 DRIP PAN DETAIL
NO SCALE



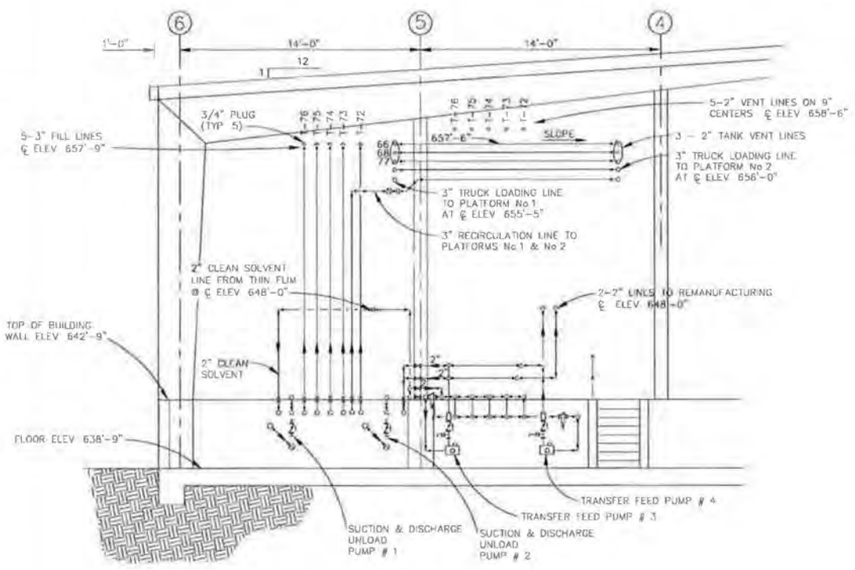
F M1 M2 QUICK DISCONNECT DETAIL
NO SCALE
13 REQUIRED
11-3"
2-2"



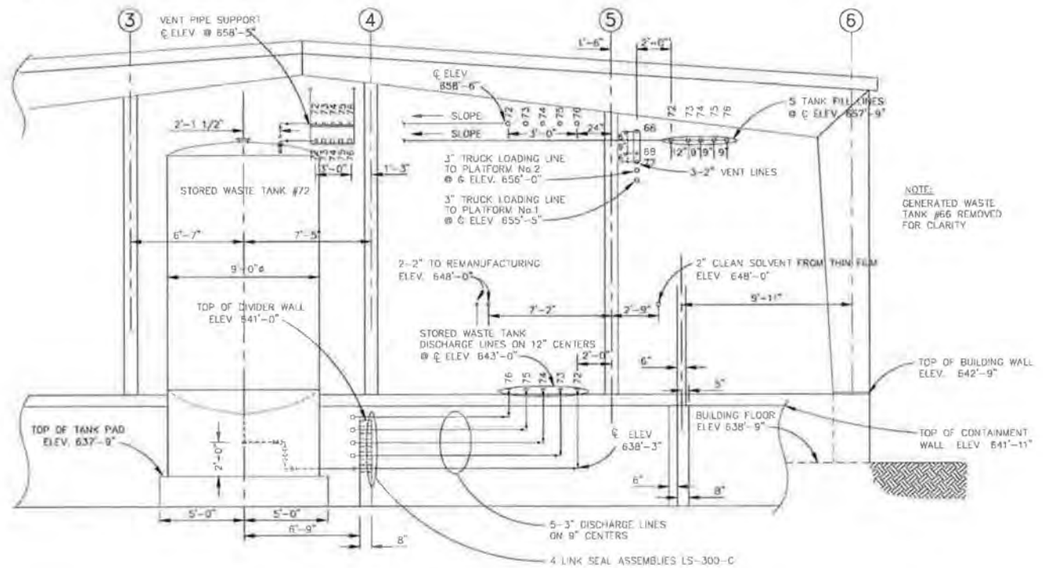
D M1 M2 PIPE SUPPORT DETAIL
(6 REQUIRED)
SCALE: 1" = 1'-0"



G M1 M2 VACUUM BREAKER DETAIL
NO SCALE
(9 REQUIRED)



1 M1 M2 SECTION
SCALE: 1/4" = 1'-0"



2 M1 M2 SECTION
SCALE: 1/4" = 1'-0"

WW Engineering & Science
Facilities Engineering Division
28209 West Six Mile Road • Livonia, Michigan 48152 • (313) 591-7222

HAZARDOUS WASTE UNLOADING & LIMITED STORAGE FACILITY
TANK FARM PIPING DETAILS
GAGE PRODUCTS, CO. FERNDALE, MICHIGAN

DESIGNED BY: GLW	DATE: MAR '91
DRAWN BY: MPM	DATE: MAY '91
CHECKED BY: RJO	DATE: JUN '91
SCALE: 1/4=1'-0"	
HORIZONTAL: NA	
VERTICAL:	
PROJECT: 83651	
M2	
SHEET NO.	

REVISED IN ACCORDANCE WITH CONSTRUCTION RECORDS

BASIS OF DESIGN
CONTAINER STORAGE BUILDING

I. General

- Maximum Storage Capacity: 50, 55-gallon drums, (2,750 gallons - maximum).
- Waste Types: D001, D002, F001, F002, F003, and F005.
- Overall total storage volume, including bulk tank storage: 25,000 gallons - maximum.
- Dimensions: 62.8' x 66'(one bay for container unloading/loading and two bays for tank truck unloading/loading).
- Containment Volume: 2' x 6' x 3' (695 gallon capacity) with an additional sump in the tank truck loading/unloading area that measures 6' x 24' x 5' (2 bay), 9,000 gallon capacity.

II. Storage Layout:

- Palletized drums: 4 per pallet, maximum
- Maximum stack height: 2 layers on pallets or other wood base
- Aisle width: 24" minimum
- Main aisle: 12' minimum width
- Incompatible waste segregation: a concrete curb will serve to separate D002 wastes (maximum of 12 drums) from other wastes in storage area to prevent accidental mixing of any leaked wastes.
- Secondary containment: with regards to squirt protection, drums will be stored from 3'to 6' feet from storage area curbing depending upon their storage arrangement per the squirt calculations.

BASIS OF DESIGN
CONTAINER STORAGE BUILDING
(continued)

III. Building Configuration:

- Minimum 50'setback from all property lines.
- Containment Area: concrete floor and curbs with a seal coat of an abrasion-resistant sealandt. This coating provides an impervious barrier for all hazardous wastes and constituents to be stored in this area.
- Roofed area to prevent precipitation and runoff from entering storage area.
- Site Drainage: away from storage area, directed to storm sewers.
- Ventilation: natural ventilation through slotted side panels.

BASIS OF DESIGN
BULK TANK STORAGE AREA

I. General

- Maximum Starage Capacity: five vertical tanks. Three with 6,000 gallon capacity each; one with 3.250 gallon capacity; and one with 1,000 gallon capacity (22.250 gallons maximum).
- Waste types: D001, F001, F002, F003, and F005.
- Dimensions: approximately 48' x 15 1/1' area that contains five vertical tanks.
- Containment Volume: 18,000 gallons

II. Storage Layout

- The bulk tank storage area is made up of five vertical tanks. The tanks are located within a secondary containment area with cement walls and a collection sump.
- All tanks are spaced within the containment area to allow for routine monitoring of the tanks.
- Secondary containment: With regards to squirt protection, protective sheathing has been installed around the outside perimeter of the hazardous waste storage tanks.

III. Building Configuration

- Minimum 43' setback from south property line.
- Containment Area: Concrete floor and retaining walls with a seal coat of an abrasion-resistant sealant. This coating provides an impervious barrier for all hazardous wastes and constituents to be stored in this area. each tank also has a surrounding deflector wall to control squirt projection beyond the containment area should a tank develop a leak.
- Roofed area to prevent prevent precipitation and runoff from entering storage area.
- The containment area has collection sump for any liquid accumulations. Any liquids in sump will be analyzed to determine disposal options.
- Site Drainage: Away from storage area, directed to storm sewers.
- Ventilation: Natural ventilation, open areas between tanks.

Protection from Precipitation and Run-off/Run-on

The Limited Storage Facility prevents run-on from entering the facility by means of the walls of the building. At those locations where there are no walls, (truck entrances and doorways), run-on is prevented from entering the facility due to the slope away from the facility. The existing grade at the facility is approximately 638' to 638"-2". The elevation at the entrances to the Limited Storage Facility is 638'-9". This is 7" higher than existing grade. The 24-hour, 25-year storm will produce 0.18" of rain per hour, for a total rainfall of 4.32". Therefore, rainwater will be kept out of the Limited Storage Facility by means of site drainage and slope away from the Limited Storage Facility.

All waste handling activities will take place under a structure that provides protection from precipitation and run-off. The Limited Storage Facility has negligible potential for blowing precipitation to enter the facility, and run-off will be eliminated by the walls and ground slope where there are no walls. The tank storage area has walls completely surrounding the facility, so run-off/run-on potential does not exist. The sloped roof covering the tank storage area will prevent direct precipitation from entering the area, and blowing precipitation will be minimal. Gage Products presently has a canopy covering, similar to the proposed roof, over the truck unloading area. That area does not typically get wet during rain events. When blowing precipitation does enter the area, it causes the ground to become wet, but no standing water collects in the area. Due to the secondary containment structure of the tank storage area, any precipitation which may enter the area would be collected in the sump.

CORROSIVE AREA SQUIRT PROTECTION

In order to address squirt protection concerns, the height of the concrete curbing on the north and east sides of the corrosive storage area will be extended to an elevation of 648'-9", (approximately 6 feet above the finished floor). The building wall panel provides squirt protection on the west side of the storage area. A hanging metal access partition wall will be added on the south side of the corrosive storage area. This partition wall will extend from the top of the 8" curb to the 648'-9" elevation.

Table 4-4.2.7, if unprotected, or Table 4-6.1(a) if protected, in accordance with Section 4-6. The storage heights of containers on protected racks shall comply with Table 4-6.1(b), as applicable.

Exception: An unprotected liquid warehouse located a minimum of 100 ft (30 m) from exposed buildings or adjoining property that can be built upon is not required to conform to Table 4-4.2.7, if there is protection for exposures. Where protection for exposures is not provided, a minimum 200 ft (61 m) distance is required.

4-5.7.7 Class I liquids shall not be permitted in the basement areas of liquid warehouses. Class II and Class IIIA liquids may be stored in basements provided that automatic sprinkler protection and other fire protection facilities are provided in accordance with Section 4-6.

4-5.7.8 Limited amounts of combustible commodities, as defined in the scope of NFPA 231, *Standard for General Storage*, and NFPA 231C, *Standard for Rack Storage of Materials*, may be stored in liquid warehouses if protection is provided in accordance with Section 4-6, and the ordinary combustibles, other than those used for packaging the liquids, are separated a minimum of 8 ft (2.4 m) horizontally, by aisles or open racks, from the liquids in storage.

4-5.7.9 Empty or idle combustible pallet storage shall be limited to a maximum pile size of 2500 sq ft (232 m^2) and to a maximum storage height of 6 ft (1.8 m). Idle pallet storage shall be separated from liquids by at least 8-ft (2.4-m) wide aisles. However, pallet storage in accordance with NFPA 231, *Standard for General Storage*, shall be acceptable.

4-5.7.10 Containers in piles shall be separated by pallets or dunnage to provide stability and to prevent excessive stress on container walls. Portable tanks stored over one tier high shall be designed to nest securely, without dunnage. (*See NFPA 386, Standard for Portable Shipping Tanks for Flammable and Combustible Liquids, for information on portable tank design.*) Materials handling equipment shall be suitable to handle containers and tanks safely at the upper tier level.

4-5.7.11 No container or portable tank shall be stored closer than 36 in. (0.90 m) to the nearest beam, chord, girder, or other roof member in an unprotected warehouse.

4-5.7.12 Solid pile and palletized storage shall be arranged so that piles are separated from each other by at least 4 ft (1.2 m). Aisles shall be provided so that no container or tank is more than 12 ft (3.6 m) from an aisle. Where storage on racks exists as permitted in this Code, a minimum 4-ft (1.2-m) wide aisle shall be provided between adjacent rows of racks and any adjacent storage of liquids. Main aisles shall be a minimum of 8 ft (2.4 m) wide, and access shall be maintained to all doors required for egress.

4-5.7.13 **Mixed Storage.** When two or more classes of liquids are stored in a single pile, the maximum quantity permitted in that pile shall be the smallest of the two or more separate maximum quantities and the heights of storage permitted in that pile shall be the least of the two or more separate heights as given in Tables 4-4.2.7 or 4-6.1(a), as applicable. When two or more classes of liquids are stored in the same rack as permitted in this Code, the maximum height of storage permitted shall be the least of the two or more separate heights given in Table 4-6.1(b).

4-6 Protection Requirements for Protected Storage of Liquids.

4-6.1 Containers and portable tanks storing flammable and combustible liquids may be stored in the quantities and arrangements specified in Tables 4-6.1(a) and 4-6.1(b), provided the storage is pro-

Table 4-6.1(a) Storage Arrangements for Protected Palletized or Solid Pile Storage of Liquids in Containers and Portable Tanks

Class	Storage Level	Max. Stge. Height (ft.)		Max. Quantity per Pile (gal.)		Max. Quantity (gal.)	
		Containers	Port. Tanks	Containers	Port. Tanks	Containers	Port. Tanks
IA	Ground Floor	5	—	3,000	—	12,000	—
	Upper Floors	5	—	2,000	—	8,000	—
	Basements	Not Permitted		—	—	—	—
IB	Ground Floor	6½	7	5,000	20,000	15,000	40,000
	Upper Floors	6½	7	3,000	10,000	12,000	20,000
	Basements	Not Permitted		—	—	—	—
IC	Ground Floor	*6½	7	5,000	20,000	15,000	40,000
	Upper Floors	*6½	7	3,000	10,000	12,000	20,000
	Basements	Not Permitted		—	—	—	—
II	Ground Floor	10	14	10,000	40,000	25,000	80,000
	Upper Floors	10	14	10,000	40,000	25,000	80,000
	Basements	5	7	7,500	20,000	7,500	20,000
III	Ground Floor	20	14	15,000	60,000	50,000	100,000
	Upper Floors	20	14	15,000	60,000	50,000	100,000
	Basements	10	7	10,000	20,000	25,000	40,000

SI Units: 1 ft = 0.30 m; 1 gal = 3.8 L.

* These height limitations may be increased to 10 ft for containers of 5 gal or less in capacity.

NOTE: See Section 4-6 for protection requirements as applicable to this type of storage.

Table 4-6.1(b) Storage Arrangements for Protected Rack Storage of Liquids in Containers

Class	Type Rack	Storage Level	Max. Stge. Height (ft) Containers	Max. Quantity (gal) Containers
IA	Double Row or Single Row	Ground Floor	25	7,500
		Upper Floor	15	4,500
		Basements	Not Permitted	—
IB	Double Row or Single Row	Ground Floor	25	15,000
		Upper Floor	15	9,000
IC		Basements	Not Permitted	—
II	Double Row or Single Row	Ground Floor	25	24,000
		Upper Floor	25	24,000
		Basements	15	9,000
III	Multi-Row Double Row or Single Row	Ground Floor	40	48,000
		Upper Floor	20	48,000
		Basements	20	24,000

SI Units: 1 ft = 0.30 m; 1 gal = 3.8 L.

NOTE: See Section 4-6 for protection requirements as applicable to this type of storage.

tected in accordance with 4-6.2 and 4-6.5, as applicable.

4-6.1.1 Other quantities and arrangements may be used where suitably protected and approved by the authority having jurisdiction.

4-6.2. Where automatic sprinklers are used, they shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, and approved by the authority having jurisdiction. (*For additional information, see Appendix D.*)

4-6.2.1 Other systems such as automatic foam-water systems, automatic water-spray systems, or other combinations of systems may be considered acceptable if approved by the authority having jurisdiction. (*For additional information, see Appendix D.*)

4-6.3 Racks storing Class I or Class II liquids shall be either single-row or double-row as described in NFPA 231C, *Standard for Rack Storage of Materials.*

4-6.4 Ordinary combustibles other than those used for packaging the liquids shall not be stored in the same rack section as liquids, and shall be separated a minimum of 8 ft (2.4 m) horizontally, by aisles or open racks, from liquids stored in racks.

4-6.5 In-rack sprinklers shall be installed in accordance with the provisions of NFPA 231C, *Standard for Rack Storage of Materials*, except as modified by 4-6.2. Alternate lines of in-rack sprinklers shall be staggered. Multiple levels of in-rack sprinkler heads shall be provided with water shields unless otherwise separated by horizontal barriers, or unless the sprinkler heads are listed for such installations.

4-7 Fire Control.

4-7.1 Suitable fire extinguishers or preconnected hose lines, either 1½-in. (3.8-cm) lined or 1-in. (2.5-cm) hard rubber, shall be provided where liquids are stored. Where 1½-in. (3.8-cm) fire hose is used, it shall be installed in accordance with NFPA 14, *Standard for the Installation of Standpipe and Hose Systems.*

4-7.1.1 At least one portable fire extinguisher having a rating of not less than 20-B shall be located outside of, but not more than 10 ft (3 m) from, the door opening into any separate inside storage area.

4-7.1.2 At least one portable fire extinguisher having a rating of not less than 20-B shall be located not less than 10 ft (3 m), nor more than 50 ft (15 m), from any Class I or Class II liquid storage area located outside of a separate inside storage area.

4-7.1.3 In protected general purpose and liquid warehouses, hand hose lines shall be provided in sufficient number to reach all liquid storage areas.

4-7.1.4 The water supply shall be sufficient to meet the fixed fire protection demand, plus a total of at least 500 gal (1892 L) per minute for inside and outside hose lines. (*See C-4-6.2.*)

4-7.2 Control of Ignition Sources. Precautions shall be taken to prevent the ignition of flammable vapors. Sources of ignition include but are not limited to: open flames; lightning; smoking; cutting and welding; hot surfaces; frictional heat; static, electrical, and mechanical sparks; spontaneous ignition, including heat-producing chemical reactions; and radiant heat.

4-7.3 Dispensing of Class I and Class II liquids in general-purpose or liquid warehouses shall not be permitted unless the dispensing area is suitably cut off from other ordinary combustible or liquid storage areas, as specified in Section 4-4, and otherwise conforms with the applicable provisions of Section 4-4.

4-7.4 Materials with a water reactivity degree of 2 or higher as outlined in NFPA 704, *Standard System for the Identification of the Fire Hazards of Materials*, shall not be stored in the same area with other liquids.

4-8 Outdoor Storage.

4-8.1 Outdoor storage of liquids in containers and portable tanks shall be in accordance with Table 4-8, as qualified by 4-8.1.1 through 4-8.1.4 and 4-8.2, 4-8.3, and 4-8.4.

4-8.1.1 When two or more classes of materials are stored in a single pile, the maximum gallonage in that pile shall be the smallest of the two or more separate gallonages.

4-8.1.2 No container or portable tank in a pile shall be more than 200 ft (60 m) from a 12-ft (3.6-m) wide access way to permit approach of fire control apparatus under all weather conditions.

4-8.1.3 The distances listed in Table 4-8 apply to properties that have protection for exposures as defined. If there are exposures, and such protection for exposures does not exist, the distances in column 4 shall be doubled.

Master Builders Technologies Corrosion Resistance Guide

CEILCOTE® CORROSION CONTROL PRODUCTS

Monolithic Linings

Monolithic Flooring

Heavy-Duty Coatings

Master Builders Technologies

Introduction

340 corrosive environments are classified by their effect on CEILCOTE CORROSION CONTROL PRODUCTS, as determined by laboratory test and field experience.

Many applications are complicated by mixtures of chemicals and unexpected temperature fluctuations during operation. There may also be difficult conditions during product installation.

For these reasons, consult Master Builders Technologies before final material selection.

How to use this guide

Example: A steel tank for electroplating using acid-copper solution at 160°F. Select the best combination of materials to protect the tank interior and exterior, floor and trenches.

1. Tank Lining

Locate "Copper Plating, Acid" in the left hand column. Since the tank interior may be subjected to possible impact from falling parts, this should be a heavy duty polyester lining. All of these are rated A-1, so you have a choice of Ceilcrete, Flakeline 100 Series or Ceilcote Lining System. Flakeline could be ruled out if there will actually be impact or abrasion. The choice between a Ceilcrete or a Ceilcote 300 series product will depend on economy or customer preference.

2. Tank Exterior

Refer to the columns under "Light Duty Linings." All are rated A-1 except Flakeline 600, rated A-2. Any of these products can be used, since those rated suitable for immersion are more than enough for spillage. Therefore, we use either one of the two lower cost products — Flakeline 300 or 600. Also refer to the CeilGard section of the chart.

3. Floor and Trenches

Consider first that the floor is subjected to spills (2) and the trench to immersion (1). Consider also that spills cool rapidly; the floor protection may see 140°F. or less. One of the Ceilcretes would be the best protection. However, if the housekeeping will be good and spills infrequent, you may select Corocrete T, which is good to 120°F., and is more economical.

For trench lining, consider that when a tank is emptied, preferably through a pipe from tank to trench, there may be exposure to 160°F. You, therefore, require a heavy duty lining; one of the Ceilcretes would be most economical.

Key to Chemical Resistant Chart

Rating	Meaning
A	Good to maximum temperature of product. In many cases, the maximum temperature recommendation varies for the type of substrate or type of service. See the temperature limit chart (opposite page).
B	Good to 180°F. (82°C.)
C	Good to 140°F. (60°C.)
D	Good to 120°F. (49°C.)
E	Good to 100°F. (38°C.)

Rating "E" is used for ambient temperature conditions.

1. Immersion, constant flow or condensing vapors. This condition applies to tanks, stacks, trenches, and floors with frequent spills that are not washed frequently or which have poor drainage.
2. Occasional splash or spillage applies to tank exteriors, walls, and floors that are not washed to dilute and remove spills.
3. Fumes that are not likely to condense.

T Varies with conditions and requires testing. This rating is given when we think the product will work, but have no test or service data.

N Not recommended. There are many cases where products rated N can be used for short term exposures or very dilute solutions. Such conditions are frequently found in chemical waste disposal operations. These require consultation with Master Builders Technologies experts.

Comments on ratings and product use

1. A product rated C-1 (140°F. immersion) can be assumed to rate a higher temperature for spillage.
2. Flakeline 222HT
   To achieve its maximum temperature rating of 150°F., Flakeline 222HT must be applied in three coats on steel, to a thickness of 45 to 75 mils.
3. Any product rated T or N for exposure to a strong, volatile solvent like Ethyl Acetate, Ethyl Ether or Methylene Chloride (one of the most difficult) could be suitable for splash and spill service because the solvents evaporate so quickly.
4. A Light duty lining such as Flakeline 252, rated A-1 (good to 130°F.) in a weak solvent like Hexane, can actually be used at much higher temperature if there is no water present.
5. Flakeline 200 Series rated E-1 (to 100°F.) in aqueous solutions will be satisfactory, in most cases, if the temperature outside the tank reaches 10°F-20°F higher than this during the day.
6. Resin Topcoats. — ΔT — (Delta T) is the difference between the vessel contents and the outside temperature. There is evidence that resin topcoats on Flakeline 100 Series can fail by blistering if the ΔT is higher than 90°F. As a general rule, we rate the top coated Flakeline at 160°F.
7. Sealants are rated only for spillage service. In many cases they can also be used in immersion service.
8. For aggressive conditions in concrete vessels, use an electrically conductive primer so the lining can be spark tested for voids.
9. Flooring is rated for temperature resistance on the basis of the first column: Frequent or Severe Spills. Constant flow over a floor, or puddles in floors, are considered immersion service.
10. Flakeline 100 Series linings are not recommended for concrete surfaces simply because it is impossible to test the thickness with a magnetic gauge. Thickness of other linings is easier to control.

Product Temperature Limits

(Wet Service unless Indicated Dry)

Linings	Steel Substrate Immersion, Constant Flow or Condensing Temperatures °F. Approx. °C.		Concrete Substrate Immersion, Constant Flow or Condensing Temperatures °F Approx. °C	
Ceilcrete® Series	160	71	180	82
Coroline® Series Except 505.2	160	71	180	82
Coroline® 505.2	160	71	160	71
Ceilcote Lining Series Except 68	160	71	160	71
Ceilcote Lining 68	140	60	140	60
Flakeline® 100 Series	200	93	—	—
CeilLine 80	160	71	—	—
Heavy-Duty Coatings	**Steel Substrate Immersion or Condensing Vapor °F Approx. °C**		**Steel Substrate (Dry Service) °F Approx. °C**	
Flakeline® 222HT & 282	150	66	350	177
Flakeline® 200 Series (Except 222HT & 282)	130	54	300	149
Flakeline® 300 Series	120	49	220	104
Flakeline® 600 Series and Flaketar™	120	49	220	104
Floor Toppings	**Frequent or Severe Spills °F Approx. °C**		**Occasional Splash, Spill or Rinse °F Approx. °C**	
Ceilcrete®	160	71	300	149
Coroline® Series	170	76	300	149
Ceilcote 681 Floor/Corocrete T	170	76	250	121
Ceilcote 682 Floor	180	82	250	121
Ceilcote 683 Floor/Corocrete SL	140	60	200	93
Ceilcote 685 Floor	180	82	250	121
Corocrete SR	140	60	200	93
Polyesters, Vinyl Esters. Refer to Following charts	**Rating (1) Immersion, Constant Flow Frequent Spillage, Condensing Vapors.**		**Ratings (2 and 3) Dry and Non-Condensing Vapors Occasional Spills, Rinse.**	
211-212	130°F	54°C	180°	82°C
232	130°F	54°C	250°	121°C
242	130°F	54°C	250°	121°C
251-252	130°F	54°C	250°	121°C
300-350	120°F	49°C	180°	82°C
222HT	150°F	66°C	400°	204°C
Epoxies	**Rating (1) Immersion, Constant Flow Frequent Spillage, Condensing Vapors.**		**Ratings (2 and 3) Dry and Non-Condensing Vapors Occasional Spills, Rinse.**	
650HB/FDA	120°F	49°C	250°F	121°C
661	120°F	49°C	225°F	106°C
600	120°F	49°C	225°F	106°C
615/620	Not Recommended		250°F/300°F	121°C/149°C
630	170°F	76°C	300°F	149°C
Urethanes	**Rating (1) Immersion, Constant Flow Frequent Spillage, Condensing Vapors.**		**Ratings (2 and 3) Dry and Non Condensing Vapors Occasional Spills, Rinse.**	
470	Not Recommended		250°F	121°C
480	Not Recommended		250°F	121°C
Expansion Joint Sealants	**Immersion or Condensing Vapors °F Approx. °C**		**Occasional Splash Spill or Rinse °F Approx. °C**	
Ceilcote EJ3 & 4	140	60	200	93
Ceilcote EJ10	120	49	180	82
Ceilcote EJ11	—	—	—	—

Notes on chemicals in Corrosion Chart

NOTE: 1 Lab tested at ambient temperature or at temperature rated. For higher temperatures, Master Builders Technologies should be consulted.

NOTE: 2 Requires carbon filler for Ceilcretes and Corolines, resin topcoats for Flakelines and CeilLine 80, a synthetic veil for the Ceilcote Lining Series.

NOTE: 3 Linings for Potassium or Sodium Chlorate are limited to 160°F. Coroline and Flakeline 100 Series are rated C-1, since there is no lette designation for 160°F. They are actually good for 160°F.

NOTE: 4 A lining for Bright Nickel plating tanks must be approved by the supplier of the bath salts. For wastes, this is not required.

Selecting the right floor system.

To help you determine the best floor system for your process environment, we have rated the performance of each system under a complete range of service conditions.

It may be necessary to combine materials or alter standard specifications to meet your requirements. Such versatility is built into Master Builders Technologies floor materials. Consult Master Builders Technologies concerning your specific application.

	WEAR			THERMAL			NEW/OLD CONCRETE					CHEMICAL SPILLAGE							SPECIALIZED AREAS					CONDITIONS		
	Heavy Truck Traffic	Occasional Truck Traffic	Foot Traffic Only	Thermal Shock 110°F to 40°F	Thermal Shock 220°F to 40°F	Thermal Shock 130°F to -20°F	Hairline Cracking	Mild Cracking	Cure Stress Relief	Construction Joint Cracking	Eroded Aggregate Exposed	Powdery Poorly Cured Surface	Mineral Acids Concentrated	Mineral Acids Dilute	Caustics	Aromatic Solvents	Chlorinated Solvents	Aliphatic Solvents	Fats and Oils	Organic Acids	Sanitary	Trenches	Foundations	Coolers and Freezers	Laboratories	Low Temp. Cure (Down to 30°F)	Damp Surfaces	Minimum Downtime
Ceilcote 681 Floor: **Unreinforced Topping, Traffic.** Aggregate-filled ⅛" to ¼" topping. High wear resistance, durability, and chemical resistance; convenient floor-patching maintenance material. Meets current USDA requirements.	E	E	E	G	F	G	F	F	N	E	N	F	G	E	F	F	E	G	F	G	N	N	G	F	E	E	E
Ceilcote 682 Floor: **Fiberglass Reinforced, Sanitary.** 100-mil floor. Epoxy resin modified for maximum cleanability, chemical, and thermal-shock resistance. Meets current USDA requirements.	F	G	E	E	E	E	E	E	E	E	G	F	G	E	G	G	E	E	G	E	N	N	E	E	E	E	F
Ceilcote 683 Floor: **Light Duty.** self-leveling 55-mil coating. Epoxy resin modified for um cleanability and chemical resistance. Meets current s requirements.	F	G	E	G	F	G	G	F	N	G	N	F	G	E	G	G	E	E	G	E	N	N	F	E	E	E	E
Ceilcote 685 Floor: **Heavy Duty.** Fiberglass-reinforced 3/16" floor. Epoxy resin modified for maximum wearability, chemical, and thermal-shock resistance. Meets current USDA requirements.	E	E	E	E	G	G	G	G	F	E	G	F	G	E	G	G	E	E	G	G	N	E	E	F	E	E	F
Ceilcrete Series: Fiberglass Reinforced, Floor and Immersion. Fiberglass-reinforced 5/32" lining. Polyester resin modified for maximum chemical resistance. Available with: Silica filler — standard applications Carbon filler — conductive or special corrosive environments. Abrasion-resistant filler — agitated slurries.	G	E	E	E	F	G	G	G	N	E	F	E	E	G	E	E	E	E	E	G	E	E	F	F	F	F	F
Coroline Series (505M 505.2 are FDA Acceptable) Fiberglass-reinforced 5/32" lining. Epoxy resins modified for maximum chemical resistance. Available with: Silica filler — standard applications. Carbon filler — conductive or special corrosive environments Abrasion-resistant filler — agitated slurries	G	E	E	E	G	G	G	F	N	E	F	F	G	E	E	E	E	E	G	G	E	E	F	F	N	F	F
Corocrete F: **Underlayment, Restoration (USDA Approved)** Aggregate filled ⅜"-6" polymer concrete. Ease of placement, rapid-setting and compatible with most Ceilcote systems	E	E	E	G	F	G	F	F	N	E	N	N	F	G	N	N	F	F	F	N	N	N	G	N	F	F	E
Corocrete T: **Unreinforced Topping, Traffic (USDA Approved)** Aggregate filled ¼" topping. High wear resistance, durability and moderate chemical resistance.	E	E	E	G	F	F	F	F	N	E	F	N	G	G	F	N	G	G	F	G	N	N	N	N	F	F	G
Corocrete SL: Medium Duty, Cleanable. Semi-self-leveling 55 mil topping. Modified for maximum clean ability and chemical resistance. Skid resistance or smooth finish available. Meets current USDA requirements.	N	F	E	G	F	G	G	F	N	F	N	F	G	E	G	G	E	E	G	E	N	N	F	E	E	E	E
Corocrete SR: Personnel Safety Floor. Two coat roller applied skid resistant system. Nominal 40-60 mils incorporates alumina grit for maximum wear and slip resistance.	G	E	E	G	F	G	G	F	N	G	F	N	F	G	F	F	G	G	F	G	N	E	F	F	N	N	G
Corocrete CS: ete Sealer. scosity, one component system for use on virtually all new concrete surfaces where dusting is a problem. Ideal for warehouse applications.	G	E	E	G	F	G	N	N	N	G	E	F	G	G	G	G	G	G	F	G	E	E	G	F	N	N	E

E = Excellent G = Good F = Fair N = Not recommended

Master Builders Technologies

	Celline 80	Coroline 505/510/505.6/505.2	Coroline 505M	Coroline 550	Celcote 2500 International	Celcrete 2500 U.S.A.	Celcrete 5500	Celcrete 6400	Celcrete 8650	Flakeline 103	Flakeline 161	Flakeline 164	Flakeline 180	Celcote Lining 25	Celcote Lining 61	Celcote Lining 64	Celcote Lining 68	Celcote Lining 74	Celcote Lining 652	Flakeline 211/212	Flakeline 222HT	Flakeline 232
Acetaldehyde 100%	T	T	T	N	N	T	T	T	T	N	N	N	T	N	N	N	T	N	N	T	T	
Acetic Acid - 10%	A1	T	T	T	C1	A1	A1	A1	A1	C1	B1	C1	A1	C1	A1	C1	N	A1	C1	A1	A1	A1
Acetic Acid - 10-50%	A1	N	N	N	D1	C1	C1	D1	A1	D1	C1	D1	C1	D1	C1	D1	N	A1	D1	A1	C1	A1
Acetic Acid 50% to (Glacial) 100%	D1	N	N	N	T	D1	D1	T	D1	T	D1	T	D1	T	D1	T	N	D1	T	E2	A1	A1
Acetic Anhydride	D1	N	N	N	E1	D1	D1	D1	D1	D1	D1	D1	D1	E1	D1	E1	N	D1	E1	D2	E1	E1
Acetone - 100%	C2	C2	C2	D2	N	C2	C2	N	C2	N	C2	N	C2	N	C2	N	N	C2	N	N	C2	D2
Acetone - 10%	C1	A1	C1	D1	E1	C1	C1	D1	A1	D1	C1	N	C1	E1	C1	N	E2	A1	E1	T	A1	A1
Acetyl Chloride - 100%	T	T	T	N	N	T	T	N	T	N	T	N	T	N	T	N	N	T	N	N	T	T
Acrylic Acid - 100%	D1	N	N	N	E1	D1	D1	D1	D1	D1	D1	D1	D1	E1	D1	D1	N	D1	E1	E2	A2	A2
Acrylonitrile	T	N	N	N	N	N	N	T	N	N	N	N	T	N	N	N	N	T	N	N	T	T
Adipic Acid - 25%	C1	C1	D1	D1	D1	C1	C1	D1	C1	C1	D1	D1	C1	D1	C1	D1	T	C1	D1	D1	C1	D1
Allyl Alcohol[1]	D1	E1	E1	T	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	T	D1	D1
Allyl Chloride	T	T	T	N	N	T	T	N	T	N	N	N	T	N	T	N	N	T	N	N	T	T
Alum (Saturated Solution)	C1	C1	C1	D1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	A1	C1	C1	D1	C1	D1
Aluminum Bromide	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	A1	A1
Aluminum Chloride	A1	A1	A1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Aluminum Nitrate (Saturated)	A1	A1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Aluminum Sulfate	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	A1	C1	C1	A1	A1	A1
Ammonia (Wet Gas)	C1	A1	A1	A1	C1	C1	C1	N	C1	B1	C1	N	C1	C1	C1	N	A1	C1	C1	N	A1	A1
Ammonium Chloride	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Ammonium Cocoampholyte[1] - 30%	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	T	C1	C1	T	C1	D1
Ammonium Fluoride - 10%[2]	C1	A1	C1	C1	A1	A1	A1	A1	A1	C1	C1	C1	C1	C1	C1	C1	A1	C1	C1	A1	A1	A1
Ammonium Hydroxide - 20%	D1	C1	C1	C1	D1	D1	D1	N	D1	N	N	N	N	D1	D1	N	E1	E1	D1	N	N	E1
Ammonium Lauryl Sulfate[1] - 30%	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	A1	D1	D1	A1	A1	A1
Ammonium Nitrate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Ammonium Persulfate	A1	D1	D1	D1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Ammonium Sulfate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Ammonium Sulfide	A1	A1	A1	A1	A1	A1	A1	D1	A1	A1	A1	D1	A1	A1	A1	D1	A1	A1	A1	A1	A1	A1
Ammonium Sulfite	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Ammonium Xylene Sulfonate[1] - 40%	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	A1	C1	C1	A1	D1	D1
Amyl Acetate[1]	D1	T	T	T	E1	D1	D1	D1	D1	D1	D1	D1	D1	E1	D1	D1	N	D1	T	N	D1	D1
Amyl Alcohol	N	D1	D1	D1	C1	C1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	D1	A1	A1	A1
Aniline	D1	N	N	N	N	T	T	E1	D1	N	T	E1	D1	N	T	E1	N	D1	N	N	D1	D1
Aniline Hydrochloride	A1	C1	C1	D1	C1	C1	C1	N	A1	D1	T	T	A1	C1	T	N	T	A1	C1	T	C1	A1
Anodizing-Chromic			See Chromic Acid - 10%																			
Anodizing-Sulfuric			See Sulfuric Acid - 20-50%																			
Antimony Chloride (tri)	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	E1	E1	E1
Aqua Regia	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Arsenous Acid	C1	T	T	T	D1	D1	D1	D1	C1	C1	A1	A1	C1	C1	A1	A1	T	C1	C1	D1	C1	D1
Barium Chloride	A1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Barium Hydroxide	C1	A1	A1	A1	C1	C1	C1	E1	C1	C1	C1	E1	C1	C1	C1	E1	A1	C1	C1	N	C1	D1
Barium Sulfide	C1	A1	A1	C1	C1	C1	C1	E1	C1	C1	C1	E1	C1	C1	C1	E1	A1	C1	C1	E1	C1	D1
Benzal Chloride	T	D1	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Benzaldehyde	E1	T	T	T	N	T	T	N	E1	N	T	N	E1	N	T	N	N	E1	N	N	E1	E1
Benzene (Benzol)	D1	D1	D1	T	N	E1	D1	E1	D1	N	D1	E1	D1	N	E1	E1	N	D1	N	N	D1	D1
Benzene Sulfonic Acid 50-100%	C1	T	T	T	C1	C1	C1	D1	C1	B1	C1	D1	C1	C1	C1	D1	N	C1	C1	A1	C1	A1
Benzene Thiol	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Benzyl Alcohol[1]	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	D1	T	D1	D1	D1	T	T	D1	T	T	D1	D1
Benzoic Acid (Saturated)	A1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Benzoyl Chloride	T	D1	D1	D1	T	T	T	N	T	T	T	N	T	T	T	N	T	T	T	T	T	T
Benzyl Chloride[1]	T	D1	T	T	N	T	T	N	T	N	T	N	T	N	T	N	N	T	N	N	T	T
Black Liquor (Paper)	C1	A1	A1	C1	C1	C1	C1	C1	C1	C1	C1	N	C1	C1	C1	N	A1	C1	C1	N	C1	D1
Boric Acid (Saturated)	A1	C1	C1	C1	A1	A1	A1	A1	A1	B1	A1	D1	A1	A1	A1	D1	A1	A1	A1	A1	A1	A1
Bromine, Wet Gas	D1	N	N	N	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	N	D1	D1	T	D1	D1
Bromine, Dry Gas	D3	N	N	N	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	N	D3	D3	T	D3	D3
Bromine Water - 5%	D1	N	N	N	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	N	D1	D1	T	D1	D1
Butanol Normal	D1	C1	C1	C1	D1	C1	C1	D1	C1	D1	C1	D1	D1	D1	C1	D1	T	D1	D1	A1	C1	A1
Butyl Acetate	E2	T	N	N	N	N	N	N	E2	N	N	N	E2	N	N	N	N	E2	N	N	E2	E2

CEILCOTE
Corrosion Control Products

	DUTY LININGS										FLOOR TOPPINGS							SEALANTS		
	Flakeline 242/242	Flakeline 251/252	Flakeline 252 International	Flakeline 261/262	Flakeline 282	Flakeline 300/350	Flakeline 600 & Flaketar 661	Ceilcote 681/685 Corocrete T	Ceilcote 682/683 Corocrete SL/SR	Ceilcrete 695	Ceilcrete 2500 U.S.A.	Ceilcrete 2500 Int.	Ceilcrete 5500	Ceilcrete 6400	Ceilcrete 6650	Coroline 505/510	Ceilcote EJ10	Ceilcote EJ11	Ceilcote EJ3/4
Acetaldehyde 100%	N	D2	N	N	D2	N	N	N	E2	D2	D2	N	D2	N	D2	D2	N	N	N
Acetic Acid - 10%	A1	A1	A1	A1	A1	A1	N	D2	D2	A2	A2	A2	A2	A2	A2	D2	D2	E2	D2
Acetic Acid - 10-50%	D1	A1	D1	D1	C1	D2	N	N	N	A2	A2	A2	A2	A2	A2	N	D2	T	T
Acetic Acid 50% to (Glacial) 100%	D2	A2	D2	D2	A2	N	N	N	N	A2	C2	D2	A2	D2	A2	N	N	N	N
Acetic Anhydride	E2	D2	D2	D2	E1	E2	N	N	N	A2	D2	D2	D2	D2	D2	N	T	N	T
Acetone - 100%	N	E2	N	N	C2	N	N	N	D2	C2	E2	N	E2	E2	C2	C2	N	N	N
Acetone - 10%	E1	A1	E1	D1	A1	E2	E2	D2	D2	A2	A2	A2	A2	A2	A2	A2	T	T	T
Acetyl Chloride - 100%	N	T	N	T	T	N	N	D1	T	T	T	T	T	T	T	T	N	T	N
Acrylic Acid - 100%	E2	A2	E2	E2	A2	E2	N	N	N	A2	C2	D2	C2	D2	A2	N	N	T	N
Acrylonitrile	N	N	N	N	T	N	N	N	N	T	T	N	T	N	T	N	N	T	N
Adipic Acid - 25%	D1	D1	D1	D1	C1	D2	T	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	E2	D2
Allyl Alcohol	D1	D1	D1	D1	D1	E1	T	D2	D2	A2	A2	A2	A2	A2	A2	D2	T	E2	T
Allyl Chloride	N	T	N	T	T	N	N	N	T	D2	T	N	T	T	D2	T	T	T	T
Alum (Saturated Solution)	D1	D1	D1	D1	C1	D2	D2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Aluminum Bromide	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	E2	D2
Aluminum Chloride	A1	A1	A1	A1	A1	A1	E1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Aluminum Nitrate (Saturated)	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Aluminum Sulfate	A1	A1	A1	A1	A1	E1	E1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Ammonia (Wet Gas)	A1	A1	A1	N	A1	N	E1	A2	A2	A2	A2	A2	A2	D2	A2	A2	D2	E2	T
Ammonium Chloride	A1	A1	A1	A1	A1	E1	E1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Ammonium Cocoampholyte - 30%[1]	D1	D1	D1	D1	C1	T	T	T	T	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Ammonium Fluoride - 10%[2]	A1	A1	A1	A1	A1	D2	D2	E2	D2	A2	A2	A2	A2	A2	A2	A2	D2	E2	D2
Ammonium Hydroxide - 20%	E1	E1	E1	N	N	N	E1	A2	A2	A2	A2	A2	A2	D2	A2	A2	D2	E2	T
Ammonium Lauryl Sulfate - 30%[1]	A1	A1	A1	A1	A1	A1	D2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Ammonium Nitrate	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Ammonium Persulfate	A1	A1	A1	A1	A1	A1	A2	D2	D2	A2	A2	A2	A2	A2	A2	D2	D2	D2	D2
mmonium Sulfate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
mmonium Sulfide	A1	A1	A1	E1	A1	A2	E1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Ammonium Sulfite	A1	A1	A1	A1	A1	A1	E1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Ammonium Xylene Sulfonate - 40%[1]	D1	D1	D1	D1	D1	D1	T	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Amyl Acetate[1]	T	D1	D1	D1	D1	N	T	T	T	D2	D2	D2	D2	D2	D2	D2	N	N	N
Amyl Alcohol	A1	A1	A1	A1	A1	A1	A2	D2	D2	A2	A2	A2	A2	A2	A2	A2	D2	E2	T
Aniline	N	T	N	E1	D1	N	N	N	N	D2	T	N	T	D2	D2	N	N	E2	N
Aniline Hydrochloride	D1	D1	D1	N	C1	T	T	T	T	A2	A2	A2	A2	A2	A2	D2	T	T	T
Anodizing-Chromic	See Chromic Acid - 10%																		
Anodizing-Sulfuric	See Sulfuric Acid - 20-50%																		
Antimony Chloride (tri)	E1	E1	E1	E1	E1	T	T	E2	E2	D2	D2	D2	D2	D2	D2	E2	D2	C2	D2
Aqua Regia	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Arsenous Acid	D1	D1	D1	D1	C1	D1	T	T	T	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Barium Chloride	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Barium Hydroxide	D1	D1	D1	E1	C1	D2	D1	A2	A2	A2	A2	A2	A2	D2	A2	A2	D2	E2	T
Barium Sulfide	D1	D1	D1	E1	C1	D2	D1	A2	A2	A2	A2	A2	A2	D2	A2	A2	D2	E2	D2
Benzal Chloride	T	T	T	T	T	T	N	T	T	T	T	T	T	T	T	D2	N	E2	T
Benzaldehyde	N	T	N	N	E1	N	N	T	T	D2	T	T	T	T	D2	T	T	N	T
Benzene (Benzol)	N	D1	N	D1	D1	D2	N	D2	D2	D2	D2	N	D2	D2	D2	D2	N	T	N
Benzene Sulfonic Acid 50-100%	A1	A1	A1	A1	C1	E1	T	T	T	A2	A2	A2	A2	A2	A2	T	T	T	T
Benzene Thiol	N	N	N	N	N	N	N	N	N	T	T	N	N	N	N	N	N	T	N
Benzyl Alcohol[1]	D1	D1	D1	T	D1	D1	T	T	T	D2	D2	D2	D2	T	D2	D2	T	D2	T
Benzoic Acid (Saturated)	A1	A1	A1	A1	A1	A1	E1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	E2	D2
Benzoyl Chloride	T	T	T	N	T	T	T	T	T	T	T	T	T	N	T	D2	T	T	T
Benzyl Chloride[1]	N	T	N	N	T	N	T	T	T	D2	T	T	T	T	D2	D2	N	T	N
Black Liquor (Paper)	D1	D1	D1	N	C1	N	E1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	T	T
Boric Acid (Saturated)	A1	A1	A1	A1	A1	E1	E1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Bromine, Wet Gas	D1	D1	D1	D1	D1	T	N										N	D2	N
Bromine, Dry Gas	D3	D3	D3	D3	D3	T	N										N	D2	N
Bromine Water - 5%	D1	D1	D1	D1	D1	T	N	N	N	A2	A2	A2	A2	A2	A2	N	N	D2	N
Butanol Normal	A1	A1	A1	A1	A1	E1	T	D2	D2	A2	A2	A2	A2	A2	A2	A2	T	D2	T
ityl Acetate	N	N	N	N	E2	T	T	T	T	D2	D2	D2	D2	D2	D2	D2	N	N	N

KEY TO CHEMICAL RESISTANCE CHART

Rating Description
- A Good to Maximum Temperature of Product
- B Good to 180 °F (82 °C) Maximum
- C Good to 140 °F (60 °C)
- D Good to 120 °F (49 °C) Ambient
- E Good to 100 °F (37 °C)

Rating Description
- 1 Immersion or Constant Flow or Condensing Vapor
- 2 Occasional Splash or Spill
- 3 Fumes Only, Not Condensing
- N Not Recommended

Rating Description
- T Varies With Conditions. May Require Test. Consult Master Builders Technologies for Recommendation

Master Builders Technologies

	HEAVY DUTY LININGS																				LIGHT	
	Ceiline 80	Coroline 505/510/505.6/505.2	Coroline 505M	Coroline 550	Ceilcrete 2500 International	Ceilcrete 2500 U.S.A.	Ceilcrete 5500	Ceilcrete 6400	Ceilcote 6650	Flakeline 103	Flakeline 161	Flakeline 164	Flakeline 180	Ceilcote Lining 25	Ceilcote Lining 61	Ceilcote Lining 64	Ceilcote Lining 68	Ceilcote Lining 74	Ceilcote Lining 652	Flakeline 211/212	Flakeline 222HT	Flakeline 232
Butyl Acrylate[1]	T	N	N	N	N	T	T	N	T	N	T	N	T	N	T	N	T	T	N	N	E1	E1
Butyl Amine	T	N	N	N	N	N	N	N	T	N	N	N	T	N	N	N	N	T	N	N	T	T
Butyl Carbitol[1]	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	T	D1	D1
Butyl Carbitol Acetate[1]	E1	D1	T	N	N	T	T	E1	E1	N	T	E1	E1	N	T	E1	N	E1	N	N	E1	E1
Butyl Cellosolve[1]	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	T	D1	D1
Butyl Cellosolve Acetate[1]	E1	D1	T	N	T	E1	E1	E1	E1	T	E1	E1	E1	T	E1	E1	N	E1	T	N	E1	E1
Butyl Ether[1]	D1	T	T	T	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	T	C1	D1
Butyl Acid Levulinic[1]	D1	D1	T	T	D1	D1	D1	T	D1	D1	D1	T	D1	D1	D1	T	N	D1	D1	T	D1	D1
Butyric Acid - 100%[1]	D1	N	N	N	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	N	D1	D1	T	D1	D1
Cadmium Plating - Cyanide	C1	A1	A1	A1	C1	C1	C1	N	C1	C1	C1	N	C1	C1	C1	N	A1	C1	C1	N	A1	A1
Calcium Bisulfite	A1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Calcium Chloride	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Calcium Hydroxide[2]	C1	A1	A1	A1	C1	C1	C1	D2	C1	N	N	N	N	C1	C1	N	A1	C1	C1	N	N	A1
Calcium Hypochlorite - 5%[2]	D1	N	N	N	D1	D1	D1	D1	D1	N	N	N	N	E1	C1	N	N	A1	A1	N	N	D1
Calcium Nitrate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Caprylic Acid (Octanoic Acid)[1]	A1	N	N	N	C1	C1	C1	C1	A1	C1	C1	C1	A1	C1	C1	C1	N	A1	C1	E1	C1	D1
Carbolic Acid (Phenol) - 88%	E1	N	N	N	N	N	N	N	E1	N	N	N	E1	N	N	N	N	E1	N	N	E1	E1
Carbon Bisulfide (Di) Fumes (Wet)	C1	D1	D1	D1	D1	E1	E1	N	C1	D1	E1	N	C1	D1	E1	N	T	C1	N	N	C1	A1
Carbon Tetrachloride	C1	C1	C1	D1	E1	C1	C1	C1	A1	E1	C1	C1	C1	E1	C1	C1	A1	A1	E2	T	A1	D1
Castor Oil	C1	D1	D1	D1	A1	A1	A1	A1	A1	C1	C1	C1	C1	A1	A1	A1	E1	A1	A1	D1	A1	D1
Cellosolve[1]	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	D1	C1	D1
Cellosolve Acetate[1]	D1	D1	T	T	N	E1	E1	E1	D1	N	E1	E1	D1	N	E1	E1	T	D1	N	N	D1	D1
Chloroacetic Acid - 1-20%[1]	B1	N	N	N	C1	A1	A1	D1	A1	C1	B1	D1	B1	C1	A1	D1	N	A1	C1	D1	D1	D1
Chloroacetic Acid - 20-50%[1]	D1	N	N	N	E1	D1	D1	E1	D1	E1	D1	D1	D1	E1	D1	D1	N	D1	E1	T	D1	D1
Chloroacetic Acid - 50-100%[1]	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E2	E2
Chlorine Dioxide Solution	C1	N	N	N	A1	A1	A1	D1	C1	A1	A1	D1	C1	A1	A1	D1	N	C1	C1	T	A1	A1
Chlorine Gas - Dry	A3	N	N	N	A3	A3	A3	A3	A3	B3	B3	B3	B3	A3	A3	A3	N	A3	A3	D3	A3	A3
Chlorine Gas - Wet	A3	N	N	N	A3	A3	A3	A3	A3	B3	B3	B3	B3	A3	A3	A3	N	A3	A3	N	A3	A3
Chlorine Water - Saturated	A1	N	N	N	A1	A1	A1	A1	A1	B1	B1	B1	B1	A1	A1	A1	N	A1	A1	E1	A1	A1
Chlorobenzene (Mono)[1]	D1	D1	D1	T	N	E1	E1	N	D1	N	E1	N	D1	N	E1	N	N	D1	N	T	D1	D1
Chlorobutane[1]	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	T	D1	D1
Chloroform	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E2	E2
Chlorophenol	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Chlorosulfonic Acid	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Chlorotoluene[1]	D1	D1	E1	T	N	E1	E1	N	D1	N	E1	N	D1	N	E1	N	N	D1	N	N	D1	D1
Chromic Acid - 10%	A1	N	N	N	N	N	N	A1	A1	N	N	B1	E1	N	N	A1	N	E1	N	N	E1	E1
Chrome Plating 20-48 oz/gal[2]	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	C1	N	T	N	D2	D2	D2
Chromic Chloride	A1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Citric Acid	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Copper Plating - Cyanide	D1	A1	A1	A1	D1	D1	D1	D1	D1	D1	D1	D1	D1	C1	C1	N	A1	C1	C1	N	D1	D1
Copper Plating - Acid	A1	D1	D1	D1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Corn Oil	A1	D1	D1	D1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Cottonseed Oil	A1	D1	D1	D1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Cresol (Cresylic Acid)[1]	T	N	N	N	N	T	T	N	T	N	T	N	T	N	T	N	N	T	N	N	T	T
Cresylic Acid[1]	T	N	N	N	N	T	T	N	T	N	T	N	T	N	T	N	N	T	N	N	T	T
Cumene[1]	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	N	D1	D1	D1	D1	D1
Cyclohexane[1]	C1	C1	C1	C1	D1	A1	A1	C1	A1	D1	B1	C1	C1	D1	A1	C1	T	C1	D1	D1	C1	D1
Cyclohexanone[1]	D1	D1	D1	T	E1	D1	D1	T	D1	E1	D1	T	D1	E1	D1	T	N	D1	E1	T	D1	D1
Cymene[1]	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	A1	D1	D1	T	D1	D1
Dextrose	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Dibromopropane Phosphate[1]	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	T	E1	E1	E1	E1	E1
Dibutyl Phthalate	C1	A1	A1	A1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	T	C1	C1	D1	A1	D1
Dichloro Acetic Acid - 20%[1]	D1	N	N	N	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	N	D1	D1	D1	D1	D1
Diethanolamine[1]	D1	N	N	N	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	D1	D1	D1
Diethylene Chloroformate[1]	T	T	T	T	N	T	T	N	T	N	T	N	T	N	T	N	N	T	N	N	E2	E2
Diethylketone - 100%[1]	E1	T	T	T	N	T	T	T	E1	N	T	T	E1	N	T	T	N	E1	N	N	E1	E1
Dimethylaminopropylamine	T	N	N	N	N	N	N	N	T	N	N	N	T	N	N	N	N	T	N	N	T	T
Dimethyl Aniline	D1	T	T	T	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	D1	D1	D1

* Lining Series

CEILCOTE Corrosion Control Products

	DUTY LININGS												FLOOR TOPPINGS						SEALANTS	
	Flakeline 242	Flakeline 251/252	Flakeline 252 International	Flakeline 261/262	Flakeline 282	Flakeline 300/350	Flakeline 600/Flaketar 661	Ceilcote 681/685/Corocrete T	Ceilcote 682/683/Corocrete SL/SR	Ceilcrete 895	Ceilcrete 2500 U.S.A.	Ceilcrete 2500 International	Ceilcrete 5500	Ceilcrete 6400	Ceilcrete 6650	Chroline 505/510	Ceilcote EJ10	Ceilcote EJ11	Ceilcote EJ3/4
Butyl Acrylate[1]	N	T	N	T	E1	N	N	N	T	D2	T	N	T	N	D2	N	N	D2	N
Butyl Amine	N	N	N	N	T	N	N	N	N	T	N	N	T	N	T	N	N	T	N
Butyl Carbitol[1]	D1	D1	D1	D1	D1	T	T	D2	D2	C2	C2	C2	C2	C2	C2	A2	N	D2	T
Butyl Carbitol Acetate[1]	N	E1	N	E1	E1	N	N	T	T	C2	D2	N	D2	D2	C2	C2	N	T	N
Butyl Cellosolve[1]	D1	D1	D1	D1	D1	T	T	T	D2	C2	D2	D2	D2	D2	D2	D2	N	E2	N
Butyl Cellosolve Acetate[1]	T	E1	T	E1	E1	N	N	N	E2	D2	D2	T	D2	D2	C2	C2	N	T	T
Butyl Ether[1]	D1	D1	D1	D1	C1	T	N	T	D2	C2	D2	D2	D2	D2	D2	D2	N	T	T
Butyl Acid Levulinic[1]	D1	D1	D1	T	D1	T	N	T	T	D2	D2	D2	D2	T	D2	D2	T	T	T
Butyric Acid - 100%[1]	D1	D1	D1	D1	D1	T	N	N	N	D2	D2	D2	D2	D2	D2	T	T	T	T
Cadmium Plating - Cyanide	A1	A1	A1	N	A1	N	A1	A2	A2	A2	A2	A2	A2	N	A2	A2	D2	E2	D2
Calcium Bisulfite	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Calcium Chloride	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Calcium Hydroxide[2]	A1	A1	A1	N	N	N	A1	A2	A2	A2	A2	A2	A2	N	A2	A2	A2	D2	A2
Calcium Hypochlorite - 5%[2]	D1	D1	D1	N	N	N	N	T	T	D2	D2	D2	D2	N	D2	T	T	D2	T
Calcium Nitrate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Caprylic Acid (Octanoic Acid)[1]	D1	D1	D1	D1	D1	D1	N	N	T	C2	C2	C2	C2	C2	C2	N	T	T	T
Carbolic Acid (Phenol) - 88%	N	N	N	N	E1	N	N	N	N	D2	N	N	N	N	D2	N	N	E2	N
Carbon Bisulfide (Di) Fumes (Wet)	N	E1	D1	N	C1	N	N	N	N	D2	D2	N	D2	N	C2	D2	N	D2	N
Carbon Tetrachloride	D1	D1	D1	D1	A1	A2	A2	D2	D2	C2	C2	D2	C2	D2	C2	A2	N	E2	N
Castor Oil	D1	D1	D1	D1	A1	T	T	T	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	T
Cellosolve[1]	D1	D1	D1	D1	A1	T	T	D2	D2	C2	C2	D2	C2	D2	C2	C2	N	E2	T
Cellosolve Acetate[1]	N	E1	N	E1	D1	N	N	N	T	D2	D2	T	D2	D2	D2	C2	N	N	N
Chloroacetic Acid - 1-20%[1]	D1	D1	D1	D1	D1	E1	N	N	T	A2	A2	C2	A2	C2	A2	T	T	T	T
Chloroacetic Acid - 20-50%[1]	E1	D1	E1	D1	D1	N	N	N	N	C2	C2	D2	C2	D2	C2	N	N	T	N
Chloroacetic Acid - 50-100%[1]	N	E2	N	N	E2	N	N	N	N	E2	E2	T	E2	T	E2	N	N	T	N
Chlorine Dioxide Solution	A1	A1	A1	A1	A1	N	N	N	N	A2	A2	A2	A2	A2	A2	N	T	E2	N
Chlorine Gas - Dry	A3	A3	A3	A3	A3	E3	N										T	E2	N
Chlorine Gas - Wet	A3	A3	A3	A3	A3	E3	N										T	E2	N
Chlorine Water - Saturated	A1	A1	A1	A1	A1	E2	N	N	T	A2	A2	A2	A2	A2	A2	N	T	E2	N
Chlorobenzene (Mono)[1]	N	D1	N	N	D1	T	N	N	T	D2	D2	N	D2	N	D2	D2	N	E2	N
Chlorobutane[1]	D1	D1	D1	D1	D1	T	T	T	T	D2	D2	D2	D2	D2	D2	D2	T	T	T
Chloroform	N	E2	N	N	E2	N	N	N	T	E2	T	N	T	N	E2	T	N	E2	N
Chlorophenol	N	N	N	N	N	N	N	T	T	E2	T	T	T	T	T	E2	N	T	N
Chlorosulfonic Acid	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E2	N
Chlorotoluene[1]	N	D1	N	N	D1	N	N	N	T	D2	D2	N	D2	N	D2	D2	N	T	N
Chromic Acid - 10%	N	N	N	A1	E1	N	E2	D2	D2	A2	A2	A2	A2	A2	A2	C2	D2	T	N
Chrome Plating 20 - 48 oz/gal[2]	N	N	N	D2	D2	N	N	N	N	D2	D2	D2	D2	C2	D2	N	N	T	N
Chromic Chloride	A1	A1	A1	A1	A1	A1	A1	D2	A2	A2	A2	A2	A2	A2	A2	A2	A2	T	D2
Citric Acid	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	C2	E2	C2
Copper Plating - Cyanide	D1	D1	D1	N	D1	N	D1	A2	A2	C2	C2	C2	C2	C2	C2	A2	D2	E2	D2
Copper Plating - Acid	A1	A1	A1	A1	A1	A1	A2	D2	D2	A2	A2	A2	A2	A2	A2	C2	C2	T	N
Corn Oil	A1	A1	A1	A1	A1	A1	T	C2	A2	A2	A2	A2	A2	A2	A2	A2	T	D2	D2
Cottonseed Oil	A1	A1	A1	A1	A1	A1	T	C2	A2	A2	A2	A2	A2	A2	A2	A2	T	D2	D2
Cresol (Cresylic Acid)[1]	N	T	N	N	N	N	N	N	N	T	T	N	T	N	T	N	N	E2	N
Cresylic Acid[1]	N	T	N	N	N	N	N	N	N	T	T	N	T	N	T	N	N	E2	N
Cumene[1]	D1	D1	D1	D1	D1	D2	N	T	T	D2	D2	D2	D2	D2	D2	D2	N	T	T
Cyclohexane[1]	D1	D1	D1	D1	D1	D1	T	C2	C2	C2	C2	C2	C2	C2	C2	C2	N	E2	D2
Cyclohexanone[1]	E1	D1	E1	T	D1	T	N	T	E2	D2	D2	E2	D2	D2	D2	A2	N	N	N
Cymene[1]	D1	D1	D1	D1	D1	T	T	T	D2	D2	D2	D2	D2	D2	D2	D2	N	T	T
Dextrose	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Dibromopropane Phosphate[1]	E1	E1	E1	E1	E1	E1	T	D2	D2	D2	D2	D2	D2	D2	D2	D2	T	T	T
Dibutyl Phthalate	D1	D1	D1	D1	A1	D1	T	D2	D2	A2	A2	A2	A2	A2	A2	A2	T	E2	T
Dichloro Acetic Acid - 20%[1]	D1	D1	D1	D1	D1	D2	N	N	N	D2	D2	D2	D2	D2	D2	T	T	T	T
Diethanolamine[1]	D1	D1	D1	D1	D1	D1	T	N	N	D2	D2	D2	D2	D2	D2	T	T	T	T
Diethylene Chloroformate[1]	N	E2	N	N	E2	N	N	N	D2	D2	D2	D2	D2	D2	D2	D2	T	T	T
Diethylketone - 100%[1]	N	T	N	T	T	N	N	T	T	D2	D2	N	D2	N	D2	D2	N	N	N
Dimethylaminopropylamine	N	N	N	T	T	N	N	N	N	T	T	N	T	N	T	N	N	T	N
Dimethyl Aniline	D1	D1	D1	D1	D1	D1	N	N	T	D2	D2	D2	D2	D2	D2	T	N	T	T

KEY TO CHEMICAL RESISTANCE CHART

Rating Description
- A Good to Maximum Temperature of Product
- B Good to 180 °F (82 °C) Maximum
- C Good to 140 °F (60 °C)
- D Good to 120 °F (49 °C) Ambient
- E Good to 100 °F (37 °C)

Rating Description
- 1 Immersion or Constant Flow or Condensing Vapor
- 2 Occasional Splash or Spill
- 3 Fumes Only, Not Condensing
- N Not Recommended

Rating Description
- T Varies With Conditions May Require Test. Consult Master Builders Technologies for Recommendation

Master Builders Technologies

HEAVY DUTY LININGS — LIGHT

	Ceilline 80	Coroline 505/510/505.2/505.6	Coroline 505M	Coroline 550	Ceilcrete 2500 International	Ceilcrete 2500 U.S.A.	Ceilcrete 5500	Ceilcrete 6400	Ceilcrete 6650	Flakeline 103	Flakeline 161	Flakeline 164	Flakeline 180	Ceilcote Lining 25	Ceilcote Lining 61	Ceilcote Lining 64	Ceilcote Lining 68	Ceilcote Lining 74	Ceilcote Lining 652	Flakeline 211/212	Flakeline 222HT	Flakeline 232
Dimethyl Carbamoyl Chloride[1]	E1	E1	E1	T	E1	E1	E1	T	E1	E1	E1	T	E1	E1	E1	T	T	E1	E1	T	E1	E1
Dimethyl Carbonyl Chloride[1]	T	E1	E1	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Dimethyl Formamide[1]	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	T	N	N	T	T	T
Dimethyl Sulfoxide[1]	T	T	T	N	E1	E1	E1	T	T	E1	E1	T	T	E1	E1	T	T	T	N	T	T	T
Dinitro Benzene[1]	T	E1	T	T	E1	T	T	E1	T	E1	T	E1	T	E1	T	E1	T	T	T	T	T	T
Dinitro Toluene[1]	T	E1	T	T	E1	T	T	E1	T	E1	T	E1	T	E1	T	E1	T	T	T	T	T	T
Dodecyl Alcohol (Lauryl)[1]	A1	D1	D1	T	C1	C1	C1	D1	A1	C1	C1	D1	A1	C1	C1	D1	E2	A1	C1	T	A1	D1
Ethoxy Ethanol[1]	E1	E1	T	E2	T	E1	E1	T	E1	T	E1	T	E1	T	E1	T	N	E1	T	T	E1	E1
Ethoxylated Nonyl Phenol[1]	T	C1	T	T	T	T	T	D1	T	T	T	D1	T	T	T	D1	T	T	T	T	E2	E2
Ethyl Acetate	T	T	N	N	N	T	T	N	T	N	T	N	T	N	T	N	N	T	N	N	T	T
Ethyl Acrylate	T	E1	N	N	N	T	T	N	T	N	T	N	T	N	T	N	N	T	N	N	T	T
Ethyl Alcohol	C1	C1	T	T	C1	C1	C1	D1	C1	C1	C1	D1	C1	C1	C1	D1	D2	C1	C1	E1	C1	D1
Ethylamine	T	N	N	N	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Ethyl Bromide	N	T	T	N	N	T	T	N	N	N	T	N	N	N	T	N	N	N	N	N	N	N
Ethyl Chloride	E1	T	T	N	T	D1	D1	E1	E1	T	D1	E1	E1	T	D1	E1	N	E1	T	T	E1	E1
Ethyl Chloroformate	T	T	T	N	N	T	T	N	T	N	T	N	T	N	T	N	T	T	N	N	T	T
Ethyl Ether	T	T	T	T	N	T	T	N	T	N	T	N	T	N	T	N	T	T	N	T	E2	E2
Ethyl Hexyl Acrylate	T	E2	T	T	T	T	T	T	T	T	T	T	T	T	T	T	N	T	T	T	T	T
Ethylene Dichloride	N	E1	N	N	N	T	T	N	N	N	T	N	N	N	T	N	N	N	N	T	N	N
Ethylene Glycol	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Ethylene Oxide (Dilute)	T	N	N	N	N	E1	E1	N	T	N	E1	N	T	N	E1	N	N	T	N	N	T	T
Ethyl Sulfate[1]	E1	E1	T	T	T	T	T	E1	E1	T	T	E1	E1	T	T	E1	N	E1	E1	T	E1	E1
Ferric Chloride	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Ferric Sulfate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Fluosilicic Acid* - 25%	N	T	T	T	C1	C1	C1	C1	C1	N	N	N	N	E1	E1	E1	T	E1	E1	N	N	N
Formaldehyde	C1	D1	D1	D1	D1	C1	C1	C1	C1	D1	C1	C1	C1	D1	C1	C1	A2	C1	C1	A1	A1	A1
Formic Acid	D1	N	N	N	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	N	D1	T	T	D1	D1
Furfural to 10%	E1	T	T	T	E1	E1	E1	T	E1	E1	E1	T	E1	E1	E1	T	T	E1	E1	T	E1	E1
Furfuryl Alcohol	E1	D1	D1	T	T	E1	E1	E1	E1	T	E1	E1	E1	T	E1	E1	T	E1	T	T	E1	E1
Gasoline																						
Aviation	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Diesel	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Jet Fuel	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Premium Unleaded	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Unleaded	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Glucose	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Glycerine	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Glycolic Acid to 70%	D1	T	N	N	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	D1	D1	D1
Gold Plating (Cyanide)	D1	A1	A1	A1	D1	D1	D1	N	D1	D1	D1	N	D1	D1	D1	N	A1	D1	D1	N	D1	D1
Grape Juice	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Green Liquor (Paper Ind)	C1	A1	A1	A1	C1	C1	C1	N	C1	C1	N	C1	C1	C1	C1	N	A1	C1	C1	N	C1	A1
Heptane	A1	A1	A1	A1	C1	A1	A1	A1	A1	C1	A1	A1	A1	C1	A1	A1	A1	A1	C1	A1	A1	A1
Hexane	A1	A1	A1	A1	D1	A1	A1	D1	A1	D1	A1	D1	A1	D1	A1	C1	A1	A1	C1	D1	A1	A1
Hydrazine - 35%	N	E1	T	T	T	T	T	N	N	T	T	N	N	T	T	N	T	N	N	N	N	N
Hydrazine Hydrate	T	E1	T	T	T	T	T	N	T	T	T	N	T	T	T	N	T	T	T	T	T	T
Hydriodic Acid - 20%	C1	T	T	T	C1	C1	C1	T	C1	C1	C1	T	C1	C1	C1	T	T	C1	C1	D2	C1	D1
Hydrobromic Acid - 20%	A1	T	T	T	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Hydrobromic Acid - 48%	C1	N	N	N	C1	C1	C1	A1	C1	C1	C1	A1	C1	C1	C1	A1	N	C1	C1	A1	C1	A1
Hydrochloric Acid - 10%	A1	E1	D2	D2	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	E2	A1	A1	A1	A1	A1
Hydrochloric Acid - 20%	A1	D2	D2	D2	A1	A1	A1	A1	A1	B1	B1	B1	B1	A1	A1	A1	D2	A1	A1	A2	A1	A2
Hydrochloric Acid - 37%	D2	N	N	N	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	N	D1	D1	E2	E1	E2
Hydrofluoric Acid - 1-10%[2]	D2	E1	E1	E1	D1	D1	D1	D1	D1	D2	D2	D2	D2	D1	D1	D1	E2	D1	D1	D2	D2	D2
Hydrofluoric Acid - 20%[2]	E2	E2	E2	E2	D1	D1	D1	D1	D1	E2	E2	E2	E2	D2	D2	D2	N	D2	D2	D2	D2	D2
Hydrofluoric Acid - 21 - 48%[2]	N	N	N	N	E1	E1	E1	E1	E1	N	N	N	N	E1	E1	E1	N	E1	E1	N	N	N
Hydrofluosilicic Acid 10%[2]	E1	C1	C1	C1	A1	A1	A1	A1	A1	E1	E1	E1	E1	A1	A1	A1	E2	A1	A1	E1	E1	E1
Hydrofluosilicic Acid - 35%[2]	D2	D2	D2	D2	D1	D1	D1	D1	D1	D2	D2	D2	D2	D1	D1	D1	T	D1	D1	D2	D2	D2
Hydrogen Peroxide - 30%	C1	T	T	T	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	E2	C1	C1	T	C1	D1
Hydrogen Sulfide Gas	A1	A1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Hypo (Photographic Solution)	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	D1	A1	A1	A1	A1	A1	A1
Hypochlorous Acid	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	T	T	N	N	N
Iodine, Crystals & Vapor	C1	T	T	T	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	T	C1	C1	D1	C1	D1
Isooctylthioglycolate[1]	D1	T	T	T	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	T	D1	D1

CEILCOTE Corrosion Control Products

	DUTY LININGS										FLOOR TOPPINGS								SEALANTS		
	Flakeline 242	Flakeline 251/252	Flakeline 252 International	Flakeline 261/262	Flakeline 282	Flakeline 300/350	Flakeline 600 & Flaketar 661	Ceilcote 681/685/Corocrete T	Ceilcote 682/683/Corocrete SL/SR	Ceilcrete 695	Ceilcrete 2500 U.S.A.	Ceilcrete 2500 International	Ceilcrete 5500	Ceilcrete 6400	Ceilcrete 6850	Coroline Series	Ceilcote EJ10	Ceilcote EJ11	Ceilcote EJ3/EJ4
Dimethyl Carbamoyl Chloride[1]	E1	E1	E1	E1	E1	T	N	T	D2	C2	C2	C2	C2	D2	C2	D2	T	T	T
Dimethyl Carbonyl Chloride[1]	T	T	T	T	T	N	N	T	T	D2	D2	D2	D2	D2	D2	D2	T	T	T
Dimethyl Formamide[1]	N	T	N	T	T	N	N	N	T	T	T	N	T	T	T	T	N	T	N
Dimethyl Sulfoxide[1]	D2	E1	E1	T	T	N	N	N	T	T	D2	D2	D2	T	T	T	N	T	N
Dinitro Benzene[1]	T	T	E1	E1	T	T	N	T	T	D2	D2	D2	D2	D2	D2	D2	T	T	T
Dinitro Toluene[1]	T	T	E1	E1	T	T	N	T	T	D2	D2	D2	D2	D2	D2	D2	T	T	T
Dodecyl Alcohol (Lauryl)[1]	D1	D1	D1	D1	A1	D2	T	D2	D2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Ethoxy Ethanol[1]	T	E1	T	T	E1	T	T	E2	E2	D2	D2	D2	D2	D2	D2	D2	T	T	T
Ethoxylated Nonyl Phenol[1]	T	T	T	E1	T	T	T	T	T	D2	D2	D2	D2	D2	D2	C2	T	T	T
Ethyl Acetate	N	E2	N	N	E2	N	N	T	E2	D2	D2	T	D2	N	D2	D2	N	N	N
Ethyl Acrylate	N	T	N	N	E2	N	N	N	T	D2	T	N	T	N	D2	D2	N	N	N
Ethyl Alcohol	D1	D1	D1	D1	C1	E1	E2	D2	C2	C2	C2	C2	C2	D2	C2	C2	E2	D2	E2
Ethylamine	T	T	T	T	T	N	N	N	N	T	T	T	T	T	T	N	N	T	N
Ethyl Bromide	N	N	N	N	N	N	N	N	T	T	T	T	T	T	T	T	N	T	N
Ethyl Chloride	T	D1	T	D1	T	E2	N	T	T	D2	D2	T	D2	D2	D2	T	N	T	N
Ethyl Chloroformate	N	T	N	N	T	N	N	N	D2	D2	D2	D2	D2	D2	D2	D2	T	T	T
Ethyl Ether	E2	D2	E2	E2	D2	N	N	N	D2	D2	D2	D2	D2	D2	D2	D2	N	T	T
Ethyl Hexyl Acrylate	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	D2	N	T	T
Ethylene Dichloride	N	T	N	N	N	N	N	N	N	D2	D2	N	D2	N	D2	D2	N	T	N
Ethylene Glycol	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Ethylene Oxide (Dilute)	N	E1	N	N	T	N	N	N	D2	D2	D2	D2	D2	D2	D2	D2	T	T	T
Ethyl Sulfate[1]	E1	T	T	E1	E1	T	T	T	D2	D2	T	T	T	D2	D2	D2	T	T	T
Ferric Chloride	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Ferric Sulfate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Fluosilicic Acid* - 25%	N	N	N	N	N	N	N	D2	D2	C2	C2	C2	C2	C2	C2	T	C2	C2	E2
Formaldehyde	A1	A1	A1	A1	A1	A1	D2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Formic Acid	T	D1	D1	D1	D1	T	N	N	N	D2	D2	D2	D2	D2	D2	D2	N	N	E2	N
Furfural to 10%	E1	E1	E1	T	E1	T	T	T	T	E2	E2	E2	E2	E2	E2	E2	T	T	E2	T
Furfuryl Alcohol	T	E1	T	E1	E1	T	N	D2	D2	D2	D2	T	D2	D2	D2	D2	T	D2	T
Gasoline																				
Aviation	N	A1	A1	A1	A1	A1	D2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2
Diesel	N	A1	A1	A1	A1	A1	D2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2
Jet Fuel	N	A1	A1	A1	A1	A1	C2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2
Premium Unleaded	A1	A1	A1	A1	A1	A1	D2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2
Unleaded	A1	A1	A1	A1	A1	A1	E1	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2
Glucose	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2	
Glycerine	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2	
Glycolic Acid to 70%	D1	D1	D1	D1	D1	D2	N	D2	D2	A2	A2	A2	A2	A2	A2	T	T	T	T	
Gold Plating (Cyanide)	D1	D1	D1	D1	D1	N	A2	A2	A2	A2	A2	A2	A2	E2	A2	A2	A2	T	A2	
Grape Juice	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2	
Green Liquor (Paper Ind)	A1	A1	A1	N	A1	N	A1	A2	A2	A2	A2	A2	A2	E2	A2	A2	A2	T	T	
Heptane	A1	A1	D1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	N	T	E2	
Hexane	A1	A1	D1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	N	D2	E2	
Hydrazine - 35%	N	T	T	N	N	T	T	T	D2	T	T	T	T	N	T	D2	T	T	T	
Hydrazine Hydrate	T	T	T	N	T	T	N	N	T	T	T	T	T	N	T	D2	T	T	T	
Hydriodic Acid - 20%	D1	D1	D1	D1	C1	N	N	N	T	C2	C2	C2	C2	T	C2	T	D2	T	T	
Hydrobromic Acid - 20%	A1	A1	A1	A1	A1	A1	N	N	T	A2	A2	A2	A2	A2	A2	T	T	T	N	
Hydrobromic Acid - 48%	A1	A1	A1	A1	A1	A2	N	N	N	A2	A2	A2	A2	A2	A2	T	T	T	N	
Hydrochloric Acid - 10%	A1	A1	A1	A1	A1	A2	D2	D2	C2	A2	A2	A2	A2	A2	A2	C2	D2	D2	D2	
Hydrochloric Acid - 20%	A2	A2	A2	A2	A1	D2	D2	D2	D2	A2	A2	A2	A2	A2	A2	D2	D2	D2	N	
Hydrochloric Acid - 37%	D2	D2	D2	D2	D2	E2	N	N	E2	D2	D2	D2	D2	D2	D2	D2	N	D2	N	
Hydrofluoric Acid - 1-10%[2]	D2	D2	D2	D2	N	N	D2	N	D2	C2	C2	C2	C2	C2	C2	D2	D2	D2	N	
Hydrofluoric Acid - 20%[2]	D2	D2	D2	D2	N	N	N	N	N	D2	D2	D2	D2	D2	D2	E2	T	D2	N	
Hydrofluoric Acid 21-48%[2]	N	N	N	N	N	N	N	N	N	E2	E2	E2	E2	E2	E2	N	N	T	N	
Hydrofluosilicic Acid 10%[2]	E1	E1	E1	E1	N	E2	E2	N	D2	A2	A2	A2	A2	A2	A2	C2	D2	D2	T	
Hydrofluosilicic Acid - 35%[2]	D1	D1	D1	D1	N	T	T	N	E2	C2	C2	C2	C2	C2	C2	D2	D2	D2	T	
Hydrogen Peroxide - 30%	D1	D1	D1	D1	C1	D2	D2	D2	D2	C2	C2	C2	C2	C2	C2	D2	T	D2	D2	
Hydrogen Sulfide Gas	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2	
Hypo (Photographic Solution)	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2	
Hypochlorous Acid	N	N	N	N	N	N	N	N	N	N	N	N	N	N	T	N	N	T	N	
Iodine, Crystals & Vapor	D1	D1	D1	D1	C1	D1	T	T	T	C2	C2	C2	C2	C2	C2	T	T	T	T	
Isooctylthioglycolate[1]	D1	D1	D1	D1	D1	D1	T	T	T	D2	D2	D2	D2	D2	D2	T	T	T	T	

KEY TO CHEMICAL RESISTANCE CHART

Rating Description
- A Good to Maximum Temperature of Product
- B Good to 180 °F (82 °C) Maximum
- C Good to 140 °F (60 °C)
- D Good to 120 °F (49 °C) Ambient
- E Good to 100 °F (37 °C)

Rating Description
1. Immersion or Constant Flow or Condensing Vapor
2. Occasional Splash or Spill
3. Fumes Only, Not Condensing
- N Not Recommended

Rating Description
- T Varies With Conditions, May Require Test. Consult Master Builders Technologies for Recommendation.

Master Builders Technologies

	HEAVY DUTY LININGS																				LIGHT	
	Celline 80	Coroline 505/510/505.2/505.6	Coroline 505M	Coroline 550	Celcrete 2500 International	Celcrete 2500 U.S.A.	Celcrete 5500	Celcrete 6400	Celcrete 8650	Flakeline 103	Flakeline 161	Flakeline 164	Flakeline 180	Celcote Lining 25	Celcote Lining 61	Celcote Lining 64	Celcote Lining 68	Celcote Lining 74	Celcote Lining 652	Flakeline 211/212	Flakeline 222HT	Flake[illegible]232
Isophorone[1]	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E2	E1	E1	D2	E1	E1
Isopropyl Acetate	E1	T	T	T	N	T	T	T	E1	N	T	T	E1	N	T	T	N	E1	N	N	E2	E2
Isopropyl Alcohol	C1	C1	C1	D1	D1	C1	C1	C1	C1	D1	C1	C1	C1	D1	C1	C1	D2	C1	D1	D1	C1	D1
Isopropyl Ether	T	E1	T	T	N	T	T	T	T	N	T	T	T	N	T	T	T	T	N	D2	E2	E2
Jet Fuel JP-4	A1	A1	A1	A1	D1	A1	A1	D1	A1	D1	A1	D1	A1	D1	A1	D1	D2	A1	D1	A1	A1	A1
Kerosene	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Ketchup	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Lactic Acid 1-20%	A1	T	T	T	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	A1	A1
Lactic Acid Concentrated	A1	N	N	N	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Lard	A1	E1	E1	E1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Lauric Acid	A1	T	T	T	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Lead Acetate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Lecithin[1]	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1
Levulinic Acid (Saturated)	A1	D1	D1	D1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	A1	D1
Linseed Oil	A1	D1	D1	D1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	A1	A1
Lithium Hydroxide - 10%[2]	N	A1	A1	A1	D1	D1	D1	N	D1	N	N	N	N	D1	D1	N	N	D1	D1	N	N	N
Lithium Hydroxide (Saturated)[2]	N	A1	A1	A1	C1	C1	C1	N	C1	N	N	N	N	C1	C1	N	N	C1	C1	N	N	N
Maleic Acid	A1	N	N	N	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Malic Acid[1]	C1	C1	C1	T	C1	C1	C1	D1	C1	C1	C1	D1	C1	C1	C1	D1	T	C1	C1	A1	C1	A1
Mercury and Salts	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Methanol 100%	N	D2	D2	D2	N	E2	E2	N	N	N	E2	N	N	N	E2	N	E2	N	N	E2	E2	E2
Methyl Acetate	T	T	N	N	N	T	T	N	T	N	T	N	T	N	T	N	N	T	N	N	E2	E2
Methylamyl Alcohol[1]	E1	E1	T	T	N	E1	E1	E1	E1	N	E1	E1	E1	N	E1	E1	T	E1	E1	T	E1	E1
Methylene Chloride	E2	E2	N	N	N	N	N	N	E2	N	N	N	E2	N	N	N	N	E2	N	N	E2	E2
Methyl Chloride	E1	N	N	N	N	N	N	N	E2	N	N	N	E2	N	N	N	N	E2	N	N	E2	E2
Methyl-Ethyl Ketone	E2	E2	E2	T	N	E2	E2	N	E2	N	E2	N	E2	N	E2	N	N	E2	N	N	E2	E2
Methyl Oleate[1]	D1	E1	T	T	E1	E1	E1	E1	D1	E1	E1	E1	D1	E1	E1	E1	T	D1	E1	E1	D1	D1
Methyl Isobutyl Ketone[1]	E1	E1	E1	T	N	T	T	N	E1	N	T	N	E1	N	T	N	N	E1	N	N	E1	E1
Milk - Fresh & Sour	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Molasses	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Naphtha - Aliphatic	A1	A1	C1	C1	C1	A1	A1	A1	A1	C1	A1	A1	A1	C1	A1	A1	A1	A1	A1	A1	A1	A1
Naphtha, Aromatic (Coal Tar)	C1	D1	D1	D1	T	D1	D1	D1	C1	T	D1	D1	C1	T	D1	D1	T	C1	T	T	C1	D1
Naphthalene (In Benzene)	D1	D1	D1	T	N	D1	D1	E1	D1	D1	D1	E1	D1	N	D1	E1	T	D1	N	D2	D1	D1
Naphthenic Acid[1]	D1	D1	D1	D1	T	D1	D1	T	D1	T	D1	T	D1	T	D1	T	T	D1	T	D1	D1	D1
Nickel Plating, Bright[4]	A1	C1	C1	T	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A2	A1	A1	A1	A1	A1
Nitric Acid - 5%	A1	E2	E2	E2	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Nitric Acid - 10%	B1	E2	E2	E2	C1	C1	C1	A1	A1	C1	C1	B1	B1	C1	C1	B1	N	C1	C1	D1	A1	A1
Nitric Acid - 25%	C1	N	N	N	D1	D1	D1	C1	C1	D1	D1	C1	C1	D1	D1	C1	N	C1	D1	D2	C1	D1
Nitric Acid - 40%	C1	N	N	N	D1	D1	D1	D1	D1	D1	D1	C1	D1	D1	D1	D1	N	D1	D1	E2	D2	D2
Nitric Acid - 60%	D1	N	N	N	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	N	D1	N	N	D2	D2
Nitric Acid - 73%	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E2	E2
Nitrilotriethanol[1]	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E2	E1	E1	T	E1	E1
Nitrobenzene	E1	E1	T	T	N	T	T	T	E1	N	T	T	E1	N	T	T	N	E1	N	N	E1	E1
Nitromethane	T	T	T	T	E1	T	T	N	T	E1	T	N	T	E1	T	N	T	T	T	T	D2	D2
Octanoic Acid	See Caprylic Acid																					
Octanol[1]	E1	E1	T	T	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	T	E1	E1	E1	E1	E1
Oils																						
Sour Crude Petroleum	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Animal	A1	T	T	T	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	A1	A1
Mineral	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Vegetable	A1	D1	D1	D1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	A1	A1
Oleic Acid	A1	N	N	N	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Oleum	See Sulfuric Acid																					
Oxalic Acid (Saturated)	A1	T	T	T	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	A1	A1
Para Xylene	D1	D1	T	T	N	D1	D1	E1	D1	N	D1	E1	D1	N	D1	E1	T	D1	N	N	D1	D1
Pelargonic Acid[1]	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E2	E1	E1	E1	E1	E1
Pentachloroethane	E1	N	N	N	T	T	T	T	E1	T	T	T	E1	T	T	T	N	E1	N	N	E1	E1

:EILCOTE Corrosion Control Products

	DUTY LININGS										FLOOR TOPPINGS							SEALANTS		
	Flakeline 242	Flakeline 251/252	Flakeline 252 International	Flakeline 261/262	Flakeline 282	Flakeline 300/350	Flakeline 600/Flaketar 661	Celcote 681/685/Concrete T	Celcote 682/683/Concrete SL/SR	Celcrete 695	Celcrete 2500 U.S.A.	Celcrete 2500 International	Celcrete 5500	Celcrete 6400	Celcrete 6650	Coroline 505/510	Celcote EJ10	Celcote EJ11	Celcote EJ/3/EJ4
Isophorone[1]	E1	E1	E1	E1	E1	T	T	E2	E2	D2	D2	E2	D2	D2	D2	D2	T	T	T
Isopropyl Acetate	N	E2	N	T	E2	N	N	E2	D2	D2	D2	D2	D2	D2	D2	D2	N	N	N
Isopropyl Alcohol	D1	D1	D1	D1	C1	E1	D2	C2	A2	A2	A2	A2	A2	C2	A2	A2	D2	D2	D2
Isopropyl Ether	N	E2	N	E2	E2	T	N	E2	D2	D2	D2	D2	D2	D2	D2	D2	T	T	T
Jet Fuel JP-4	D1	A1	D1	D1	A1	A1	D1	C2	A2	A2	A2	A2	A2	A2	A2	A2	N	D2	D2
Kerosene	A1	A1	A1	A1	A1	A1	A1	C2	A2	A2	A2	A2	A2	A2	A2	A2	N	D2	D2
Ketchup	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Lactic Acid 1-20%	A1	A1	A1	A1	A1	A1	T	T	D2	A2	A2	A2	A2	A2	A2	T	T	D2	T
Lactic Acid Concentrated	A1	A1	A1	A1	A1	A2	N	N	N	A2	A2	A2	A2	A2	A2	N	N	D2	N
Lard	A1	A1	A1	A1	A1	A1	D2	D2	D2	A2	A2	A2	A2	A2	A2	D2	N	D2	T
Lauric Acid	A1	A1	A1	A1	A1	A1	N	N	T	A2	A2	A2	A2	A2	A2	T	N	T	T
Lead Acetate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	T	A2
Lecithin[1]	A1	A1	A1	A1	A1	A1	D1	D2	D2	D2	D2	D2	D2	D2	D2	D2	A2	E2	A2
Levulinic Acid (Saturated)	A1	A1	A1	A1	A1	A1	T	T	D2	A2	A2	A2	A2	A2	A2	D2	D2	E2	D2
Linseed Oil	A1	A1	A1	A1	A1	A1	T	D2	D2	A2	A2	A2	A2	A2	A2	D2	N	D2	T
Lithium Hydroxide* - 10%	N	N	N	N	N	N	E1	A2	A2	A2	A2	A2	A2	N	A2	A2	E2	E2	E2
Lithium Hydroxide* (Saturated)	N	N	N	N	N	N	E1	A2	A2	A2	A2	A2	A2	N	A2	A2	D2	D2	D2
Maleic Acid	A1	A1	A1	A1	A1	A1	N	N	N	A2	A2	A2	A2	A2	A2	N	T	T	T
Malic Acid[1]	A1	A1	A1	A1	A1	A1	T	D2	C2	A2	C2	C2	C2	D2	A2	C2	D2	E2	D2
Mercury and Salts	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Methanol 100%	E2	D2	E2	E2	E2	E2	E2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	E2	D2
Methyl Acetate	N	E2	N	N	D2	N	N	D2	D2	D2	D2	D2	D2	D2	D2	D2	N	N	N
Methylamyl Alcohol[1]	E1	E1	N	E1	E1	T	T	T	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2
Methylene Chloride	N	N	N	N	E2	N	N	N	N	E2	E2	N	N	N	E2	E2	N	E2	N
Methyl Chloride	N	N	N	N	E2	N	N	N	N	E2	N	N	N	N	E2	N	N	T	N
Methyl-Ethyl Ketone	N	E2	N	N	E2	N	N	T	E2	D2	E2	E2	E2	E2	E2	D2	N	N	N
ethyl Oleate[1]	E1	E1	E1	E1	D1	E1	T	T	D2	D2	D2	D2	D2	D2	D2	D2	N	T	T
Methyl Isobutyl Ketone[1]	N	T	N	N	E1	N	N	N	D2	D2	D2	N	D2	N	D2	D2	N	N	N
Milk - Fresh & Sour	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Molasses	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Naphtha - Aliphatic	A1	A1	A1	A1	A1	A1	A1	C2	C2	A2	A2	C2	A2	A2	A2	A2	N	D2	E2
Naphtha, Aromatic (Coal Tar)	T	D1	T	D1	C1	T	T	D2	D2	A2	C2	D2	C2	D2	C2	C2	N	D2	E2
Naphthalene (In Benzene)	N	D1	D1	E1	D1	E2	E2	T	D2	C2	C2	D1	C2	D2	C2	C2	N	E2	N
Naphthenic Acid[1]	T	D1	T	T	D1	D2	T	E2	E2	C2	D2	T	D2	T	D2	C2	N	T	T
Nickel Plating, Bright[4]	A1	A1	A1	A1	A1	A1	E2	D2	C2	A2	A2	A2	A2	A2	A2	A2	A2	T	E2
Nitric Acid - 5%	A1	A1	A1	A1	A1	A2	E2	E2	E2	A2	A2	A2	A2	A2	A2	D2	D2	E2	N
Nitric Acid - 10%	D1	D1	D1	D1	A1	D2	N	N	N	A2	B2	B2	B2	A2	A2	D2	D2	E2	N
Nitric Acid - 25%	D2	D2	D2	D2	C1	E2	N	N	N	B2	C2	C2	C2	B2	B2	N	T	E2	N
Nitric Acid - 40%	D2	E1	E1	E1	D1	E2	N	N	N	C2	C2	C2	C2	B2	C2	N	T	E2	N
Nitric Acid - 60%	E2	E2	E2	D2	D2	N	N	N	N	D2	D2	D2	D2	D2	D2	N	T	E2	N
Nitric Acid - 73%	N	N	N	N	E2	N	N	N	N	E2	N	N	N	N	E2	N	N	E2	N
Nitrilotriethanol[1]	E1	E1	E1	E1	E1	T	T	D2	D2	D2	D2	D2	D2	D2	D2	D2	T	T	T
Nitrobenzene	N	T	N	T	E1	N	N	N	T	E2	T	N	T	T	E2	E2	N	E2	T
Nitromethane	T	T	E1	N	T	T	T	T	T	E2	D2	T	T	E2	T	E2	N	N	T
Octanoic Acid	(see Caprylic Acid)																		
Octanol[1]	E1	E1	E1	E1	E1	E1	T	T	T	D2	D2	D2	D2	D2	D2	D2	T	N	T
Oils																			
Sour Crude Petroleum	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	N	E2	A2
Animal	A1	A1	A1	A1	A1	A1	T	E2	E2	A2	A2	A2	A2	A2	A2	D2	N	E2	A2
Mineral	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	N	E2	A2
Vegetable	A1	A1	A1	A1	A1	A1	T	D2	D2	A2	A2	A2	A2	A2	A2	C2	N	E2	A2
Oleic Acid	A1	A1	A1	A1	A1	A1	N	N	N	A2	A2	A2	A2	A2	A2	N	N	T	D2
Oleum	See Sulfuric Acid																		
Oxalic Acid (Saturated)	A1	A1	A1	A1	A1	A1	T	A2	A2	A2	A2	A2	A2	A2	A2	T	A2	D2	A2
Para Xylene	N	D1	N	E1	D1	N	N	D2	D2	A2	D2	D2	D2	D2	D2	D2	N	E2	N
Pelargonic Acid[1]	E1	E1	E1	E1	E1	E1	T	T	D2	C2	C2	C2	C2	C2	C2	D2	N	T	N
Pentachloroethane	N	N	N	N	E1	N	N	E2	N	E2	E2	E2	E2	T	E2	E2	N	E2	N

:ET TO CHEMICAL RESISTANCE CHART

Rating Description
- A Good to Maximum Temperature of Product
- B Good to 180 °F (82 °C) Maximum
- C Good to 140 °F (60 °C)
- D Good to 120 °F (49 °C) Ambient
- E Good to 100 °F (37 °C)

Rating Description
- 1 Immersion or Constant Flow or Condensing Vapor
- 2 Occasional Splash or Spill
- 3 Fumes Only, Not Condensing
- N Not Recommended

Rating Description
- T Varies With Conditions. May Require Test. Consult Master Builders Technologies for Recommendation

Master Builders Technologies

HEAVY DUTY LININGS — LIGHT

	Ceilcrete 80	Coroline 505/510/505.2/505.6	Coroline 505M	Coroline 550	Ceilcrete 2500 International	Ceilcrete 2500 U.S.A.	Ceilcrete 5500	Ceilcrete 6400	Ceilcrete 6650	Flakeline 103	Flakeline 161	Flakeline 164	Flakeline 180	Ceilcote Lining 25	Ceilcote Lining 61	Ceilcote Lining 64	Ceilcote Lining 68	Ceilcote Lining 74	Ceilcote Lining 652	Flakeline 211/212	Flakeline 222HT	Flakeli[illegible]-2
Perchloric Acid - 30%	E1	N	N	N	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	N	E1	E1	N	E1	E1	
Perchloroethylene	D1	D1	D1	D1	E1	D1	D1	D1	D1	E1	D1	D1	D1	E1	D1	D1	T	D1	D1	E2	D1	D1
Phenol - 5%	C1	N	N	N	N	E1	E1	C1	C1	N	E1	C1	C1	N	E1	C1	N	C1	N	N	D1	D1
Phenol - 85%	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Phenol Sulfonic Acid - 65%	N	N	N	N	T	T	T	T	N	T	T	T	N	T	T	T	N	E1	N	N	N	N
Phosphoric Acid - 20%	A1	N	N	N	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Phosphoric Acid - 85%	A1	N	N	N	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Phosphorous Oxychloride[1]	T	C1	T	T	N	N	N	E1	T	N	N	E1	T	N	N	E1	T	T	N	N	T	T
Phosphorous Trichloride[1]	T	C1	T	T	N	T	T	N	T	N	T	N	T	N	T	N	T	T	N	N	N	N
Picric Acid - 10% in Alcohol	D1	T	T	T	E1	D1	D1	E1	D1	E1	D1	E1	D1	E1	D1	D1	T	D1	E1	T	D1	D1
Polyacrylic Acid - 50%[1]	D1	D1	T	T	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	D1	D1	D1
Potassium Acetate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Potassium Bichromate	A1	T	T	T	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	A1	A1
Potassium Bromide	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Potassium Carbonate - 25%	C1	A1	A1	A1	C1	C1	C1	E1	C1	C1	C1	E1	C1	C1	C1	E1	A1	C1	C1	E2	C1	A1
Potassium Chlorate[3]	C1	C1	C1	C1	A1	A1	A1	T	A1	C1	C1	T	C1	A1	A1	A1	A1	A1	A1	A2	A1	A1
Potassium Chloride	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Potassium Cyanide	C1	A1	A1	A1	C1	C1	C1	T	C1	C1	C1	T	C1	C1	C1	T	A1	C1	C1	N	C1	A1
Potassium Fluoride[2]	C1	A1	A1	A1	A1	A1	A1	A1	A1	C1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Potassium Hydroxide - 10%[2]	D1	A1	A1	A1	D1	D1	D1	N	D1	N	N	N	N	D1	D1	N	A1	D1	D1	N	N	D1
Potassium Hydroxide - 50%[2]	C1	A1	A1	A1	C1	C1	C1	N	C1	N	N	N	N	E1	C1	N	C1	C1	C1	N	N	A1
Potassium Nitrate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Potassium Permaganate	A1	T	T	T	A1	A1	A1	C1	A1	A1	A1	C1	A1	A1	A1	C1	T	A1	A1	A1	A1	A1
Potassium Persulfate	A1	T	T	T	A1	A1	A1	D1	A1	A1	A1	D1	A1	A1	A1	D1	T	A1	A1	A1	A1	A1
Potassium Sulfate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Propanediol[1]	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1
Propionic Acid - 100%[1]	D1	N	N	N	E1	D1	D1	T	D1	E1	D1	T	D1	E1	D1	T	N	D1	E1	T	D1	D1
Propylene Glycol	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Pyridine	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Rayon Spin Liquor	A1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	D1	A1	A1	A1	A1	A1
Salicylaldehyde[1]	E1	T	T	T	N	E1	E1	E1	E1	N	E1	E1	E1	N	E1	E1	T	E1	N	D2	E1	E1
Salicylic Acid	C1	C1	C1	T	C1	C1	C1	T	C1	C1	C1	T	C1	C1	C1	T	T	C1	C1	D2	C1	D1
Salt Brine	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Silicon Tetrachloride[1]	T	T	T	T	N	E1	E1	N	T	N	E1	N	T	N	E1	N	T	T	N	N	T	T
Sodium Acetate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Bicarbonate	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	N	N	N	A1	A1	N	A1	A1	A1	N	N	A1
Sodium Bisulfate	C1	A1	A1	A1	C1	C1	C1	N	E1	E1	E1	N	E1	C1	C1	N	C1	C1	C1	N	E1	E1
Sodium Bisulfite	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Bromate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Carbonate - Sat'd[2]	C1	A1	A1	A1	C1	C1	C1	N	E1	N	N	N	N	C1	C1	N	C1	C1	C1	N	N	E1
Sodium Chloride	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Chlorite - Sat'd	D1	N	N	N	D1	C1	C1	C1	D1	D1	C1	C1	D1	D1	C1	C1	N	D1	D1	A2	A1	A1
Sodium Chromate[3]	A1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	A1	A1
Sodium Chlorate[3]	C1	C1	C1	C1	A1	A1	A1	A1	A1	C1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Cyanide - 15%	A1	A1	A1	A1	C1	A1	A1	D1	A1	C1	B1	D1	A1	C1	A1	D1	A1	A1	C1	B1	A1	A1
Sodium Dichromate	A1	D1	D1	D1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Fluoride[2]	C1	A1	A1	A1	A1	A1	A1	A1	A1	C1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Hydrosulfide - 45%[2]	C1	A1	A1	A1	A1	A1	A1	C1	A1	C1	C1	D1	C1	A1	A1	C1	A1	A1	A1	E1	A1	A1
Sodium Hydroxide - 10%[2]	E1	A1	A1	A1	D1	D1	D1	N	N	N	N	N	N	D1	D1	N	D1	D1	D1	N	N	E1
Sodium Hydroxide - 50%[2]	E1	A1	A1	A1	C1	C1	C1	N	C1	N	N	N	N	C1	C1	N	A1	C1	C1	N	N	A1
Sodium Hypochlorite - 3%[2]	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	D1	D1	N	D2	D2	
Sodium Hypochlorite - 17%[2]	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	D1	D1	N	D2	D2	
Sodium Lauryl Sulfate - 20%	C1	C1	C1	C1	D1	D1	D1	D1	C1	D1	D1	D1	C1	D1	D1	D1	E1	C1	D1	D2	C1	D1
Sodium Oxalate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Peroxide - Peroxide Bleach[1]	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	T	A1	A1	A1	T	A1	A1	A1	T	A1	A1
Sodium (Acid) Phosphate	A1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Phosphate (Tri)	D1	A1	A1	A1	C1	C1	C1	N	C1	E1	E1	N	E1	A1	A1	N	E1	C1	C1	N	E1	E1

CEILCOTE Corrosion Control Products

	DUTY LININGS											FLOOR TOPPINGS								SEALANTS	
	Flakeline 242	Flakeline 251/252	Flakeline 252 International	Flakeline 261/262	Flakeline 282	Flakeline 300/350	Flakeline 600/Flaketar 661	Ceilcote 681/685/Corocrete T	Ceilcote 682/683/Corocrete SL/SR	Ceilcrete 695	Ceilcrete 2500 U.S.A.	Ceilcrete 2500 International	Ceilcrete 5500	Ceilcrete 6400	Ceilcrete 6850	Coroline 505/510	Ceilcote EJ10	Ceilcote EJ11	Ceilcote EJ3/EJ4
Perchloric Acid - 30%	E1	E1	E1	E1	E1	D2	N	T	T	D2	D2	D2	D2	D2	D2	T	T	T	N
Perchloroethylene	E2	D1	E2	D1	D1	E2	E2	E2	D2	D2	D2	E2	D2	D2	D2	C2	N	T	T
Phenol - 5%	N	E1	N	E1	D1	N	N	N	N	B2	D2	T	D2	B2	B2	N	N	E2	T
Phenol - 85%	N	N	N	N	N	N	N	N	N	D2	N	N	N	N	D2	N	N	E2	N
Phenol Sulfonic Acid - 65%	N	T	T	T	E1	N	N	N	N	D2	T	T	T	T	D2	N	N	D2	N
Phosphoric Acid - 20%	A1	A1	A1	A1	A1	A1	E2	D2	D2	A2	A2	A2	A2	A2	A2	N	D2	E2	D2
Phosphoric Acid - 85%	A1	A1	A1	A1	A1	A1	N	N	N	A2	A2	A2	A2	A2	A2	N	T	E2	T
Phosphorous Oxychloride[1]	N	N	N	N	T	N	E2	E2	E2	T	N	N	N	N	T	C2	T	T	T
Phosphorous Trichloride[1]	N	T	N	N	T	N	E2	E2	E2	T	T	N	T	N	N	C2	T	T	T
Picric Acid - 10% in Alcohol	T	D1	E1	E1	D1	N	N	N	T	C2	C2	D2	C2	D2	D2	T	D2	D2	D2
Polyacrylic Acid - 50%[1]	D1	D1	D1	D1	D1	D1	T	T	T	D2	D2	D2	D2	D2	D2	D2	D2	T	T
Potassium Acetate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	E2	A2
Potassium Bichromate	A1	A1	A1	A1	A1	A1	T	E2	E2	A2	A2	A2	A2	A2	A2	C2	D2	E2	D2
Potassium Bromide	A1	A1	A1	A1	A1	A1	A1	A2	C2	A2	A2	A2	A2	A2	A2	A2	A2	E2	A2
Potassium Carbonate - 25%	A1	A1	A1	E1	A1	E2	A1	A2	A2	A2	A2	A2	A2	D2	A2	A2	A2	D2	E2
Potassium Chlorate[3]	A1	A1	A1	T	A1	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2	A2	A2	D2	A2
Potassium Chloride	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Potassium Cyanide	A1	A1	A1	T	C1	N	E1	A2	A2	A2	A2	A2	A2	D2	A2	A2	A2	D2	A2
Potassium Fluoride[2]	A1	A1	A1	A1	N	N	D2	D2	C2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Potassium Hydroxide - 10%[2]	D1	D1	D1	N	N	N	A1	A2	A2	C2	C2	C2	C2	N	C2	A2	C2	E2	N
Potassium Hydroxide - 50%[2]	A1	A1	A1	N	N	N	A1	A2	A2	C2	C2	C2	C2	N	C2	A2	C2	E2	N
Potassium Nitrate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	E2	A2
Potassium Permaganate	A1	A1	A1	A1	A1	A1	T	D2	D2	A2	A2	A2	A2	A2	A2	D2	D2	E2	D2
Potassium Persulfate	A1	A1	A1	A1	A1	A1	T	C2	C2	A2	A2	A2	A2	C2	A2	D2	D2	E2	D2
Potassium Sulfate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Propanediol[1]	D1	D1	D1	D1	D1	D1	D1	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	E2	D2
Propionic Acid - 100%[1]	E1	D1	E1	T	D1	T	N	N	N	D2	D2	D2	D2	T	D2	N	N	T	N
Propylene Glycol	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Pyridine	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Rayon Spin Liquor	A1	A1	A1	A1	A1	A1	E2	D2	D2	A2	A2	A2	A2	A2	A2	C2	D2	E2	D2
Salicylaldehyde[1]	D2	E1	E1	E1	E1	E2	T	T	D2	D2	D2	N	D2	D2	D2	T	T	T	T
Salicylic Acid	D1	D1	D1	T	C1	D2	T	D2	D2	C2	C2	C2	C2	C2	C2	C2	C2	E2	C2
Salt Brine	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Silicon Tetrachloride[1]	N	E1	N	N	T	N	T	T	T	D2	D2	D2	D2	D2	D2	T	T	T	T
Sodium Acetate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	T	A2
Sodium Bicarbonate	E1	E1	E1	N	N	N	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Bisulfate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Bisulfite	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Bromate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Carbonate - Sat'd[2]	E1	E1	E1	N	N	N	A1	A2	A2	A2	A2	A2	A2	D2	A2	A2	A2	D2	D2
Sodium Chloride	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Chlorite - Sat'd	D1	D1	D1	D1	D1	N	N	T	T	C2	B2	C2	B2	B2	C2	T	D2	D2	D2
Sodium Chromate[3]	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Chlorate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Cyanide - 15%	A1	A1	A1	A1	A1	D2	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Dichromate	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Fluoride[2]	A1	A1	A1	A1	E1	E2	E2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	T	A2
Sodium Hydrosulfide - 45%[2]	A1	A1	A1	E1	A1	E2	A2	C2	A2	A2	A2	A2	A2	A2	A2	C2	A2	D2	T
Sodium Hydroxide - 10%[2]	E1	D1	D1	N	N	N	D1	A2	A2	C2	C2	C2	C2	N	C2	A2	N	D2	A2
Sodium Hydroxide - 50%[2]	E1	E1	E1	N	N	N	E1	A2	A2	C2	C2	C2	C2	N	C2	A2	N	D2	A2
Sodium Hypochlorite - 3%[2]	D2	D2	D2	N	N	N	N	N	D2	D2	D2	D2	D2	N	D2	N	D2	E2	N
Sodium Hypochlorite - 17%[2]	E2	E2	E2	N	N	N	N	N	N	E2	E2	E2	E2	N	E2	N	N	E2	N
Sodium Lauryl Sulfate - 20%	D1	D1	D1	D1	C1	D2	A2	C2	C2	A2	C2	A2	C2	C2	A2	B2	D2	E2	D2
Sodium Oxalate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	T	A2
Sodium Peroxide - Peroxide Bleach[1]	A1	A1	A1	T	A1	T	D1	A2	A2	A2	A2	A2	A2	D2	A2	A2	A2	D2	N
Sodium (Acid) Phospate	A1	A1	A1	A1	A1	A1	D1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Phosphate (Tri)	E1	E1	E1	N	E1	N	E1	A2	A2	A2	A2	A2	A2	N	A2	A2	A2	A2	A2

. TO CHEMICAL RESISTANCE CHART

Rating Description
- A Good to Maximum Temperature of Product
- B Good to 180 °F (82 °C) Maximum
- C Good to 140 °F (60 °C)
- D Good to 120 °F (49 °C) Ambient
- E Good to 100 °F (37 °C)

Rating Description
- 1 Immersion or Constant Flow or Condensing Vapor
- 2 Occasional Splash or Spill
- 3 Fumes Only, Not Condensing
- N Not Recommended

Rating Description
- T Varies With Conditions, May Require Test. Consult Master Builders Technologies for Recommendations

Master Builders Technologies

HEAVY DUTY LININGS | LIGHT

	Celline 80	Coroline 505/510/505.2/505.6	Coroline 505M	Coroline 550	Celcrete 2500 International	Celcrete 2500 U.S.A.	Celcrete 5500	Celcrete 6400	Celcrete 6650	Flakeline 103	Flakeline 161	Flakeline 164	Flakeline 180	Calcote Lining 25	Calcote Lining 61	Calcote Lining 64	Calcote Lining 68	Calcote Lining 74	Calcote Lining 652	Flakeline 211/212	Flakeline 222HT	232	F
Sodium Polymethacrylate[1]	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1
Sodium Sulfate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Sulfide (Saturated)[2]	A1	A1	A1	A1	A1	A1	A1	E1	A1	A1	A1	E1	A1	A1	A1	E1	A1	A1	A1	E1	A1	A1	A1
Sodium Sulfite	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Tartrate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Thiosulfate (Hypo)	A1	A1	A1	A1	C1	A1	A1	T	A1	C1	A1	T	A1	C1	A1	T	A1	A1	A1	A1	A1	A1	A1
Soybean Oil	A1	T	T	T	A1	A1	A1	T	A1	A1	A1	T	A1	A1	A1	T	A1	A1	A1	A1	A1	A1	A1
Stearic Acid	A1	N	N	N	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1	A1
Styrene	D1	N	N	N	N	N	N	N	D1	N	N	N	D1	N	N	N	N	D1	N	E2	D1	D1	D1
Sugar	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sulfamic Acid - 25%	C1	T	T	T	C1	C1	C1	A1	C1	C1	C1	C1	C1	C1	C1	A1	T	C1	C1	A1	A1	A1	A1
Sulfite Liquor (Paper)	A1	A1	A1	A1	A1	A1	A1	D1	A1	A1	A1	D1	A1	A1	A1	D1	A1	A1	A1	A1	A1	A1	A1
Sulfur Dioxide (Wet)	A1	C1	C1	D1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sulfur Trioxide (Wet)	A1	D1	D1	E1	A1	A1	A1	A1	A1	B1	B1	B1	A1	A1	A1	A1	E2	A1	A1	A1	A1	A1	A1
Sulfuric Acid - 10%	A1	D1	E1	E1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	E2	A1	A1	A1	A1	A1	A1
Sulfuric Acid - 25%	A1	E2	E2	E2	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1	A1
Sulfuric Acid - 50%	A1	D2	D2	D2	A1	A1	A1	A1	A1	B1	B1	B1	B1	A1	A1	A1	N	A1	A1	A1	A1	A1	A1
Sulfuric Acid - 70%	C1	N	N	N	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	N	C1	C1	A2	D1	E1	E1
Sulfuric Acid - 75%	D1	N	N	N	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	N	E1	E1	D2	E1	E1	E1
Sulfuric Acid - 93-98%	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E2	E2	E2
Tall Oil	A1	B1	B1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A2	A1	A1	A1	A1	A1	A1
Tartaric Acid	A1	T	T	T	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A2	A1	A1	A1	A1	A1	A1
Tetrachloroethane[1]	D1	E1	E1	T	N	E1	E1	N	D1	N	E1	N	D1	N	E1	N	N	D1	N	N	D1	D1	D1
Tetrachloroethylene[1]	See Perchlorethylene																						
Tetrahydrofuran	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E2	E2	E2
Tetrahydrofurfuryl Alcohol[1]	E1	T	T	T	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	T	E1	E1	T	E1	E1	E1
Thionyl Chloride	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Thionyl Chloride - Water Sol'n	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Tin Plating (Fluoborate)	See Fluoboric Acid																						
Tin Plating (Stannate)	See Sodium Hydroxide																						
Toluol (Toluene)	E1	E1	T	T	N	N	N	N	E1	N	N	N	E1	N	N	N	N	E1	N	N	E1	E1	E1
Toluene Sulfonic Acid	A1	T	T	T	A1	A1	A1	D1	A1	A1	A1	D1	A1	A1	A1	D1	T	A1	A1	T	A1	A1	A1
Toluidine[1]	T	T	T	T	N	E1	E1	N	T	N	E1	N	T	N	E1	N	N	T	N	N	T	T	T
Triethylamine[1]	E1	T	T	T	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	N	E1	E1	T	E1	E1	E1
Triethylenetetramine[1]	T	T	T	T	E1	E1	E1	E1	T	E1	E1	E1	T	E1	E1	E1	N	E1	N	T	T	T	T
Triethyl Phosphite[1]	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	T	E1	E1	E1	E1	E1	E1
Trichloroacetic Acid - 20%	A1	N	N	N	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1	A1
Trichlorobenzene (1,2,4-)[1]	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	T	E1	E1	T	E1	E1	E1
Trichloroethane[1]	E1	E1	E1	T	N	E1	E1	N	E1	N	E1	N	E1	N	E1	N	N	E1	N	N	E1	E1	E1
Trichloroethylene	E2	E1	T	T	N	E1	E1	N	E1	N	E1	N	E1	N	E1	N	N	E2	N	N	E2	E2	E2
Tricresyl Phosphate 100%	C1	C1	C1	C1	T	T	T	T	C1	T	T	T	C1	T	T	T	D2	C1	C1	T	C1	D1	D1
Trisodium Phosphate (Sat'd)[2]	C1	A1	A1	A1	A1	A1	A1	E1	A1	C1	C1	E1	C1	A1	A1	E1	A1	A1	A1	D2	A1	A1	A1
Turpentine	A1	D1	D1	D1	C1	C1	C1	D1	A1	C1	C1	D1	A1	C1	C1	D1	T	A1	C1	E1	A1	A1	A1
Urea Solutions	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Vinegar	A1	E1	E1	E1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	E1	A1	A1	A1	A1	A1	A1
Vinyl Chloride	T	T	T	N	N	T	T	N	N	N	T	T	N	T	N	N	N	T	N	N	E2	E2	E2
Water, Distilled & Demineralized	A1	A1	A1	A1	A1	A1	A1	A1	A1	B1	B1	B1	B1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
White Liquor (Paper)	C1	A1	A1	A1	A1	A1	A1	N	A1	C1	C1	N	C1	A1	A1	N	A1	A1	A1	N	A1	A1	A1
Wine	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Xylol (Xylene)	D1	D1	T	T	N	N	N	N	D1	N	N	N	D1	N	N	N	N	D1	N	N	D1	D1	D1
Zinc Plating - Acid Fluoborate	See Fluoboric Acid																						
Zinc Plating - Cyanide	See Sodium Hydroxide 10%																						
Zinc Plating - Acid Sulfate	A1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	E1	A1	A1	A1	A1	A1	A1

?EILCOTE
,orrosion Control Products

	DUTY LININGS							FLOOR TOPPINGS										SEALANTS	
	Flakeline 242	Flakeline 251/252	Flakeline 252 International	Flakeline 261/262	Flakeline 282	Flakeline 300/350	Flakeline 600/Flakefar 661	Cellcote 681/685/Concrete T	Cellcote 682/683/Concrete SL/SR	Cellcrete 595	Cellcrete 2500 U.S.A.	Cellcrete 2500 International	Cellcrete 5500	Cellcrete 6400	Cellcrete 6650	Coroline Series	Cellcote EJ10	Cellcote EJ11	Cellcote EJ3/EJ4
Sodium Polymethacrylate[1]	D1	D1	D1	D1	D1	D1	D1	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	E2	D2
Sodium Sulfate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Sulfide (Saturated)[2]	A1	A1	A1	E1	A1	E2	A2	A2	A2	A2	A2	A2	A2	D2	A2	A2	D2	D2	D2
Sodium Sulfite	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Tartrate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Thiosulfate (Hypo)	A1	A1	A1	T	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Soybean Oil	A1	A1	A1	A1	A1	A1	A2	D2	C2	A2	A2	A2	A2	A2	A2	D2	N	D2	D2
Stearic Acid	A1	A1	A1	A1	A1	A1	N	D2	D2	A2	A2	A2	A2	A2	A2	D2	N	T	D2
Styrene	N	N	N	N	D1	E2	N	D2	D2	D2	D2	N	D2	N	D2	D2	N	E2	N
Sugar	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sulfamic Acid - 25%	A1	A1	A1	A1	A1	A1	T	T	T	A2	A2	B2	B2	A2	B2	D2	D2	E2	D2
Sulfite Liquor (Paper)	A1	A1	A1	D1	A1	A1	A2	A2	A2	A2	A2	A2	A2	C2	A2	A2	A2	E2	A2
Sulfur Dioxide (Wet)	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Sulfur Trioxide (Wet)	A1	A1	A1	A1	A1	A1	E1	E2	E2	A2	A2	A2	A2	A2	A2	A2	C2	D2	D2	N
Sulfuric Acid - 10%	A1	A1	A1	A1	A1	A1	E2	D2	D2	A2	A2	A2	A2	A2	A2	A2	C2	D2	D2	N
Sulfuric Acid - 25%	A1	A1	A1	A1	A1	A2	N	E2	E2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2	N
Sulfuric Acid - 50%	A1	A1	A1	A1	A1	A2	N	E2	E2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2	N
Sulfuric Acid - 70%	E1	E1	E1	E1	E1	E2	N	N	N	A2	A2	A2	A2	A2	A2	A2	N	D2	D2	N
Sulfuric Acid - 75%	E1	E1	E1	E1	E1	D2	N	N	N	B2	C2	C2	C2	B2	C2	N	E2	D2	N
Sulfuric Acid - 93-98%	N	N	N	N	E2	N	N	N	N	D2	N	N	N	N	N	N	N	E2	N
Tall Oil	A1	A1	A1	A1	A1	A1	E2	C2	C2	A2	A2	A2	A2	A2	A2	A2	A2	N	T	D2
Tartaric Acid	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Tetrachloroethane[1]	N	E1	N	N	D1	N	N	N	T	D2	E2	N	D2	E2	D2	D2	N	T	N
Tetrachloroethylene[1]	See Perchlorethylene																		
Tetrahydrofuran	N	N	N	N	E2	N	N	N	N	E2	N	N	N	N	E2	N	N	N	N
Tetrahydrofurfuryl Alcohol[1]	E1	E1	E1	E1	E1	T	T	D2	D2	D2	D2	D2	D2	D2	D2	D2	T	T	T
Thionyl Chloride	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	T	N
hionyl Chloride - Water Sol'n	N	N	N	N	N	N	N	N	N	T	N	N	N	N	T	T	N	T	N
Tin Plating (Fluoborate)	See Fluoboric Acid																		
Tin Plating (Stannate)	See Sodium Hydroxide																		
Toluol (Toluene)	N	N	N	N	E1	N	N	E2	E2	D2	E2	E2	E2	E2	D2	D2	N	E2	N
Toluene Sulfonic Acid	A1	A1	A1	D1	A1	N	T	D2	D2	A2	A2	A2	A2	C2	A2	D2	T	T	T
Toluidine[1]	N	E1	N	N	T	N	N	T	T	T	D2	N	D2	N	T	T	N	T	N
Triethylamine[1]	E1	E1	E1	E1	E1	T	T	N	T	D2	D2	D2	D2	D2	D2	D2	T	T	T	T
Triethylenetetramine[1]	N	E1	E1	E1	T	T	N	N	T	D2	D2	D2	D2	D2	D2	D2	T	T	T	T
Triethyl Phosphite[1]	E1	E1	E1	E1	E1	E1	T	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	T	T	T
Trichloroacetic Acid - 20%	A1	A1	A1	A1	A1	A1	N	N	N	A2	A2	A2	A2	A2	A2	A2	N	D2	T	T
Trichlorobenzene (1,2,4-)[1]	E1	E1	E1	E1	E1	T	T	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	N	T	T
Trichloroethane[1]	N	E1	N	N	E1	N	N	D2	D2	D2	D2	N	D2	N	D2	D2	N	E2	N
Trichloroethylene	N	E2	N	N	E2	N	N	N	E2	D2	D2	N	D2	D2	D2	D2	N	E2	N
Tricresyl Phosphate 100%	C1	T	T	T	A1	T	E2	E2	E2	C2	E2	E2	E2	E2	C2	C2	T	T	T
Trisodium Phosphate (Sat'd)[2]	A1	A1	A1	E1	A1	D2	A1	A2	A2	A2	A2	A2	A2	C2	A2	A2	C2	D2	C2
Turpentine	A1	A1	A1	D1	A1	E1	T	D2	D2	A2	C2	C2	C2	D2	A2	A2	N	E2	T
Urea Solutions	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Vinegar	A1	A1	A1	A1	A1	A1	E2	D2	D2	A2	A2	A2	A2	A2	A2	B2	D2	D2	D2
Vinyl Chloride	N	E2	N	N	E2	N	N	N	N	E2	E2	N	E2	N	E2	E2	N	T	N
Water, Distilled & Demineralized	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
White Liquor (Paper)	A1	A1	A1	N	A1	N	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	T	D2
Wine	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Xylol (Xylene)	N	N	N	N	D1	N	N	E2	E2	D2	E2	E2	E2	E2	D2	D2	N	E2	N
Zinc Plating - Acid Fluoborate	See Fluoboric Acid																		
Zinc Plating - Cyanide	See Sodium Hydroxide 10%																		
Zinc Plating - Acid Sulfate	A1	A1	A1	A1	A1	A1	D1	C2	C2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2

KEY TO CHEMICAL RESISTANCE CHART

Rating Description
- A Good to Maximum Temperature of Product
- B Good to 180 °F (82 °C) Maximum
- C Good to 140 °F (60 °C)
- D Good to 120 °F (49 °C) Ambient
- E Good to 100 °F (37 °C)

Rating Description
- 1 Immersion or Constant Flow or Condensing Vapor
- 2 Occasional Splash or Spill
- 3 Fumes Only; Not Condensing
- N Not Recommended

Rating Description
- T Varies With Conditions, May Require Test. Consult Master Builders Technologies for Recommendation

Master Builders Technologies

PROTECTIVE COATINGS

	CellGard® 550 HB	CellGard 550/FDA	CellGard 615/620	Flakeline 630	CellGard 470	CellGard 490
Acetic Acid - 10%	N	N	N	N	D2	C2
Acetone - 10%	E2	E2	E2	E1	D2	D2
Acetone - 100%	E2	E2	E2	E1	E2	D2
Alum	D2	D2	C2	C1	C2	B2
Aluminum Chloride	D2	D2	C2	C1	C2	B2
Aluminum Sulfate	D2	D2	C2	C1	C2	E2
Ammonia Anhydrous Liquid	D2	D2	C2	E1	B2	B2
Ammonia Aqua	D2	D2	D2	C2	B2	B2
Ammonia Wet Gas	D2	D2	D2	C2	B3	B3
Ammonium Chloride	D2	D2	A2	B2	C2	E2
Ammonium Hydroxide - 20%	D2	D2	A2	C2	B2	B2
Ammonium Nitrate	D2	D2	A2	C2	C2	E2
Ammonium Sulfate	D2	D2	A2	C2	C2	E2
Aniline	N	N	N	N	N	N
Benzene	E2	E2	D2	E1	D2	E1
Benzoic Acid	D2	D2	C2	B2	B2	B2
Benzyl Chloride	N	N	N	C2	D2	D2
Black Liquor (Paper)	D2	D2	C2	C1	C2	B2
Bleach	N	N	N	C2	C2	B2
Boric Acid	D2	D2	D2	C2	B2	B2
Bromine Water - 5%	N	N	N	C2	C2	B2
Butanol	D2	D2	C2	D1	C2	C2
Butyl Cellosolve	D2	D2	C2	D1	C2	C2
Butyl Cellosolve Acetate	D2	D2	C2	D1	C2	C2
Cadmium Plating (Cyanide)	A2	A2	A2	C2	C2	B2
Calcium Bisulfite	A2	A2	A2	C1	B2	B2
Calcium Chloride	A2	A2	D2	C2	C2	E2
Calcium Hydroxide	A2	A2	C2	C1	C2	C2
Calcium Hydrochlorite 5%	N	N	N	N	C2	C2
Calcium Nitrate	D2	D2	C2	C1	C2	A2
Carbon Bisulfide Fumes	E2	E2	D2	C2	D2	C2
Carbon Tet	E2	E2	E2	E1	C2	B2
Cellosolve	D2	D2	D2	D1	C2	C2
Chlorine Gas (Wet)	N	N	N	N	N	N
Chlorine Water	N	N	E2	C2	N	N
Chlorobenzene	D2	D2	D2	D1	C2	C2
Chloroform	N	N	N	N	N	N
Chromic Acid - 10%	N	N	N	E2	C2	C2
Chrome Plating	N	N	N	D2	N	N
Chromic Chloride	D2	D2	C2	C1	C2	C2
Citric Acid	D2	D2	D2	C2	C2	C2
Copper Plating (Cyanide)	E2	D2	C2	C2	C2	C2
Copper Plating (Acid)	N	N	D2	C2	C2	C2
Dextrose	E1	D1	C2	C1	C2	C2
Ethanol	C2	C2	C2	D1	C2	C2
Ethyl Acetate	E2	E2	D2	C2	E2	E2

KEY TO CHEMICAL RESISTANCE CHART

Rating Description
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- B Good to 180 °F (82 °C) Maximum
- C Good to 140 °F (60 °C)
- D Good to 120 °F (49 °C) Ambient
- E Good to 100 °F (37 °C)

Rating Description
- 1 Immersion or Constant Flow or Condensing Vapor
- 2 Occasional Splash or Spill
- 3 Fumes Only, Not Condensing
- N Not Recommended

Rating Description
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CEILCOTE Corrosion Control Products

PROTECTIVE COATINGS

	CeilGard 650 HB	CeilGard 650/FDA	CeilGard 615/620	Flakeline 630	CeilGard 470	CeilGard 480
Ethylene Dichloride	N	N	N	N	N	N
Ethylene Glycol	D2	D2	D2	C1	C2	C2
Ferric Chloride	D2	D2	C2	C1	C2	C2
Ferric Sulfate	D2	D2	C2	C1	D2	C2
Fertilizer - Dry	A3	A3	A3	B3	D2	C2
Fertilizer - Liquid	D2	C2	C2	C1	C2	C2
Formaldehyde	D2	D2	D2	D1	C2	C2
Gasoline - Aviation	C2	C2	C2	C1	C2	C2
Gasoline - Diesel	C2	C2	C2	C1	D2	D2
Gasoline - Jet Fuel	D2	D2	C2	C1	D2	C2
Gasoline - Prem. Unleaded	D2	D2	C2	D1	C2	C2
Gasoline - Unleaded	E2	E2	E2	C1	C2	C2
Glycerine	D1	D1	B2	B1	C2	D1
Green Paper Liquor	D2	D2	A2	C1	C2	C2
Hexane	E1	E1	C2	C1	D2	C2
HCL - 1-10%	E2	E2	D2	C2	C2	C2
Hydrofluosilicic Acid	A2	A2	A2	C2	C2	C2
Hydrogen Peroxide - 30%	A2	A2	A2	C2	C2	C2
H_2S - Wet	E2	E2	E2	B2	D2	C2
Hypo (Photographic Liquid)	D1	D1	A2	C1	C2	C2
IPA	D2	D2	A2	C1	C2	C2
JP4 Jet Fuel	D2	D2	C2	C1	D2	C2
Kerosene	D1	D1	C2	B1	C2	C2
Lactic Acid - 1-10%	D2	D2	D2	B2	C2	C2
MeOH	C2	C2	C2	C2	C2	C2
MEK	N	N	N	C2	D2	C2
MIBK	D2	D2	D2	C2	D2	C2
MICK	D2	D1	D2	C1	C2	C2
Molasses	E1	D1	C2	C1	C2	A2
Muriatic Acid	N	N	N	N	N	N
Naptha (Aliphatic)	D1	D1	E2	C1	D2	D2
Naptha (Aromatic)	D2	D2	D2	C1	C2	C2
Nitric Acid - 5%	E2	E2	E2	D2	C2	C2
Nitric Acid - 10%	N	N	E2	D2	C2	C2
Nitrobenzene	E2	E2	D2	C2	E2	E2
Oil, Animal	D2	D2	C2	C1	C2	C2
Oil, Mineral	E1	E1	C2	C1	C2	D2
Petroleum, Sour Crude	D2	C2	C2	C1	C2	D2
Oil, Vegetable	D2	D1	C2	C1	C2	D2
Para Xylene	E2	E2	D2	C1	N	N
Perchloroethylene	E2	D2	D2	C1	N	E2
Phenol - 5%	N	N	N	D2	N	D2
Phenol - 85%	N	N	N	D2	N	N
Phosphoric Acid - 20%	N	N	N	D2	C2	C2
Phosphoric Acid - 85%	N	N	N	E2	N	N
Potassium Bichromate	D2	D2	C2	B2	C2	C2

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Master Builders Technologies

	PROTECTIVE COATINGS					
	CalGard 650 HB	CalGard 650/FDA	CalGard 615/620	Flakeline 630	CalGard 470	CalGard 480
Potassium Chloride	E1	E1	C2	C1	C2	C2
Potassium Hydroxide - 10%	A2	A2	A2	C1	C2	C2
Potassium Hydroxide - 50%	A2	A2	A2	C1	D2	C2
Propylene Glycol	E1	D1	A2	C1	C2	A2
Rayon Spin Liquor	N	N	C2	B2	C2	C2
Salt Brine	D1	D1	B2	C1	C2	C2
Sodium Bicarb	E1	D1	C2	C1	C2	A2
Sodium Bisulfate	D2	D2	C2	C2	C2	C2
Sodium Carbonate	D1	D1	C2	C1	C2	A2
Sodium Chlorate	D1	D1	A2	C1	C2	C2
Sodium Chloride	E1	E1	C2	C1	D2	C2
Sodium Chromate	D2	D2	C2	C2	C2	C2
Sodium Dichromate	C2	C2	C2	C2	C2	C2
Sodium Hydroxide - 10%	C2	E1	C2	C1	C2	C2
Sodium Hydroxide - 50%	C2	E1	C2	C1	D2	C2
Sodium Hypochlorite - 3%	N	N	N	N	C2	C2
Sodium Phosphate - 25%	C2	E1	C2	C2	C2	A2
Sodium Sulfate	C2	D1	C2	C1	C2	C2
Sodium Sulfide	C2	C2	C2	C1	C2	C2
Sodium Sulfite	C2	C2	C2	C1	C2	A2
Sodium Thiosulfate	C2	D1	C2	C1	C2	C2
Styrene	E2	E2	D2	D1	C2	C2
Sugar	E1	D1	C2	C1	C2	C2
Sulfur Dioxide (Wet) Sulfurous Acid	E2	D2	D2	C2	C2	C2
Sulfur Trioxide (Wet)	E2	E2	E2	C2	D2	C2
Sulfuric Acid - 10%	N	N	N	D2	D2	D2
Sulfuric Acid - 25%	N	N	N	D2	D2	D2
Sulfuric Acid - 50%	N	N	N	E2	N	N
Sulfuric Acid - 70%	N	N	N	N	N	N
Sulfuric Acid - 75%	N	N	N	N	N	N
Sulfuric Acid - 93-98%	N	N	N	N	N	N
Tall Oil	D2	D2	C2	C2	C2	C2
Toluene	E2	D2	D2	D1	C2	C2
Trichloroethane	E2	E2	C2	E2	E2	D2
Trichlorothylene	E2	E2	E2	E2	E2	D2
Tricresyl Phosphate	E1	E1	C2	C1	C2	C2
Trisodium Phosphate	E1	D1	C2	C1	C2	C2
Turpentine	E1	D1	C2	B1	C2	D2
Urea	D2	D2	C2	C1	C2	C2
Vinegar	E2	D2	D2	D2	D2	C2
Water, Distilled	E1	D1	C2	D1	D2	A2
White Liquor - Paper	C2	C2	C2	C1	C2	C2
Wine	E1	E1	A2	D1	C2	C2
Xylol	E2	D2	C2	D1	C2	C2
Zinc Plating (Acid Sulfate)	D2	D2	D2	C2	D2	C2

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Solving corrosion problems for industry, worldwide

Master Builders Technologies

From floors to stacks, Ceilcote corrosion control products from Master Builders, helps hundreds of industries solve their toughest corrosion problems.

Master Builders Technologies is industry's partner in corrosion problem-solving. As the pioneer and technological leader in polymer linings, coatings, flooring and grout, we have become an increasingly important factor in the cost-effective operation of hundreds of industrial plants and processes.

ur corrosion-fighting products are ..e-of-the-art. Proven products such as Ceilcrete, Brutem, Ceilcote, Coroline, Tarpon Flake, Concresive, Poly Plus and Flakeline are unsurpassed in solving industry's toughest corrosion problems.

Master Builders Technologies product and service base has expanded in both scope and reach. We tap a tremendous range of company assets to meet our customers' needs, from special formulations through skilled installation, anywhere in the World.

Protective Coatings

Our family of Coatings for metal, concrete and other substrates solves corrosion problems by the hundreds. These easy to apply coatings include polyesters, epoxies, coal tar expoxies, urethanes, phenolics, epoxy novolacs and specialized formulations that will cure below freezing.

Nowhere else will you find such a wide range of protection from atmospheric corrosion.

Monolithic Linings

The corrosive environments encountered in many industries we serve vary widely in the demands they make on linings. Pickling tanks require one type; flocculation tanks another. The oil and gas industry requires protection for facilities aboveground, belowground and underwater. An electric utilities gas desulfurization system may require five different lining types.

But so long as the corrosion problem can be solved by a polymer-based lining — and the exceptions are rare — Master Builders Technologies has the solution.

Our linings are monolithic, without seams or joints. They form a continuous, protective barrier against corrosion. They are made of epoxy, polyester and other special polymers. They adhere to carbon steel, alloy and concrete surfaces.

They provide excellent resistance to permeation, chemicals, abrasion and, of course, corrosion. They have immersion temperature resistance to 200 degrees F. and dry temperature resistance to 400 degrees F. They cure quickly, are easy to maintain and provide long, cost-effective service life. Today, millions of square feet of Master Builders Technologies linings protect industrial installations-worldwide.

Flooring Systems

Our flooring systems supply specialized materials which solve the specific corrosion problems found in a wide range of industries, from utilities turbine rooms to pharmaceutical plants. Our floors protect concrete from attack by acids, alkalis and chemicals of all kinds — including water and lubricating oils. They are further specialized to solve problems of abrasion and skid resistance and heavy traffic. From light-duty concrete sealers to heavy-duty trowel-applied systems, Master Builders Technologies provides the answers.

YOUR BEST DEFENSE AGAINST CORROSION

Ceilcote® Corrosion Control Products offer a broad spectrum of solutions to your corrosion problems in moderate to the most aggressive chemical environments. Whether subjected to chemical immersion, spillage, fumes, or environmental corrosion, our range of polymer linings, floorings and coatings form a continuous protective barrier against corrosion.

Highly engineered fillers combined with flake, mat or fabric reinforcement, and a full range of polymer-based matrix systems optimize resistance to permeation and chemical attack.

Special formulations resist 98% sulfuric acid, bridge cracks in concrete, resist abrasion, mechanical abuse, and cure below freezing.

Our systems protect metal or concrete surfaces, cure quickly to minimize downtime, are easy to maintain and provide a long cost-effective service life.

We've been industry's partner in corrosion problem-solving for over half a century. Chances are, we already have a solution to your problem.

Whatever your needs, you can rely on Ceilcote Corrosion Control Products for cost effective answers to your specific problems.

For immediate attention call:
In the U.S.A.
phone 1-800-227-3350
FAX (216) 831-6460
In Canada
phone 1-800-227-3350
FAX (416) 741-7925
In Latin America
phone (905) 557-5544
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MASTER BUILDERS COVERS ALL YOUR NEEDS.

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Printed in U.S.A.

TRUCK UNLOAD AND LIMITED STORAGE FACILITY

CEILCRETE*

REINFORCED TROWEL APPLIED POLYESTER TOPPING/LINING

DESCRIPTION:

CEILCRETE is a time-tested and proven development in corrosion-proof surfacing, designed especially for the protection of concrete and steel against the attack of corrosive chemicals. With nearly 30 years of service in corrosive environments, long-term case histories and reliability are to be expected.

CEILCRETE has three components: a liquid resin, a liquid hardener, and a powder, which are mixed together immediately before use. CEILCRETE is trowel applied in combination with a heavy-duty reinforcing layer of fiberglass or synthetic cloth. The resultant mixture hardens to 75% of its ultimate strength in 8-16 hours at 75°F and will withstand light service at that time. Ultimate strength is developed in two or three days. P-380 Primer is used to ensure excellent bond strength to concrete.

TYPES:

CEILCRETE 2500S and B (Silica and Carbon filled)—Resistant to alkali and acid. B type is electrically conductive and non-sparking; is best for strong alkali and chromic acid.

CEILCRETE 550S and B—Excellent resistant to strong acids as well as solvents.

CEILCRETE 6400S and B—Unusual resistance to strong acids such as nitric, sulfuric, and chromic. Limited resistance to alkalis.

CEILCRETE 6650S, B, and HF—Same resistance to alkalis and acid as 2500; also excellent for many solvents, chlorinated aromatics and aliphatics.

CEILCRETE 695—Exceptional resistance to strong acids (concentrated sulfuric) and moderate to high concentrations of alkalis. Also has good resistance to solvents and organics. Refer to Ceilcote Bulletin 5-13.7.

CEILCRETE "AR"—designation reference to more abrasion resistant version which incorporates a special hard filler in the topcoat.

USES:

- Tank lining
- Trench lining
- Equipment foundations
- Tank pads
- Pump bases
- Piers
- Concrete pipe lining
- Chimney lining
- Scrubber lining
- Floor covering
  - — Acid proof
  - — Spark proof
  - — Conductive

BID SPECIFICATION:

Shall be a fiberglass reinforced, silica or carbon filled, modified polyester resin-based lining, manufactured by the Ceilcote Company and installed at a nominal 1/8" total thickness per manufacturer's recommended practices or as directed by a Ceilcote Field Supervisor.

* Reg. U.S. Pat. & Tm. Off.

PHYSICAL PROPERTIES:

The CEILCRETE types differ somewhat in physical properties but generally meet or exceed the following standards:

Tensile Strength—2,000-2,500 psi (ASTM C 307-83)
Compressive Strength—11,000-13,000 psi (ASTM C 579-82)
Taber Abrasion Factor—70-100 (CS 17F wheel, 1,000 gm wt., 5,000 revolutions)
Coefficient of expansion (in/in/°F) range, 70°F-210°F reinforced with Type H Cloth—$12\text{-}15 \times 10^{-6}$
Electrical Properties[1] Megger Reading (3 ft. span)—0 to 200,000 ohms (500 to 10,000 ohms typical)
Permeance (ASTM E 96)—0.0135 @ 125 mils thickness

[1]Refer to carbon filled

FLASH POINTS (Pensky-Martens Closed Cup):

CEILCRETE 2500, 5500 Liquids	91°F	(32.8°C)
CEILCRETE 6650 Liquid	83°F	(28°C)
CEILCRETE 6400 Liquid	87°F	(30.6°C)
CEILCRETE 695 Liquid	82°F	(28°C)
P-370 Liquid	73°F	(22.8°C)
P-380 Liquid	83°F	(28.3°C)
Hardener No. 2	175°F	(79.4°C)
Hardener No. 3	210°F	(98.9°C)
T-431 Smoothing Liquid	131°F	(55°C)
T-410 Solvent	52°F	(11°C)

CHEMICAL RESISTANCE:

With the types of CEILCRETE available, most chemical requirements can be met; however, there are limitations which require special consideration.

1. Certain strong solvents and organic chemicals.
2. Very strong alkalis.
3. Very strong oxidizing acids.

For specific chemical resistance, refer to the Ceilcote Master Corrosion Resistance Guide (Bulletin 1-4) or contact The Ceilcote Company. Chemical resistance data on CEILCRETE systems are developed using ASTM C 267 and ASTM C 868 in addition to actual installation performance history.

TEMPERATURE RESISTANCE:

CEILCRETE is recommended for continuous immersion at temperatures up to 160°F on steel or concrete substrates. Splash or spillage temperature for floor applications should be limited to 300°F or less, depending upon severity of service. Specific temperature resistance is dependent on the chemical environment.

DESIGN INFORMATION:

Reinforcement

CEILCRETE is installed with a reinforcing layer of fiberglass fabric. The reinforcement performs the following functions:

1. Lowers the coefficient of expansion.
2. Minimizes effects of resin shrinkage.
3. Minimizes possibility of thin spots because of the multi-layer application.

Force 10,000™
High Performance Concrete Admixture

GRACE · CONCRETE ADMIXTURES

DESCRIPTION:

FORCE 10,000™ is a microsilica-based liquid admixture designed to increase concrete compressive and flexural strengths, increase durability, reduce permeability and improve hydraulic abrasion-erosion resistance. FORCE 10,000 contains a minimum of 5.5 pounds of microsilica and weighs 11.5±0.1 pounds per gallon.

USES:

FORCE 10,000 can be used to consistently produce concrete with strengths of 6,000 psi and higher in most instances with locally available materials and existing methods. It may also be used in precast and prestress applications where high early strengths are required.

The addition of FORCE 10,000 also produces concrete with increased watertightness and dramatically reduced permeability compared to conventional mixes. Reduced permeability is an important advantage in slowing the intrusion of chloride where corrosion of reinforcing steel is a potential problem. Examples are parking garages, bridge decks and concrete in a marine environment. FORCE 10,000 also enhances the durability of concrete against aggressive chemical attack and in hydraulic abrasion-erosion applications.

CHEMICAL ACTION:

FORCE 10,000 improves concrete through two mechanisms. The extremely fine microsilica particles are able to fill the microscopic voids between the cement particles, creating a less permeable structure. In addition, the microsilica reacts with the free calcium hydroxide within the concrete to form additional calcium silicate hydrate (glue), producing a tighter paste-to-aggregate bond.

ADDITION RATE:

FORCE 10,000 dosage rates will vary based on the requirements of the application. Dosage rates should be calculated on percent microsilica per hundred weight of cement, or on pounds per cubic yard of concrete, as appropriate. Dosage rates will be as specified. If not specified, consult your Grace representative for your particular job needs.

COMPATIBILITY WITH OTHER ADMIXTURES:

FORCE 10,000 is compatible with all conventional air entraining agents, water reducers, superplasticizers, set retarders and DCI® corrosion inhibitor. Only non-chloride set accelerators, such as Daraset® ,may be used with FORCE 10,000 concrete. All admixtures must be added separately to assure their prescribed performance. Trial mixes and pretesting of concrete are recommended to optimize dosage rates, and ensure ultimate performance.

CONCRETE MIX:

FORCE 10,000 can be used in either central or transit mix concrete production, and in mobile mixers. FORCE 10,000 may be used in conjunction with water reducing admixtures (both normal and high range as approved by ASTM) to assure workability of the mix.

FORCE 10,000 does not affect concrete set times. When slump life extension is desired for transportation, finishing, etc, FORCE 10,000 may be used with an ASTM C494, Type G, slump extending superplasticizer like DARACEM™ 100 as manufactured by W.R. Grace & Co.-Conn., or approved equal.

MIX WATER REDUCTION:

Mix water adjustment is essential to account for the water in FORCE 10,000 and thus maintain the desired water/cement ratio. The mix water added at the batch plant must be reduced by 5.6 pounds of water per gallon of FORCE 10,000.

FINISHING AND CURING OF SLABS:

FORCE 10,000 concrete can be used in flatwork with little or no modification to the recommended practices outlined in ACI 302, "Guide for Concrete Floor and Slab Construction."

FORCE 10,000 will reduce the surface bleed water of concrete in large applications. ACI 308, "Standard Practice for Curing Concrete", must be followed to ensure that any problems that can occur due to decreased bleeding are minimized. Your Grace representative is available to review your particular job needs.

PRECONSTRUCTION TRIAL MIX:

It is strongly recommended that trial mixes be made several weeks before construction start up. This will allow the concrete producer an opportunity to determine the proper batching sequence and amounts of other admixtures needed in order to deliver the required concrete mix to the jobsite. A trial mix will also help determine whether the combination of concrete materials and construction practices will allow the concrete to meet a specified performance. Grace's broad experience with this product can help the concrete producer deliver a satisfactory product regardless of the mixture proportions. Contact your Grace salesman for help with trial mixes.

DISPENSING FORCE 10,000:

Dispensing equipment for the liquid FORCE 10,000 will be provided by W.R. Grace & Co.-Conn.

PACKAGING/AVAILABILITY:

FORCE 10,000 is available in bulk via Grace delivery vehicles. It is also available in 55 gallon drums.

FREEZING POINT:

FORCE 10,000 will freeze at approximately 32 degrees Fahrenheit. Care should be taken to prevent FORCE 10,000 from freezing, since once frozen the admixture is no longer useable.

FLAMMABILITY:

None.

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Concrete Products

FT-48

Printed in U.S.A. 3/90 FA/GPS/5000

Force 10,000® concrete. Strength, durability, and versatility through microsilica technology.

Force 10 000 is a microsilica-based admixture that expands the capabilities of concrete. With it, it is possible to build longer lasting, more abrasion resistant marine and hydraulic structures, to support high-rise buildings with smaller, stiffer columns, to design bridge beams for longer-than-ever span lengths, to construct parking garages and bridge decks that will outlast any ever built before.

Dam spillways, chemical plant slabs, airport runways, industrial floors, shotcrete applications — wherever it's used, Force 10,000 concrete performs beyond expectations. Now there is the means to satisfy a range of engineering requirements not previously possible with ordinary concrete, a way to open the door to new uses of concrete, a solution for getting more performance from concrete.

The effect of microsilica on concrete chemistry.

The microsilica (silica fume) in Force 10,000 improves the strength and reduces the permeability of concrete by altering the hydration reaction and by the "microfiller effect".

When water is added to portland cement, the hydration reaction produces calcium silicate hydrate, the glue which holds the system together, and calcium hydroxide, a weaker product which can occupy as much as 25% of the volume of the cement paste. Since Force 10,000 contains pozzolans (finely divided materials that are siliceous in nature and have little cementitious value by themselves), it will react with a portion of the calcium hydroxide in concrete to produce a greater amount of aggregate-binding calcium silicate gel. More glue in the mix improves bonding within the concrete matrix and reduces permeability.

Aggregate-to-paste interface without microsilica.

Aggregate-to-paste interface with microsilica.

The microfiller effect.
In a typical mix of 600 pounds cement and 45 pounds microsilica, there are more than 50,000 particles of microsilica for each grain of cement. The extreme fineness of microsilica allows it to fill the microscopic voids between cement particles, which reduces permeability and improves the paste-to-aggregate bond.

Cuddy Foods: A case for concrete in a chemical environment.

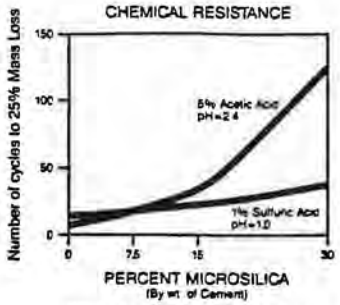
Force 10,000. Concrete that stands up to chemical attack and hydraulic abrasion.

The level of impermeability of Force 10,000 concrete makes it ideal for structures subject to chemical attack or the abrasive force of moving water. It is very difficult for most chemicals to penetrate Force 10,000's structural matrix, or for water to abrade it. Thus, it can significantly lengthen the service life of flooring in food processing plants, wineries, chemical plants, paper mills, and waste treatment plants, and add years to the life of dam spillways, tunnels, concrete pipes, roads, and bridge overlays. Force 10,000 concrete's ability to outperform conventional concrete in those applications makes it highly cost-effective.

Microsilica concrete provides a lean solution for a fat problem.

Cuddy Foods of London, Ontario, Canada, processes one million chickens per week, a busy manufacturing procedure which leaves large amounts of fat and acids on the plant floor. Even though the floors are cleaned nightly, it's a highly corrosive environment for concrete, one made worse by the abrasive (600 psi) steam spray used to scour the slabs. The incessant barrage took its toll; Cuddy Foods' previous concrete floor showed signs of deterioration after just one year. Thought was given to replacing the old concrete with paving bricks or sulphur bricks, but they were too costly. Force 10,000 concrete offered a long-term solution at a substantial savings over any other method. A series of trial batches showed that the necessary strengths and resistance to chemicals and abrasion could be attained. A final mix was designed, and the floor was placed.

After two and a half years in the same corrosive environment, the Force 10,000 floor shows no signs of spalling, breakdown, or deterioration.



Note. Each cycle consists of 7 days in solution, remove and wire brush, 7 days dry.

ENGINEERING BULLETIN
FORCE 10,000®/NUMBER ONE

FORCE 10,000® MICROSILICA AND ITS USES IN CONCRETE

One of the newest construction materials available to designers and engineers is Force 10,000®, a microsilica-based concrete admixture which expands the versatility and capability of portland cement concrete. This new technology can dramatically improve concrete strengths, durability and impermeability, allowing concrete to be used in ways never before possible. Applications of Force 10,000 are broad, and include high-strength structural columns, less permeable parking garage decks, and abrasion resistant hydraulic structures.

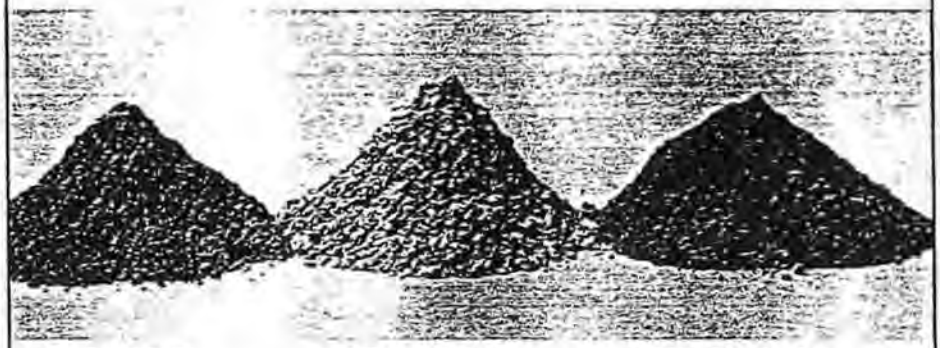
This introductory bulletin will describe what microsilica is and how it works in concrete, as well as some of the practical considerations specifiers should be aware of when considering microsilica concrete. Additional Engineering Bulletins will discuss specific applications of Force 10,000 concrete.

Background

Condensed silica fume is a by-product from silicon and ferrosilicon industries, where these metals are produced in submerged electric arc furnaces. As the molten metal is produced, a silica-based gas is emitted. This gaseous fume, as it rises, cools rapidly and forms extremely minute, glassy, spherical particles. The condensed silica fume, referred to as microsilica, is collected in a bag house, a system for filtering the hot air and gases vented from the furnace.

Until the last few decades, the microsilica particles were considered a waste product and discarded. However, during the 1950's European researchers began to examine potential uses and investigate potential applications for microsilica, including its use in combination with portland cement.

Figure 1.



CEMENT FLY ASH MICROSILICA

Physical and Chemical Composition

The physical characteristics of microsilica are quite different than standard concrete components, but the chemical make-up is rather similar. Microsilica is an extremely fine particulate, with average diameters 100 times finer than cement particles. Specific gravities of microsilica are low, about 2.2, versus 3.15 for most portland cements. Because microsilica is an extremely fine material, its raw bulk densities are very low, varying from 9 to 25 pounds per cubic foot, versus a dry bulk density of 94 pounds per cubic foot for cement. Figure 1 provides a visual comparison of cement, fly ash, and microsilica.

The chemical make-up of microsilica is almost pure silicon dioxide (SiO_2). Table 1 compares a typical chemical analysis of the three common concrete constituents pictured above.

Table 1.

CHEMICAL ANALYSIS

	Cement	Fly Ash	Microsilica
SiO_2 Silica	21.3%	49.0%	92-98%
Al_2O_3	4.5	24.6	0.5
Fe_2O_3	4.0	7.3	2.1
MgO	2.4	1.6	0.3
CaO	63.1	9.1	0.8
Na_2O	0.1	0.2	0.1
K_2O	1.2	0.6	1.0
SO_3	2.2	0.4	0.2

How Microsilica Works in Concrete

Microsilica improves concrete through two primary mechanisms — the basic pozzolanic reaction, and a microfiller effect.

When water is added to portland cement hydration occurs forming two products, as shown below:

$$\text{Cement} + \underset{H_2O}{\text{Water}} \longrightarrow \underset{CSH}{\text{Calcium Silicate Hydrate}} + \underset{Ca(OH)_2}{\text{Calcium Hydroxide}}$$

The calcium silicate hydrate formed is the glue, or binder, which holds the system together. The weaker calcium hydroxide does not contribute as a binder, and can occupy as much as one quarter of the volume of the hydration products. Further, the calcium hydroxide can combine with carbon dioxide to form a soluble salt which will leach through the concrete, and can cause efflorescence, a familiar architectural problem. When high amounts of calcium hydroxide are present, concrete may be more vulnerable to sulphate attack, chemical attack, and adverse alkali-aggregate reactions.

The pozzolanic microsilica reacts with the calcium hydroxide and water to produce more aggregate-binding calcium silicate gel, while simultaneously reducing the calcium hydroxide content, as shown in the chemical reaction below:

$$\underset{Ca(OH)_2}{\text{Calcium Hydroxide}} + \underset{SiO_2}{\text{Microsilica}} + \underset{H_2O}{\text{Water}} \longrightarrow \underset{CSH}{\text{Calcium Silicate Hydrate}}$$

This additional glue improves bonding within the concrete matrix and helps reduce permeability, while the reduction in calcium hydroxide improves concrete durability.

The beneficial effect of microsilica can be seen more dramatically from the two scanning electron photomicrographs shown in Figures 2 and 3:

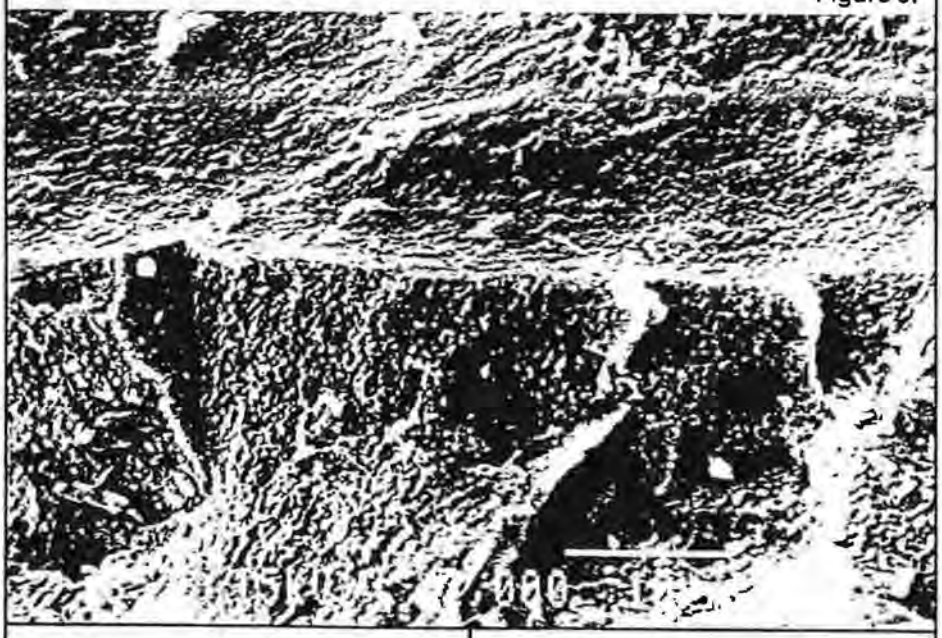
Figure 2 is magnified over two thousand times and highlights the aggregate-to-paste interface of a concrete matrix without microsilica.

Concrete Without Microsilica

Figure 2.

Concrete With Microsilica

Figure 3.



The top portion of the photo is a socket formerly occupied by an aggregate. Calcium hydroxide crystals are present underneath the interface, thereby preventing a good paste-(lower left corner) -to-aggregate bond.

Conversely, Figure 3 shows a similar view with microsilica concrete. The top portion shows an aggregate socket with no calcium-hydroxide crystals beneath the interface. The paste forms an excellent bond to the aggregate, producing stronger concrete, and reducing permeability.

The second mechanism by which microsilica improves concrete quality is through the so-called "microfiller effect." Most condensed silica fume has an average particle size of about 0.15 micrometers, while a typical portland cement has an average particle size of 15 micrometers.

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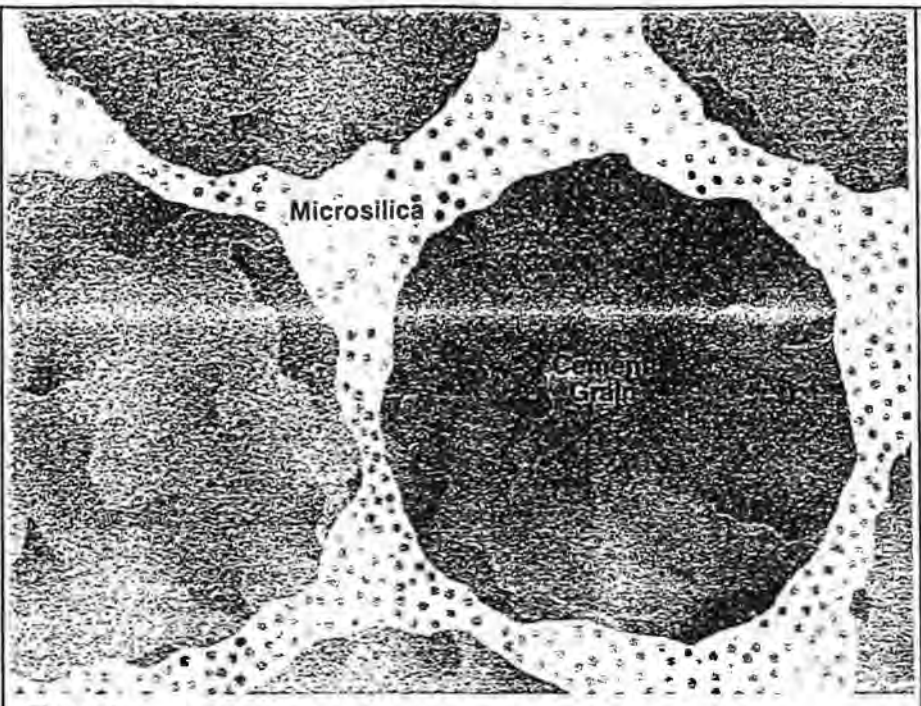


Figure 4.

Because of this size relationship, in a typical mix (e.g., 600 pounds cement and 60 pounds of microsilica) there are over 50,000 particles of microsilica for each grain of cement, as depicted in Figure 4 above.

The extreme fineness of microsilica allows it to fill the microscopic voids between cement particles. The microfiller effect is credited with greatly reducing permeability and improving the paste-to-aggregate bond of microsilica concrete compared to conventional concrete.

Placing, Finishing and Curing Considerations

Microsilica concrete is not difficult to work with, but because it is used for special applications, care should be taken to ensure that good quality concreting practices are followed.

The water demand of concrete can increase when microsilica is added to the mix. Just as with aggregates, the smaller sized microsilica particles have an increased surface area, and thereby, increased water demand. One method of compensating for this effect is to increase the water content; however, this leads to a lower quality concrete. The use of a superplasticizer, or high-range water reducer, in conjunction with the microsilica is almost universally recommended.

Depending on the dosage of microsilica, the fresh concrete may be more cohesive and sticky than conventional concrete. Due to this cohesiveness, slumps one to two inches higher than normal should be used for similar types of placement. For ease of placement, the highest practical slump (attained through the use of superplasticizers) should be specified. Despite the increased cohesiveness, microsilica concrete produces a very creamy paste and is very pumpable.

One of the biggest differences in using microsilica concrete occurs during finishing. The addition of microsilica will virtually eliminate bleed water, making it more susceptible than conventional concrete to plastic shrinkage cracking. Practices outlined in the Guide for Concrete Floor and Slab Construction (ACI 302) and Hot Weather Concreting (ACI 305) should be followed to provide a good surface.

Finishing and curing practices which have worked successfully in the field generally involve underfinishing and overcuring the concrete. Curing should begin immediately following the finishing operation, and can include fog misting and placing wet burlap over the surface. Careful attention to curing is essential; as with any concrete, microsilica concrete will perform much better when properly cured. The Standard Practice of Concrete Curing (ACI 308) should be closely followed.

The addition of microsilica can also influence the color of both plastic and hardened concrete. Typically, a microsilica concrete is darker gray than conventional concrete, and it can become almost black, depending on the dosage of microsilica used. This does lighten or bleach out with time.

Specifying Microsilica in Concrete

Microsilica is typically specified in dosages expressed by weight of cement. Dosages will vary depending on the application and the level of protection required, and typically range between 5% and 15% microsilica by weight of cement.

Grace has developed sample specifications for high strength, corrosion protection and durability applications using Force 10,000 concrete. Your Grace representative will be able to work with you to modify the sample specifications to meet your specific needs.

Summary of Benefits

Because of the pozzolanic nature and extreme fineness of the microsilica, Force 10,000's use in concrete can improve many of its properties, opening up a wide range of applications. Its benefits include:

Dramatically Increased Strength

- Ready-mixed concrete compressive strengths of 10,000 to 20,000 psi
- Flexural strengths of 1,500 to 2,000 psi

Significantly Reduced Permeability/Increased Resistivity

- Rapid chloride permeability test results below 500 coulombs
- Reduced water and gas permeability
- High resistivities providing corrosion protection

Improved Durability

- Higher resistance to aggressive chemical attack
- Better resistance against sulfate attack
- Improved hydraulic abrasion-erosion resistance
- Better resistance to adverse alkali-aggregate reactivity

These benefits make microsilica concrete suitable for a number of applications, ranging from structural beams and columns, to parking garage and marine structures, to chemical plant slabs, to dam spillways. These benefits and applications will be topics of future Engineering Bulletins.

ENGINEERING BULLETIN
FORCE 10,000® /NUMBER THREE

WATER AND GAS PERMEABILITY OF FORCE 10,000® CONCRETE

There are many applications in industry which require a concrete with very low permeability. Structures where contamination from either the inside or outside is critical — such as waste water treatment plants or water containment vessels — may need such protection. Tunnel linings also may require a less permeable concrete to protect against water seepage and permeation of certain gases. Additionally, reduced permeability is important in structures which are in environments exposed to salts — both road and marine — where the salts eventually migrate into the concrete and initiate corrosion of reinforcing steel.

In all of these applications, Force 10,000, a microsilica-based concrete admixture, can provide reduced permeability through two different mechanisms. First, the fine particle size of the microsilica (one-hundredth the size of cement grains) acts to fill in potential voids or gaps within the matrix. Second, the pozzolanic microsilica combines with the free lime (calcium hydroxide) in the concrete system to produce additional paste (calcium-silicate-hydrate), providing better bonding between the aggregates, and reducing the potential for creation of "transmission" channels. Thus the permeation of liquids and gases can be significantly reduced versus conventional concrete.

This Engineering Bulletin describes the results from both water and gas permeability tests run on Force 10,000 concrete. (In reference to the permeability of chlorides, Force 10,000 not only reduces concrete permeability, but also increases resistivity, thus reducing the concrete's ability to pass electrical currents and impeding the corrosion process. This is the topic of a separate Engineering Bulletin.)

Water Permeability

To evaluate the water permeability of Force 10,000 concrete, Grace contracted an independent testing agency, Law Engineering, to perform the standard U.S. Army Corps of Engineer's Test CRD-C48-73, "Method of Test for Water Permeability of Concrete." Basically, the test involves placing a specific head pressure on the concrete specimen and measuring the flow rate of water through this specimen over time. Once a stable rate is achieved, the permeability coefficient of the specimen can be calculated by applying d'Arcy's law for unidirectional flow at constant head pressure.

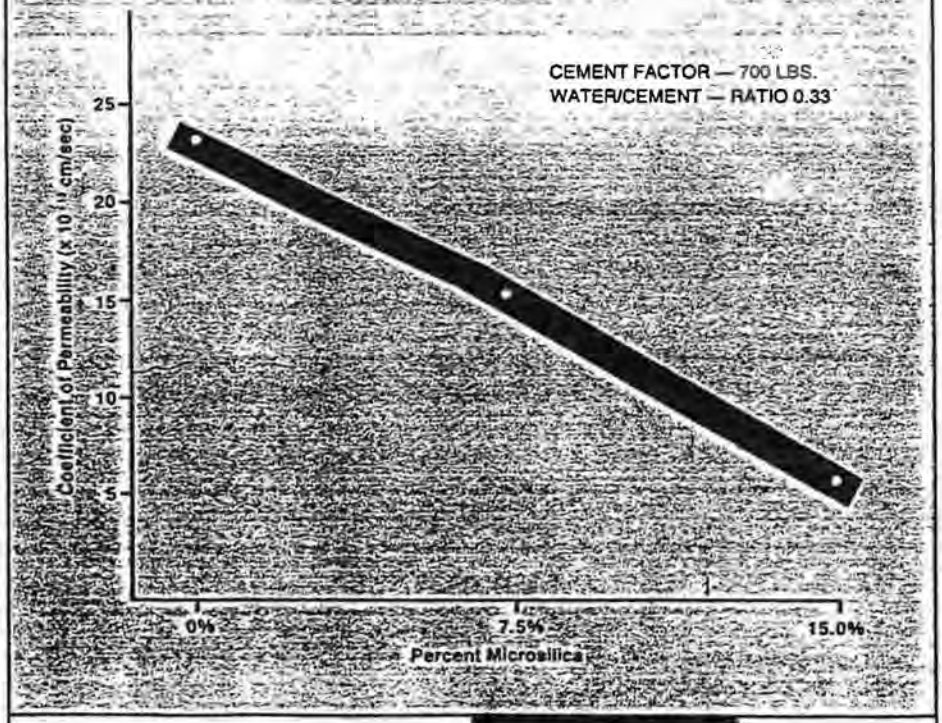
In this particular test the concrete was exposed to head pressures of 240 psi (or about 16 atmospheres). The specimens, with a 6 inch diameter, were cast at Grace's lab, and given to Law Engineering for testing. The three comparison samples each had 700 pounds of cement and a water/cement ratio of 0.33. The microsilica dosages were 0%, 7.5%, and 15% by weight of cement.

The permeability results of the three mixes are shown below in Figure 1:

As shown, the coefficient of permeability of the concrete decreased significantly with the addition of microsilica: by 30% for a 7.5% dosage rate, and by 73% for the 15% dosage rate. The microsilica concrete values were both below 20×10^{-12} cm/sec, which is considered to be very low permeability for concrete.

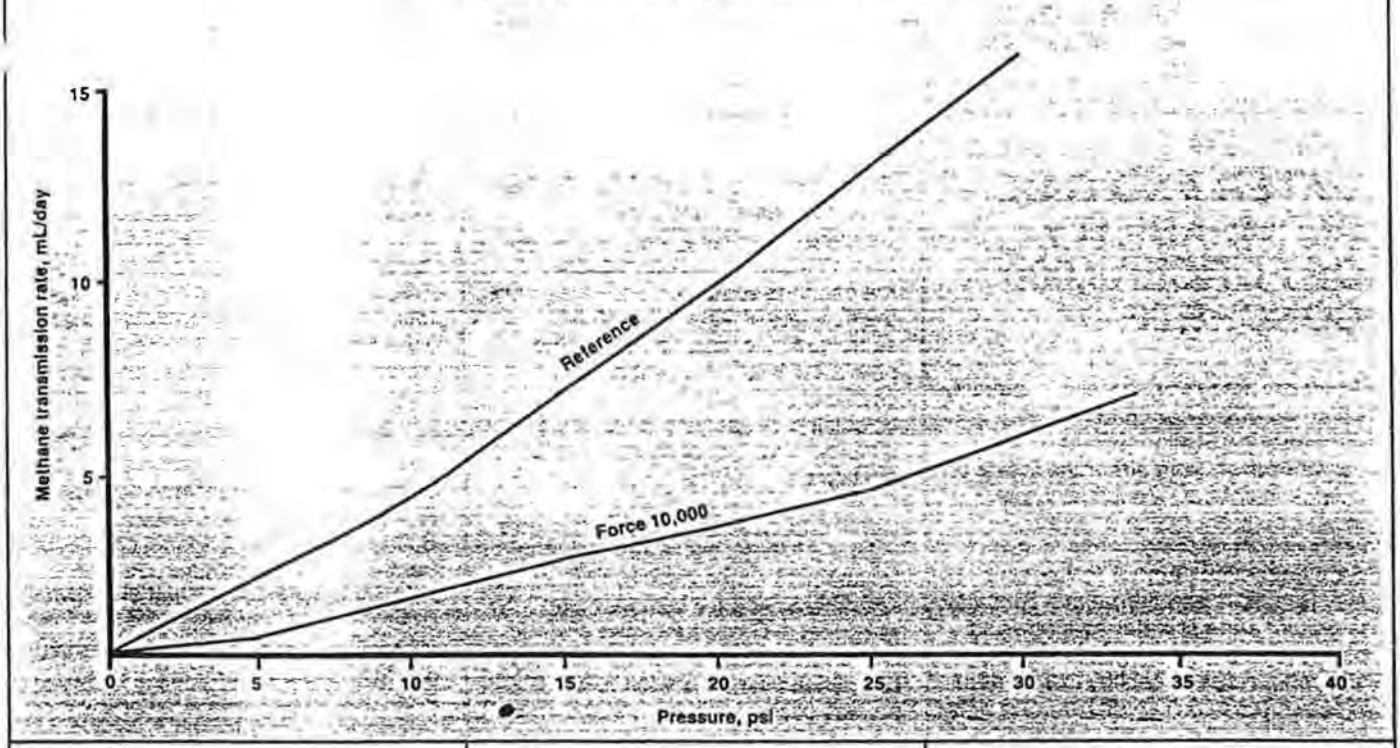
In addition to this work performed by Law Engineering, others have conducted tests with similar results. E. J. Sellevold, of the Norwegian Building Research Institute, concluded from a review of European lab and field data that for equal compressive strength levels, concrete with microsilica is more impermeable than ordinary portland cement concrete. From this he concluded that the "efficiency" factor for microsilica in concrete is greater with respect to permeability than to compressive strength (Effect of Microsilica on the Durability of Concrete Structures, Concrete International, December 1987, p. 39-43).

Figure 1. Water Permeability of Microsilica Concrete



GRACE Concrete Products

Figure 2. Methane Gas Transmission Rates



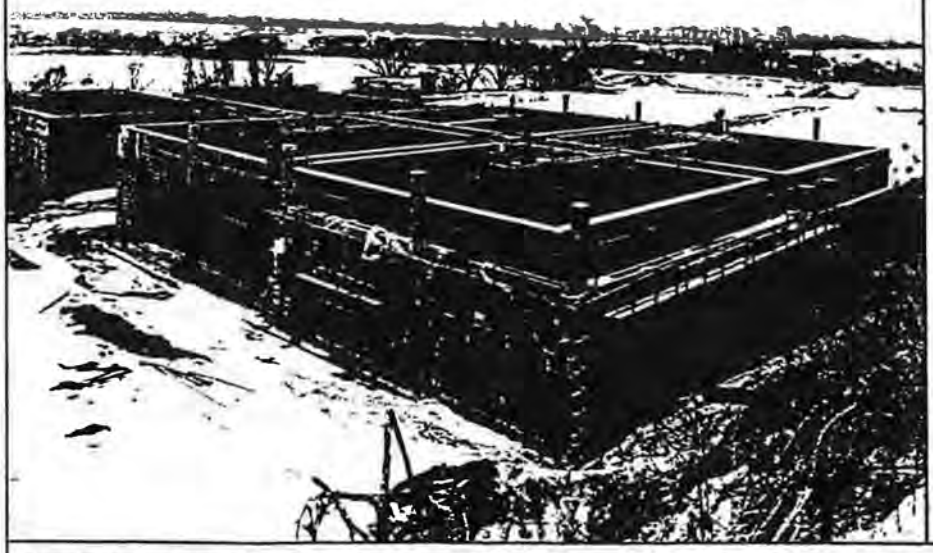
Gas Permeability

Grace is also examining the permeability of microsilica concrete to methane and nitrogen gases. The test used, developed by Matrecon, Inc., compares the gas permeability of concrete at pressures ranging from 5 to 30 psi. While testing is still continuing, Matrecon concluded that microsilica significantly reduced the permeation of methane gas through the concrete, as shown in Figure 2.

Methane transmission rates, measured in milliliters per day, were significantly reduced for the microsilica concrete at all pressure levels tested between 5 psi and 30 psi. Significant benefits are shown at lower pressures (5 psi) which more accurately reflects conditions likely to be encountered in a tunnel environment.

Summary

As shown in the previous two Figures, Force 10,000 can significantly reduce the permeability of concrete to both liquids and gases. At dosages of 15% microsilicia by weight of cement, the water permeability was reduced by over 70% versus the reference. Similarly, methane gas transmission rates were more than halved with microsilica concrete. In applications where water and gas permeability reductions are important, such as tunnel linings and storage vessels, Force 10,000 can be used to improve the concrete properties.



Force 10,000 Microsilica can be used to reduce water permeability in a wide range of applications including: water treatment plants, water containment vessels and tunnel linings.

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ENGINEERING BULLETIN

FORCE 10,000® /NUMBER FOUR

CORROSION PROTECTION USING FORCE 10,000 MICROSILICA

This Engineering Bulletin briefly examines how the addition of microsilica to concrete can help protect the reinforcement against chloride-induced corrosion. A description of the reinforcement corrosion process is given. Laboratory studies and field data are used to quantify corrosion test results and better explain protection requirements. Microsilica, also known as silica fume or condensed silica fume, is available as a dry powder, a densified powder or as a liquid slurry admixture.

The Chloride-Induced Corrosion Process

The chloride-induced corrosion of reinforcement in concrete is an electrochemical process caused by chlorides which migrate through the pores of the concrete to attack the steel. The alkaline environment of concrete creates a thin, passivating layer around all the embedded steel. Chlorides attack the steel through defects in this protective barrier to start the corrosion process. Iron at the anode (usually the top mat of reinforcement in a slab) chemically combines with the chloride ion and eventually becomes the corrosion product, ferric oxide (Fe_2O_3). Buildup of ferric oxide causes staining and cracking of the concrete. During this corrosion process, electrons are released and travel to the cathodic steel to form hydroxl ions (OH^-). The cathode is located where there is good access to oxygen, usually the bottom mat of reinforcement in a slab. The hydroxl ions travel through the concrete to the anodic steel, completing the corrosion process. Chlorides are available primarily from deicing salts and marine environments. Clearly if the permeability of the concrete were significantly reduced, it would take longer for chlorides to travel from the concrete surface to the reinforcement. This would increase the time to corrosion-initiation and extend the service life of the structure. Also if the resistivity of the concrete were increased, the corrosion process could be slowed even if chlorides reach the reinforcement.

Concrete Permeability

When cement combines with water the resulting chemical reaction forms calcium silicate hydrate (CSH) "glue" and calcium hydroxide. The CSH binds the aggregate together while the crystalline calcium hydroxide simply occupies space and contributes to a weaker and more permeable concrete matrix. Microsilica consists primarily of silicon dioxide (SiO_2) which, when added to fresh concrete during the batching process, chemically combines with the calcium hydroxide to form more CSH. See the W. R. Grace & Co.–Conn. Engineering Bulletin, Number One, "Force 10,000 Microsilica and its Uses in Concrete", for a more complete explanation. Additionally, microsilica is roughly one-one hundredth the size of a cement grain which helps to fill in the voids between the larger CSH particles and the aggregate. The addition of microsilica to the concrete mix results in a significantly less permeable matrix.

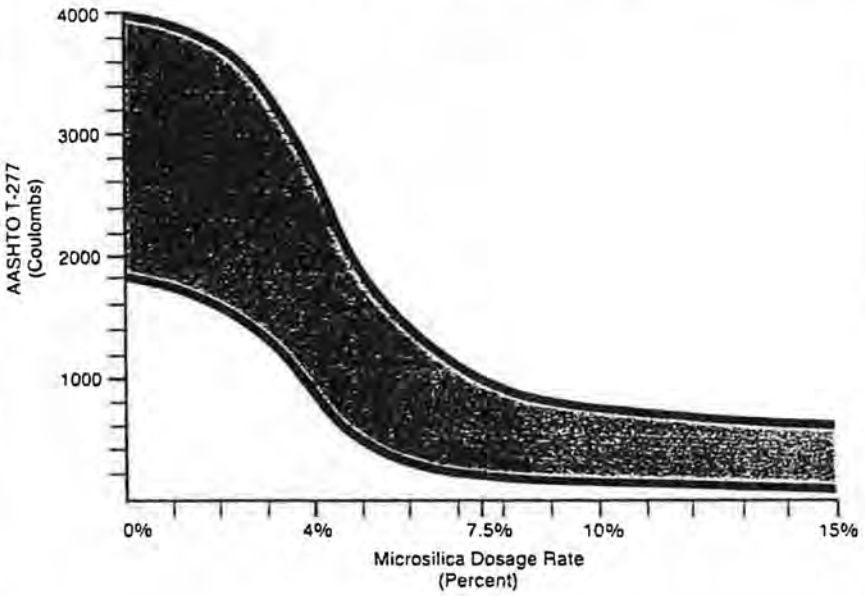
The most common test method used to measure the chloride permeability of concrete is AASHTO T-277, "Rapid Determination of the Chloride Permeability of Concrete"[1]. As the name implies, this test is a rapid method for determining concrete chloride permeability for research and ongoing construction projects. Actually, this test does not measure permeability but rather the resistivity of the concrete which has a good inverse correlation with concrete permeability. The test consists of a four-inch-diameter by two-inch-thick specimen which is subjected to a 60 volt potential for six hours to measure the electrical charge passed in coulombs. AASHTO anticipates a precision variability of 19.5% while ASTM expects it to be higher. See the Grace Technical Bulletin, "Understanding the Rapid Chloride Permeability Test" (GEN-87-01) for a complete description. There are at least a dozen parameters which can affect the final coulomb reading, so an exact, reproducible test measurement is nearly impossible. Five chloride permeability categories were, therefore, created as shown in Table 1. Concretes with coulomb readings in the same category are considered to have equivalent chloride permeability. Design engineers who specify microsilica generally require a coulomb reading in the 100 to 1,000 coulomb category which is classified as "very low".

It is recommended that test specimens be 4" x 8" cylinders cast from a ready-mix truck at the job site according to ASTM C-31 and cured for 90 days prior to testing. Some engineers believe inaccuracies exist in the FHWA rapid permeability test method and are specifying "percent microsilica by

Table 1 — AASHTO T-277 Chloride Permeability Based on Charge Passed

Charge Passed (coulombs)	Chloride Permeability	Typical of
>4,000	High	High water-cement ratio (>0.6). Conventional PCC.
2,000-4,000	Moderate	Moderate water-cement ratio (0.4-0.5). Conventional PCC.
1,000-2,000	Low	Low water-cement ratio (<0.4). Conventional PCC.
100-1,000	Very Low	Latex modified concrete, "Iowa" dense concrete.
<100	Negligible	Polymer impregnated concrete. Polymer concrete.

Figure 1. Expected Range of AASHTO T-277 Test Results at a Water-Cement Ratio of 0.40 at 90 Days.



Division of W. R. Grace & Co., measure actual chloride contents in the concrete as a function of time, mix design and depth in the concrete. From these data, the actual chloride permeability of the concrete can be measured as an effective diffusion coefficient. These are compared to AASHTO T-277 results in Table 2. Using these diffusion coefficients and further calculations, Grace has been able to estimate the amount of chloride reaching the reinforcement in certain structures as a function of time. See your Grace representative for further details.

This chloride ponding test data proves that as more microsilica is added to a constant mix design, the concrete chloride permeability is reduced. These data also qualitatively agree with the AASHTO T-277 test method which states that as the coulombs measured decrease, the chloride permeability also decreases.

weight of cement" rather than coulomb levels. Usually a specified microsilica quantity is based on the severity of the service environment. Two common microsilica dosage rates are 7.5 percent by weight of cement in parking structures and 10 percent for piles in a marine environment. Combining microsilica with other corrosion protection systems, such as DCI corrosion inhibitor, is also a common practice.

Laboratory and field tests[2,3,4,5,6] have been performed to measure the effect of microsilica dosage rates on the permeability of concrete. Figure 1 shows the results of these studies utilizing a 650 pound cement factor mix at a 0.40 water-cement ratio after 90 days of curing. Two points are apparent from this figure: 1) as more microsilica is added to the concrete the chloride permeability (as measured in coulombs) is reduced; and 2) the coulombs measured usually vary for samples of the same mix design. The actual coulomb test result is very dependent on the concrete materials used, microsilica amount and testing accuracy.

A method used by Grace to determine actual chloride ingress into concrete with and without microsilica consists of cyclic ponding of concrete blocks and "lollipops" (Figure 2) with a sodium chloride solution for extended lengths of time. These ongoing tests[6], performed at the Construction Products

Figure 2. Chloride Ponding Test Specimens

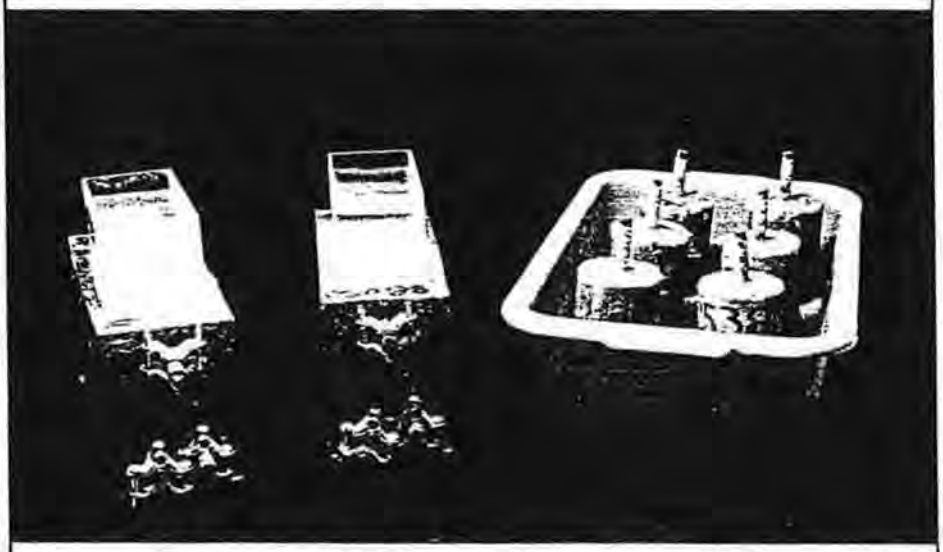


Table 2 — Effective Diffusion Coefficients Versus AASHTO T-277 Results

Mix	Water Cement Ratio	Microsilica (%)	28 — Day AASHTO T-277 (coulombs)	Effective Diffusion Coefficient (10^{-8} cm²/sec)
A	0.48	0.0	3700	9
B	0.48	15.0	225	0.6
C	0.43	7.5	380	0.8
D	0.38	0.0	2660	2
E	0.38	15.0	100	0.3

Cement Factor: 600 lbs./cubic yard

Concrete Resistivity

Concrete resistivity, the resistance of concrete to the passage of a corrosion-induced electrical current, is also an index of corrosion protection. In a concrete structure when chlorides attack the reinforcement, electrons are released at the anode and travel via the steel to the cathode. At the cathode, hydroxl ions are produced which travel to the anode through the concrete to complete the corrosion circuit. **Macrocell corrosion** takes place between an anode and cathode separated by a large distance such as a top and bottom mat of reinforcement in a slab. By increasing the resistivity of the concrete, the process of macrocell corrosion may be slowed but not stopped. **Microcell corrosion** is defined as that which takes place when the anode and cathode are adjacent to each other on the same reinforcement. Microcell corrosion is usually not affected by increased concrete resistivity and may be less severe than macrocell corrosion. The addition of microsilica to the concrete increases its resistivity and, thus, reduces the macrocell corrosion rate.

The resistivity of moist concrete with a water-cement ratio between 0.50 to 0.35 is normally between 2,000 to 12,000 ohm-cm. Microsilica can raise the resistivity to 30,000 ohm-cm or greater. The macrocell corrosion process for concrete at 30,000 ohm-cm should be approximately six times slower than that of 5,000 ohm-cm concrete. Laboratory research tests at Grace continue to measure these concrete properties. Table 3 shows 28-day compressive strengths, coulombs and resistivity measurements for concrete with a cement factor of 600 pounds per cubic yard[6].

Table 3 — Concrete Properties

Mix #	Microsilica by Mass of Cement* (%)	Water-Cement Ratio	28-Day Compressive Strength (psi)	28-Day Chloride Permeability (coulombs)	28-Day Resistivity (Kohm-cm)
1	0	0.48	5160	361	7.7
2	3.75	0.48	5417	3175	16.3
3	7.5	0.48	6346	348	45.4
4	15.0	0.48	7357	198	94.7
5	0	0.43	5264	2585	9.3
6	3.75	0.43	6547	2210	22.1
7	7.5	0.43	7214	213	67.7
9	15.0	0.43	8582	98	118.0
10	0	0.38	5782	3485	10.8
11	3.75	0.38	9312	736	24.3
12	7.5	0.38	9288	132	73.9
13	15.0	0.38	12119	75	161.0

*Cement Factor: 600 lbs./cubic yard

Quality Concrete

Even though microsilica improves the various properties of concrete, the first line of defense against chloride-induced corrosion is quality concrete. Quality concrete results when the concrete mix design, construction practices and structural design comply with the guidelines of the American Concrete Institute.(ACI).

Design and Construction Recommendations

When designing a microsilica concrete mix for chloride-induced corrosion protection, two types of specifications may be used: a performance type or a prescription type. A performance specification requires a maximum coulomb level to be met at 90 days and allows the concrete producer to design the mix to meet this. A prescription specification lists the ingredients of the mix such as maximum water-cement ratio and percent microsilica. Use a performance or a prescription type specification but not both. A common practice is to specify a maximum coulomb level (performance type) to be met before the project starts and then to require that mix design be used throughout the project.

Some design recommendations from ACI-318 "Building Code Requirements for Reinforced Concrete" for corrosive environments include the following:

- Water-cement ratio = 0.40 maximum
- Concrete cover over the reinforcement = 1½" minimum
  = 2" recommended
- Air-entrainment for freeze-thaw durability = 6 ± 1½% for ¾" aggregate.
- Proper concrete finishing and curing techniques.

One of the more important aspects of quality concrete is curing. Microsilica concrete usually does not bleed as much as normal concrete due to the lower water-cement ratio and the reduced permeability of the concrete. One method to help alleviate this problem is to use fog misting. Fog misting should begin soon after placing and be maintained until proper curing has begun in order to minimize surface drying. ACI-308 "Standard Practice for Curing Concrete" must be followed to guard against plastic shrinkage cracks. To allow the concrete to cure properly for maximum corrosion protection performance, as with strength and durability, ACI recommends seven days of wet curing. It is better to underfinish and overcure microsilica concrete.

ACI 357 "Guide for the Design and Construction of Fixed Offshore Concrete Structures" gives recommendations for marine concrete design.

Conclusions

1. Microsilica in concrete can significantly increase the service life of a structure in a corrosive environment.
2. The greatest benefit of adding microsilica to concrete for corrosion protection is that it significantly reduces the chloride permeability of concrete which slows down the chloride ingress.
3. Microsilica increases the resistivity of concrete which impedes the electrical current generated by macrocell corrosion.
4. Reducing the water-cement ratio of concrete and increasing the microsilica content lowers permeability and increases resistivity.
5. Designing for quality concrete, as defined by ACI guidelines, is the first line of defense against chloride-induced corrosion.

References

1. "Rapid Determination of the Chloride Permeability of Concrete" by D. Whiting, FHWA Report No. FHWA/RD-81/119, 1981.
2. "Effect of Microsilica and Fly Ash Upon the Microstructure and Permeability of Concrete", by M. J. Scali, D. Chin and N. S. Berke, Proceedings of the Ninth International Conference on Cement Microscopy, April 5-9, 1987.
3. "Microsilica and Concrete Durability" N. S. Berke, Paper No. 870275, Presented at 67th Annual Transportation Research Board Meeting, January 11-14, 1988, Washington, D.C.
4. "Influence of Force 10,000 Condensed Silica Fume Concrete Admixture on Chloride Ion Permeability", S. L. Marusin, T. J. Rowe, and D. W. Deno, WJE Report No. 860348, Wiss, Janney, Elstner Associates, Inc., Arlington, TX 1986.
5. "Corrosion Protection Through the Use of Concrete Admixtures," N. S. Berke, and T. G. Weil, Second International Conference on Performance of Concrete in Marine Environment, August 21-26, 1988, St. Andrews by the Sea, New Brunswick, Canada.
6. "Protection Against Chloride-Induced Corrosion — A Review of Data and Economics on Microsilica and Calcium Nitrite", N. S. Berke, D. E. Pfeiffer, T. G. Weil, Concrete International, December 1988.

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ENGINEERING BULLETIN
Force 10,000®/Number Five

MECHANICAL PROPERTIES OF FORCE 10,000® CONCRETE

Force 10,000®, a microsilica-based concrete admixture from Grace Construction Product Division, has gained acceptance in a number of diverse applications. These include environments which are highly corrosive, chemically saturated, or very abrasive and where less-permeable, more-durable concrete is required. In addition, Force 10,000 is being utilized in structural members requiring concrete with improved mechanical properties. This includes ready-mix concrete for columns and beams for high-rise construction and for prestressed girders and piles.

This Engineering Bulletin will discuss the influence of microsilica on some of the principal mechanical properties of importance to design engineers. Some of these are increased compressive strength, modulus of elasticity, flexural strength (modulus of rupture), split tensile, shrinkage, and creep.

Test Data

Data for this Bulletin were obtained from various sources. The Construction Products Division of W. R. Grace & Co.–Conn. ran a multitude of laboratory and field tests with the results incorporated here. Other data were taken from published literature and are referenced. Wiss, Janney, Elstner Associates (WJE), Irving, Texas was contracted to run mechanical property tests for concrete with various microsilica dosage rates. The standard reference mixes listed with the WJE test results were developed at Grace. Tests were made with either a liquid-slurry microsilica product or a dry-densified product.

Compressive Strength

Compressive strength is the primary performance measure of concrete and is a property which microsilica strongly benefits. To better understand the contribution of microsilica to high strength concrete versus that of other standard mix ingredients, Grace studied the strength contributions in psi per pound of cement, types C and F fly ashes,

Figure 1
Compressive Strength Contribution

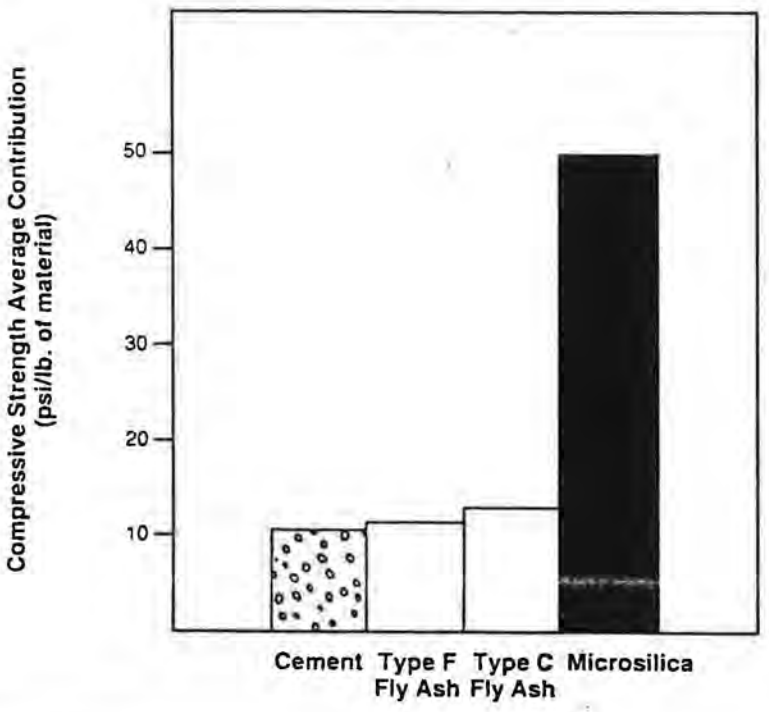


Figure 2
Compressive Strength (28 days) vs. Microsilica Dosage Rate

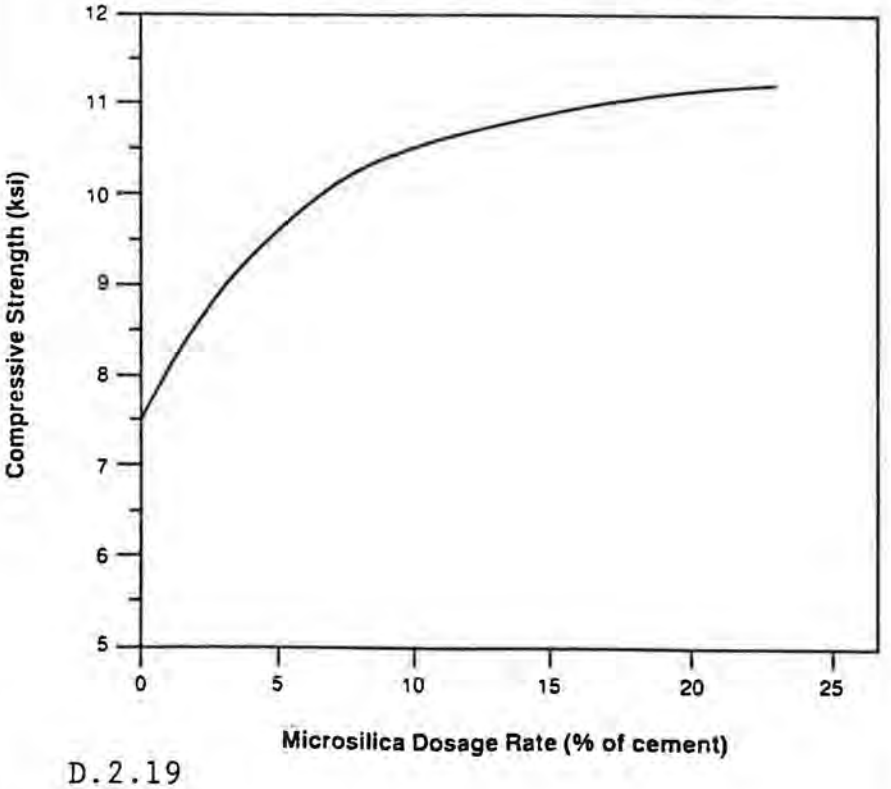


Table 1
Compressive Strength Concrete Mix Designs

	Figure 1	Figure 2
Cement (lbs.)	550 to 800	700
Coarse Aggregate (lbs.)	1710 to 1610	1720
Fine Aggregate (lbs.)	1060 to 1325	1060
Water/Cement Ratio	0.40	0.40
Fly Ash (lbs.)	0 to 140	0
Microsilica (%)	0 to 20	0 to 22.5
Air Content (%)	1.5	1.5
Admixtures added for workability		

and microsilica. These are summarized in Figure 1. The values are an average from many different mix designs and microsilica dosage rates.

Pound for pound, microsilica is significantly more efficient in compressive strength development than both cement and fly ash. At 28 days, microsilica can be almost 5 times more effective than cement in contributing to compressive strength. This is a result of both the pozzolanic nature and fineness of the microsilica, which are described in detail in Force 10,000 Engineering Bulletin Number One.

Figure 2 shows how microsilica influences the compressive strength of concrete at 28 days. Table 1 gives the concrete mix design which corresponds to the results in Figures 1 and 2. Concrete with 5% or 10% microsilica content exhibits good strength gains and even 15% dosages provide additional benefits, although the added benefit for the incremental 5% addition is less.

Despite increased nominal strength at dosages in excess of 20%, the compressive strength contribution is lower than in the 5% to 15% dosage range. Therefore, for high-strength applications, microsilica dosages are typically 15% or less. Table 2 gives the concrete mix designs and compressive strength results from the addition of 5%, 10% and 15% microsilica in the WJE study. All compressive strength tests were run according to ASTM C39.

Because of microsilica's exceptional strength contribution, concrete compressive strengths in excess of 10,000 psi are easily and routinely available with Force 10,000. For two major high-rise projects in Seattle[1], ready-mixed microsilica concrete consistently produced 19,000 psi at 56 days (56 or 90-day compressive strengths are typically specified for high-strength concrete).

It should be noted from Table 2, that high strength concrete may be produced without microsilica. However, with microsilica it can be mass produced on a more consistant basis and with greater workability.

Table 2
Wiss, Janney, Elstner Mechanical Properties Study
Concrete Mix Designs

	Reference Mixes				
	Similar Mix Design	Similar Strength	Mix A	Mix B	Mix C
Cement, Type I	700	850	691	696	694
Fly Ash, Type C	—	—	—	149	—
Coarse Aggregate	1,850	1,775	1,842	1,857	1,852
Fine Aggregate	1,400	1,325	1,356	1,174	1,280
Microsilica (Force 10,000)					
— lbs/cy	0	0	32	66	100
— % of cement	0	0	4.6	9.4	14.4
Water/Cement Ratio	0.35	0.30	0.35	0.35	0.35
Daracem 100 (oz/cwt)	18	26	18	18	18
Air Content (%)	1.5	1.6	2.4	1.9	2.0

Test Results (28 Days)

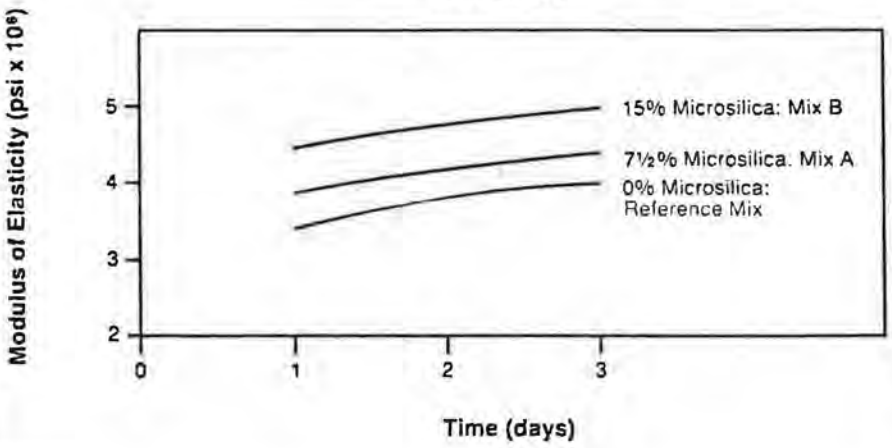
Compressive Strength (psi)	6,500 to 7,500	11,000	9,790	11,570	11,350
Modulus of Elasticity (psi x 10^6)	4.5 to 5.1	5.7 to 6.0	6.09	6.37	6.25
Poisson's Ratio	0.20	0.20	0.20	0.21	0.20
Flexural Strength (psi)	650 to 950	1,200 to 1,300	1,295	1,525	1,530
Split Tensile (psi)	550 to 650	650 to 800	750	760	690
Length Change at one year (μin./in.)	−400 to −600	−500 to −700	−387	−365	−458
Unit Creep at two years (μin./in./psi)	0.35 to 0.50	0.25 to 0.50	.15	—	—

NOTE: All weights in pounds per cubic yards of concrete.
Reference Mixes by Grace and WJE for comparison. Similar Strength Reference Mixes were performed under laboratory conditions.

Table 3
Modulus of Elasticity Study Concrete Mix Designs

	Reference Mix	Mix A	Mix B
Cement, Type I (lbs.)	658	658	752
Coarse Aggregate (lbs.)	1800	1800	1800
Fine Aggregate (lbs.)	1336	1278	1148
Microsilica (Force 10,000)			
— lbs/cy	0	49	113
— % of cement	0	7.5	15.0
Water/Cement Ratio	0.40	0.40	0.35
WRDA-19 (oz/cwt)	12	18	20
Air Content (%)	1.5	1.5	2.3

Figure 3
Modulus of Elasticity Study
(0 to 3 days)



The modulus of elasticity of concrete is dependent upon the modulus of both the paste and aggregates and their relative amounts in the mix. Typically, the modulus of normal paste ranges from 2.5 to 3.5 million psi, whereas moduli for aggregates are significantly higher. Stress differential occurs at the paste-aggregate bond, and values for the resultant concrete moduli can be in the 3 to 5 million psi range for normal strength concrete. With microsilica pastes, the modulus of concrete can be increased to ranges of 5 to 7 million psi, approaching that of some aggregates. The mix then behaves as if it were homogeneous, the stress differential between paste and aggregate is decreased, and the overall concrete modulus of elasticity can average 6 million psi and more.

For three different concrete mixes run by WJE, the modulus at 28 days ranged from 6.1 to 6.4 million psi as summarized in Table 2. These are values for 9,700 to 11,600 psi compressive strength concrete. For higher strength concrete, such as for the Seattle projects referenced earlier, the modulus of elasticity was typically 6.8 to 7.2 million psi at 56 days.

A study was conducted at the Grace[2] laboratory to measure modulus of elasticity for various dosage rates of microsilica and cement factors. Table 3 lists these mix designs. Figure 3 shows the modulus of elasticity for the first three days while Figure 4 shows the values at three to twenty-eight days.

Modulus of Elasticity

As tested according to ASTM C469, the modulus of elasticity, or slope of the stress-strain curve increases proportionally for high strength concrete. This is used for determining deformation and stiffness of a structure. For high-rise buildings, the stiffer the structure, the less it sways and drifts, increasing safety factors and the comfort level for occupants on higher floors. For a recently-constructed 56-story building in Seattle, column stiffness was of extreme importance. By going to a higher-strength, stiffer concrete, designers were able to use ten-foot diameter core columns occupying only sixty percent of the area which would have been required by normal-strength columns. This resulted in a significant increase in usable floor space, considerable construction cost savings and a stiffer structure.

Figure 4
Modulus of Elasticity Study
(3 to 90 days)

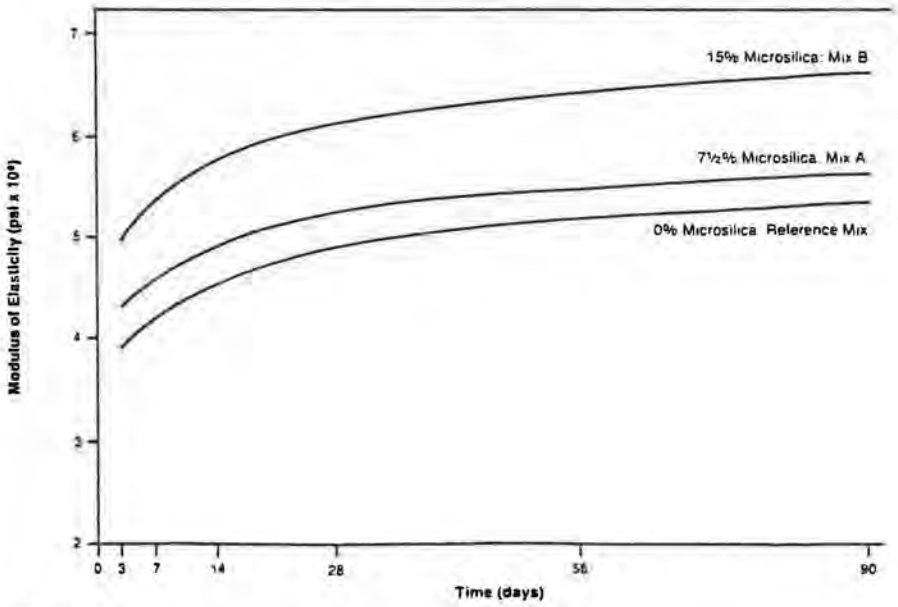


Figure 5
Compressive Strength Results from Modulus of Elasticity Study

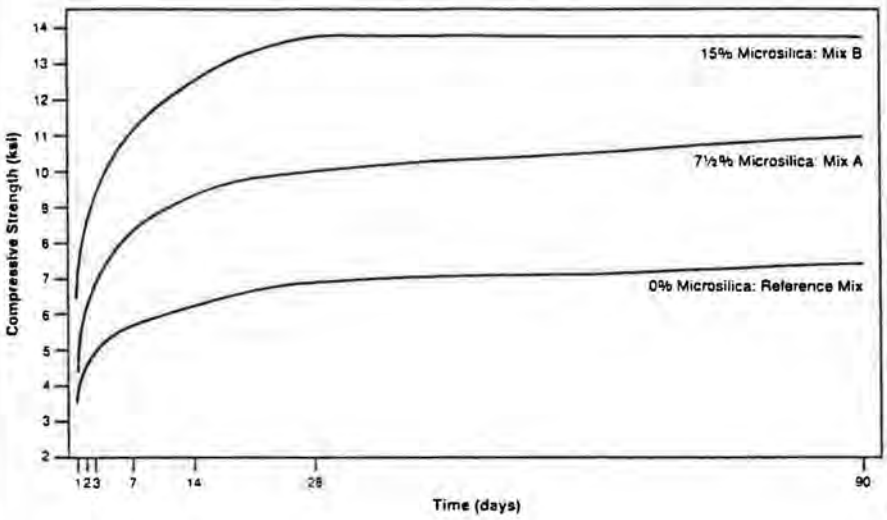


Figure 5 shows the corresponding compressive strength curves. These figures show that higher-strength concretes produce greater modulus of elasticity values which help reduce deflection in columns and beams.

Although a greater modulus of elasticity indicates a more brittle material, this is easily corrected through the use of additional reinforcement for high-strength concrete design. The benefits of higher strength concrete and a stiffer structure outweigh any inconvenience. This does not mean, however, that a large increase in compressive strength represents a corresponding large increase in modulus of elasticity. In fact from the Grace study, 28-day compressive strengths for the Reference Mix was 7,400 psi and the 7½% microsilica mix 10,500 psi while corresponding moduli of elasticity were 4.9 x 10^6 and 5.2 x 10^6 psi respectively (Figure 4). Concretes of similar compressive strength, with or without microsilica, exhibit moduli of elasticity which are similar as shown in Table 2.

Poisson's Ratio

In the study performed by WJE on Force 10,000 concrete, Poisson's ratio, the ratio of strain in the lateral direction to strain in the vertical direction, averaged between 0.20 and 0.21 for all three mixes. This value is in line with normal strength concrete.

Flexural Strength (Modulus of Rupture)

The flexural strength, or modulus of rupture, as measured by ASTM C78, becomes an important material parameter in airport and roadway paving applications, in building floors or roof decks and in pavement repair and bonded overlays where flexural failure is more probable than failure in compression. Since flexural strength of the aggregate is usually significantly greater than that of the paste, it becomes extremely important to have good paste-to-aggregate bonding which ties the aggregate together. Because Force 10,000 paste provides excellent bonding to the aggregate, the concrete flexural strengths are greatly improved. Flexural values 800 psi in 24 hours have been achieved with Force 10,000, with 28 day values in excess of 1,500 psi. The WJE 28-day results were 1295 psi for 5% microsilica, 1525 for 10% microsilica plus fly ash, and 1530 psi for 15% microsilica (Table 2). Concrete with microsilica produces greater flexural strengths than similar compressive strength concrete without microsilica (Table 2).

In another Grace laboratory study[3], flexural strengths were measured at 1, 7 and 28 days for concrete containing 0%, 5%, 10% and 15% microsilica. Table 4 lists the concrete mix designs used. Figure 6 gives the flexural strength results from this study and Figure 7 the compressive strength results.

ACI 318 recommends using the equation: $7.5\sqrt{f'_c}$ for estimating concrete flexural strength for design purposes when testing is not available. For Force 10,000 concrete, studies by Grace and WJE have shown that flexural strength results were over 50% greater than the ACI formula prediction. This is attributed in part to the better paste to aggregate bo developed by microsilica concrete, and in part to the conservative nature of the ACI 318 equation.

Data presented in the ACI 363R "State of the Art Report on High Strength Concrete"[4] show that the ACI 318 equation seriously understates the

Table 4

Flexural Strength Study Concrete Mix Designs

	Reference Mix	Mix A	Mix B	Mix C
Cement, Type I (lbs.)	658	658	658	658
Coarse Aggregate (lbs.)	1800	1800	1800	1800
Fine Aggregate (lbs.)	1358	1320	1278	1221
Microsilica (Force 10,000)				
— lbs/cy	0	33	66	99
— % of cement	0	5.0	10.0	15.0
Water/Cement Ratio	0.40	0.40	0.40	0.40
WRDA-19 (oz/cwt)	12	18	18	
Air Content (%)	1.5	1.5	1.5	

Figure 6
Flexural Strength Study

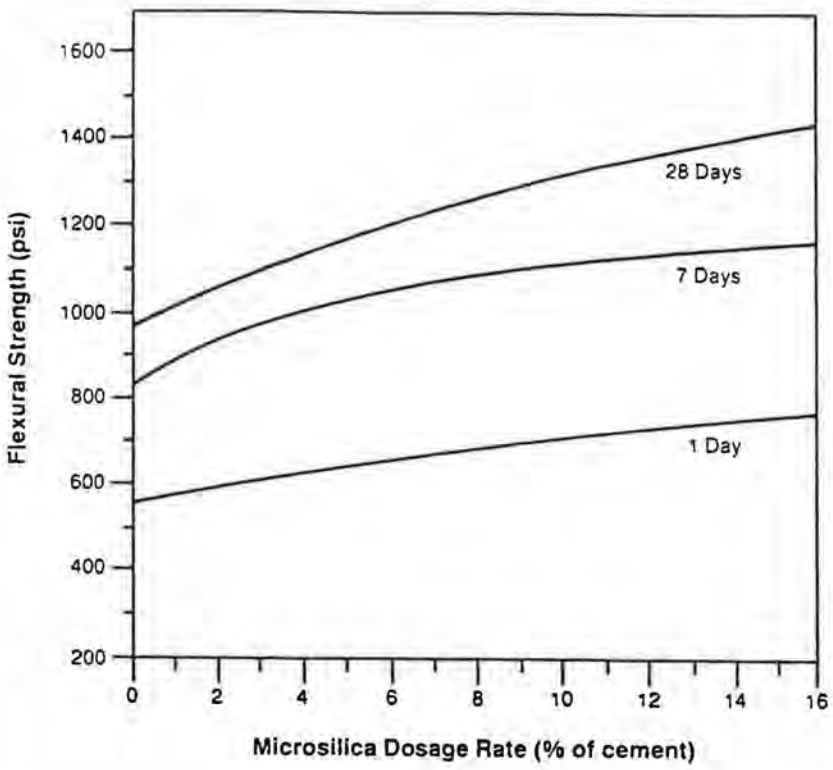
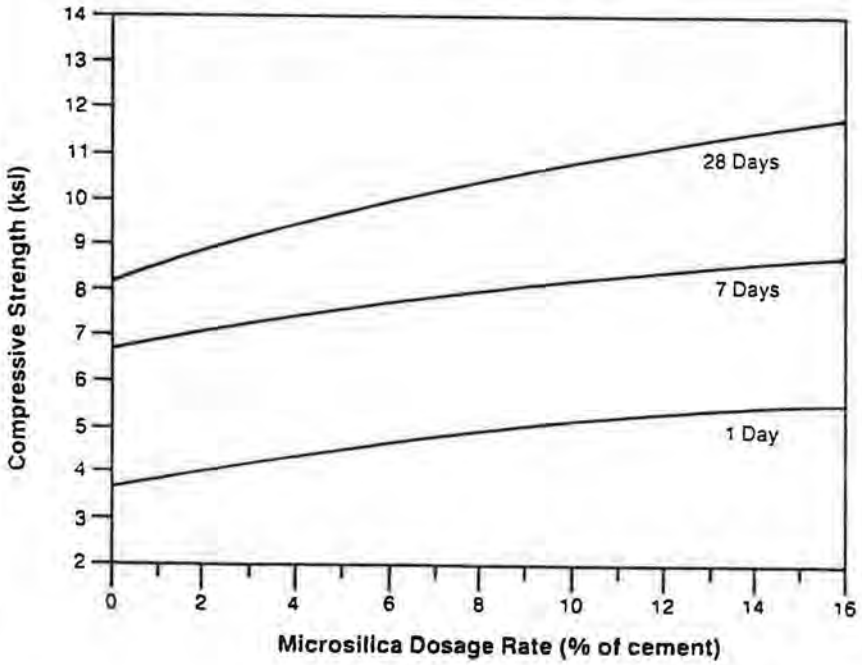


Figure 7
Compressive Strength Results from Flexural Strength Study



flexural strength of high-strength concrete. The relationship is more accurately represented by: $f_r = 11.7\sqrt{f'_c}$. The W. R. Grace data compare favorably to the ACI 363R equation but better fit the following: $f_r = 0.5\, f'^{0.65}_c$. This equation predicts somewhat higher flexural strength at high compressive strengths than does the ACI 363R equation. The Grace data and all of these formulas are shown in Figure 8.

Split Tensile

Split tensile strengths as measured by ASTM C496 are important in design considerations when assurances of adequate concrete shear strength is required. In general it is a measure of concrete quality. Values for the WJE test are shown in Table 2.

Length Change

Two types of shrinkage cracking are well-known in concrete: plastic and drying shrinkage. Plastic shrinkage typically occurs during the first twelve hours after placement, and is due to a rapid drying of the concrete surface. Since concrete which contains 5% and higher microsilica dosage rate bleeds less in slabs than normal concrete, it is important to maintain an adequate surface moisture level with fog misting and moist curing during this critical time period. Following good curing practices as outlined in ACI guidelines will alleviate most plastic shrinkage cracking.

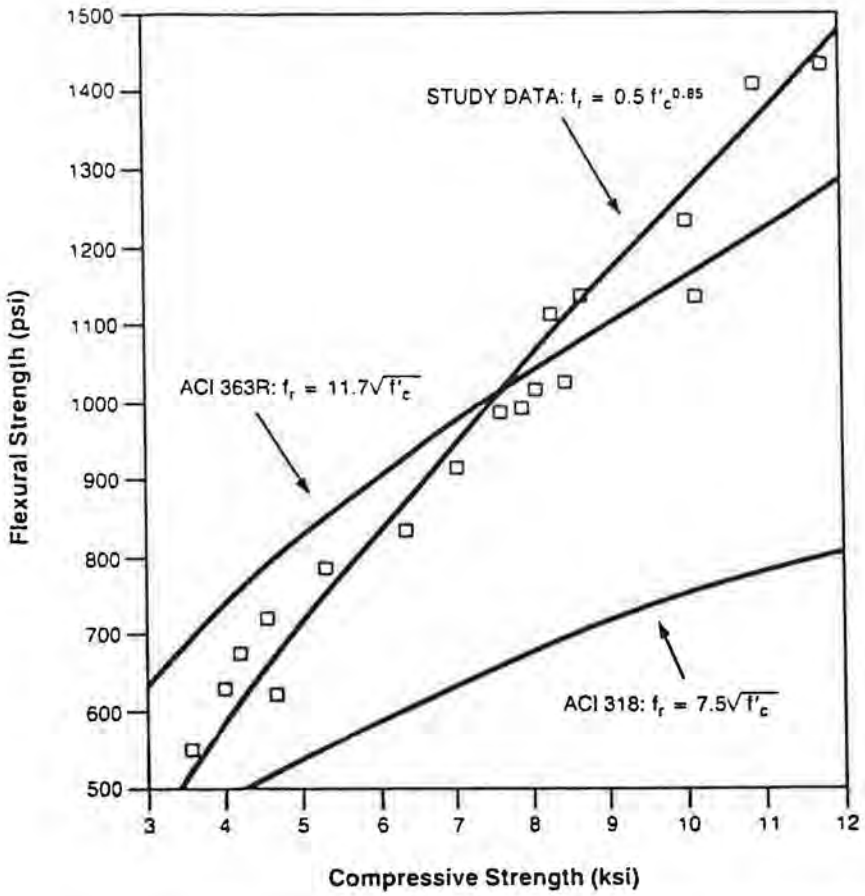
Drying shrinkage occurs following the initial set, and is affected by the volumes of the cement paste and aggregate, and by the stiffness and maximum size of the aggregate. Tests were performed according to ASTM C157 with results at one year from the WJE report shown in Table 2. The microsilica concrete shrinkage values are less than concrete without microsilica at one year.

Creep

The WJE study tested for concrete creep according to ASTM C512. Creep is the measure of axial deformation of a material under continuous load. The two-year creep value for the 5% microsilica concrete mix is shown in Table 2. This value is considered better than normal-strength concrete.

Figure 8

Flexural Strength versus Compressive Strength



Conclusion

Concrete compressive strengths have been climbing higher over recent years. The addition of microsilica has resulted in a quantum leap to even higher strengths and increases in all other mechanical properties of concrete. These increased values will allow the structural engineer to design concrete structures today which were only a dream yeaterday.

References

1. "Concrete Strength Record Jumps 36% ", K. A. Godfrey, Jr., October 1987, Civil Engineering.
2. "Modulus of Elasticity Study of Force 10,000 Concrete", M. P. Dallaire, N. S. Berke, June 1989, Unpublished.
3. "Flexural Strength Study of Force 10,000 Concrete", M. P. Dallaire, N. S. Berke, April 1989, Unpublished.
4. "State-of-the-Art Report on High Strength Concrete", ACI 363.

FT-29 Printed in U.S.A. 4/90 FA/GPS/5000

Calculation Sheet

Computed by WALTERS Subject _____ Sheet 1 of _____
Checked by _____ Job No. 603088
Client GAGE Date AUG 23, 1989

CONTAINMENT VOLUMES

CONTAINER STORAGE AREA

MAXIMUM STORAGE STORAGE OF HAZARDOUS CHEM = 25000 GAL
TANK FARM TANK VOLUME = 6000 + 6000 + 6000 + 3250 + 1000
= 22,250 GAL

MAX. CONTAINER STORAGE VOLUME = 25000 - 22,250 = 2,750 GAL

FROM 40 CFR 264 SUBPART I - USE AND MANAGEMENT OF CONTAINE

PARAGRAPH 264.175 CONTAINMENT

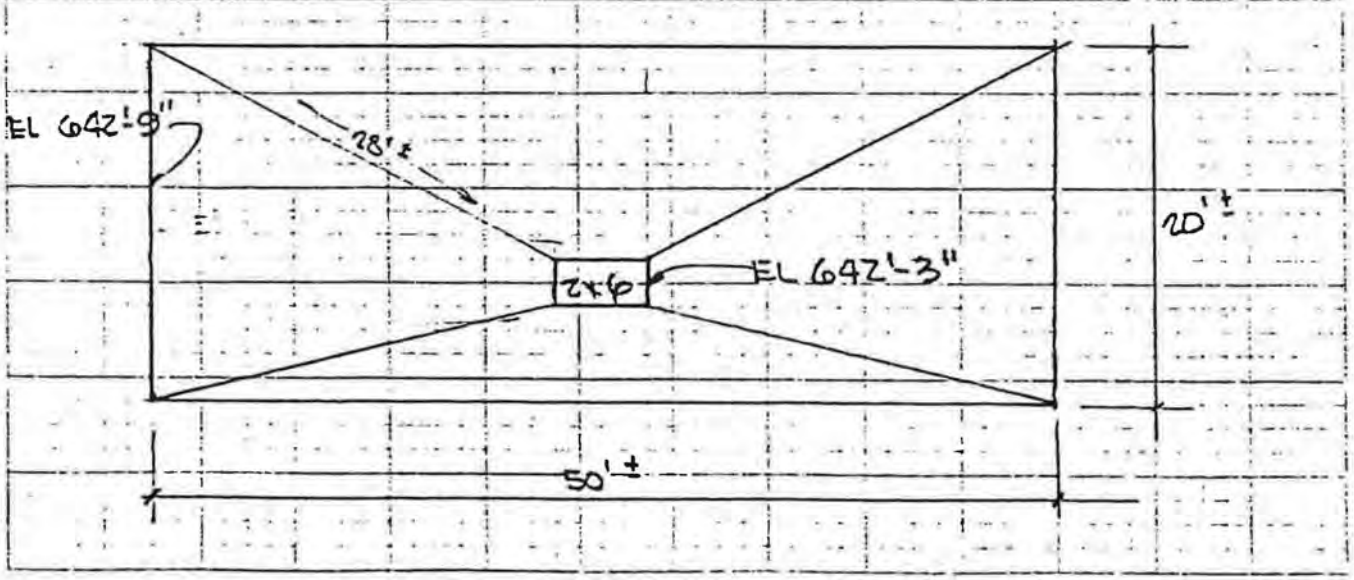
CONTAINMENT VOLUME = (.10)(TOTAL VOL OF CONTAINERS)
OR
= LARGEST CONTAINER

∴

VOL 1 = (.10)(2,750 GAL) = 275 GALLONS
VOL 2 = 550 GALLONS (SEE MINUTES MTG Nº 1)

USE: 550 GALLONS

CONTAINMENT AREA



Calculation Sheet

Computed by WALTER'S Subject _____ Sheet 2 of _____
Checked by _____ Job No. 63088
Client GAGE Date AUG 29, 1989

SLOPE FLOOR @ 1/4" / FT FROM FURTHEREST CORNER TO SUMP

$\Delta = (1/4)(28) = 7"$

USE: 6"

∴

FIRST FLR EL = 638'-9"
SECOND FLR EL = 638'-9" + 4'-0" = 642'-9"
CONTAINER STORAGE SUMP EL = 642'-9" - 6" = 642'-3"

CALCULATE CONSERVATIVE FLOOR CONTAINMENT:

EAST-WEST SLOPE = (1/2)(25)(.5)(1')(7.48)(2) — 25' / 6"
= 200 GALLONS

NORTH-SOUTH SLOPE = (1/2)(10)(.5)(6')(7.48)(2)
= 225 GALLONS

CHECK FOR AN ASSUMED DEPTH OF 2" OVER THE ENTIRE AREA

VOL = (50)(20)(.17)(7.48) = 1,250 GALLONS > 425

ASSUME A 2'x2' SUMP INTERIOR PLAN DIMENSION 3' DEEP

CONTAINMENT VOL = (2)(2)(3)(7.48) = 90 GALLONS

TRY 2'x6' x 3' DEEP ← USE

CONTAINMENT VOL = (2)(6)(3)(7.48) = 270 GALLONS

THEREFORE

TOTAL CONTAINMENT VOL = 200 + 225 + 270 = 695 GALLONS

O.K.

Calculation Sheet

Computed by WALTERS Subject _____ Sheet 3 of _____
Checked by _____ Job No. 603088
Client _____ Date AUG 24, 1989

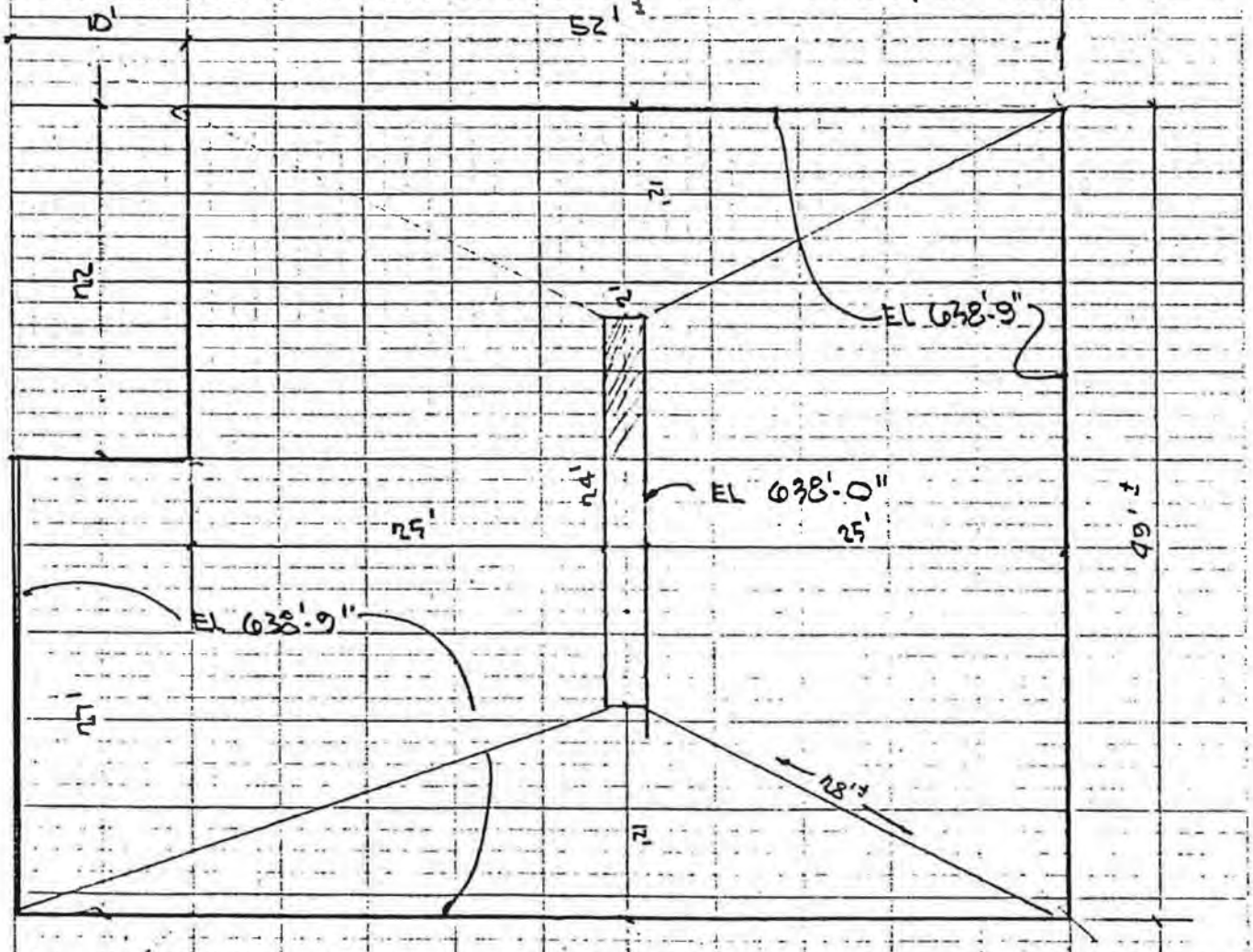
UNLOADING AREA

MAXIMUM STORAGE OF HAZARDOUS CHEM = 6000 GALL

FROM PART 5 ROLE 158

CONTAINMENT VOL = (6000)(1.5) = 9000 GALLONS

CONTAINMENT AREA



SLOPE FLOOR 1/4"/FT FROM NEAREAST CORNER

Δ = (1/4"/FT)(28') = 7"

USE: 8"

Calculation Sheet

Computed by WALTERS Subject _____ Sheet 9 of _____
Checked by _____ Job No. 963088
Client GP&E Date AUG 29, 1989

TRUCK UNLOAD FLOOR CONTAINMENT

TOP OF FLOOR ELEVATION: BLDG. PERIMETER 638'-9"

TOP OF TRENCH GRATE AT SUMP 638'-0"

Δ OF FLOOR = 9" = 0.75'

CALCULATE CONSERVATIVE FLOOR CONTAINMENT:

VOL 1 = (.5)(.75)(.75)(24)(2)(7.48) = 3,350

VOL 2 = (.5)(12)(.75)(4)(2)(7.48) = 259

3600 GAL (CONSERVATIVE)

CHECK NUMBER BY ASSUMING A 1" DEPTH OVER TOTAL FLOOR AREA

VOL CHECK = (52)(50)(.17)(7.48) = 3,306 GAL

DETERMINE THE DEPTH OF A 8'X24' SUMP

VOL SUMP = 9000 - 3600 = 5400 GALLONS

5400 = (8)(24)(X)(7.48)

$X = \frac{5400}{(8)(24)(7.48)} = 1.5$ ft TO DEEP

ASSUME A 4' WIDE TRENCH BELOW

5400 = (4)(24)(X)(7.48) TO DEEP

X = 7.5 FT

ASSUME A 6' WIDE TRENCH

X = 5400/(6)(24)(7.48) = 5.0 ← OK

Stored Waste Containment

Volume Calculation

1. Gross Area: 47.833' x 15.167' + 9.833' x 4.5' = 769.7'
2. Average Btm. of Containment: $\frac{637.333 + 636.79167}{2} = 637.06'$
3. T.O. Wall = 641'
4. Average Depth = 641' - 637.06' = 3.94'

Tank Pad Reduction

5. Average Depth = 637.75 - 637.06' = 0.69'
6. $[(3) \times \pi\, 5^2 + (1) \times \pi \times 4.25^2] \times 0.69' = 201$ cf
7. Tank skirt height to bottom of tank:
   - 9' Ø → 36"
   - 7'-6" Ø → 36"
   - 5' Ø → 36"
8. Assume no volume reduction until 637.75' + 3' - 637.06' = 3.69
9. Net volume to 3.69'
   769.7' x 3.69' - 201 cf = 2639.2 cf
10. Net volume from 3.69 to 3.94'
    $[769.7' - (3 \times \pi\, 4.5^2 + \pi \times 3.75^2 + \pi \times 2.5^2)] \times 0.25' = 128.7$ cf
11. Total Net Volume
    2639.2 + 128.7 = 2767.9 cf
    = 20,704 gallons
12. 20 minutes sprinkling
    0.37 gpm/ft^2 x 20 min. x 769.7' = 5696 gallons H_20
13. Total volume available to contain spillage:
    20,704 - 5,696 = 15008 gallons
    15,008 gallons/6,000 gallons = ≈ 250%

Explanation of Calculations

1. Calculate the gross interior area of the stored waste containment (Reference Sht S4 for dimensions).
2. Calculate the average elevation of the sloped containment slab (Reference elevations Sht S4).
3. Top of wall elevation (Reference Section 1 Sht. S5).
4. Calculate average containment depth by subtracting 3 from 2.

5&6. Calculate the average volume of the concrete tank pads so this can be subtracted form the gross volume.

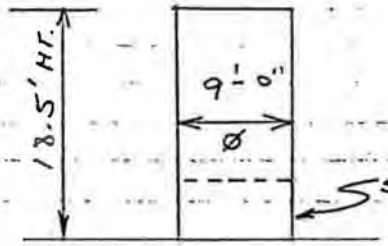
7&8. Indicate height from top of tank pads to average btm. of tanks so we know at what elevation we need to start deducting volume of storage tanks.

9. Calculate net volume stored to bottom of tanks by multiplying results of 1 and 8 and subtracting results of 6.
10. Calculate net volume stored from bottom of tanks to the top of the lowest containment wall section.
11. Add result of 9 and 10.
12. Containment area will be sprinkled for fire protection. Currently, there are no NFPA or BOCA guidelines for containing sprinkled water. The 20-minute time period used is from the latest addition of the uniform building code which is typically used by western states. Here we are calculating how much water will be sprinkled in 20 minutes, based on flow rates provided by the fire protection system designer.
13. Total volume available for containment is calculated by subtracting result of 12 from result of 11.

TANK FOUNDATIONS CHECK

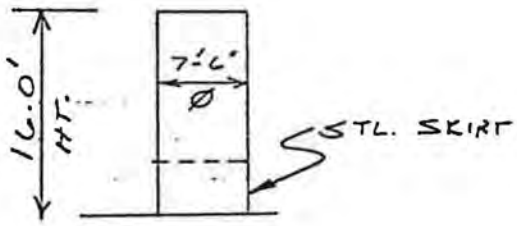
TANK SIZES:

CASE I 6000 GALLON



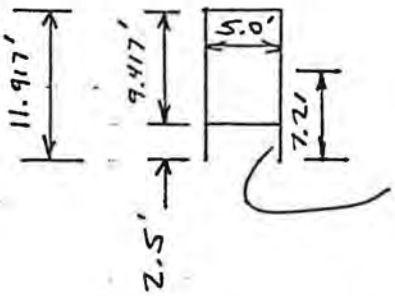
WT. EMPTY = 6540 lbs
EST. OPERATING WT = 65,000 lbs.

CASE II 3250 GALLON



WT. EMPTY = 4600 lbs
EST. op. WT = 37,000 lbs.

CASE III 1000. GALLON



WT. EMPTY = 1725 lbs
EST. op. WT = 11,500 lbs

CALCULATE BOCA WIND LOAD

WIND SPEED = 75 MPH

$P_d = P_e \; I^2 \; C_p$

P_e = 13 PSF (EXP B 20'-40')

$I = 1.0$

$h/D = 12/5 = 2.4$ WORST CASE

$D\sqrt{P_e} = 5 \times \sqrt{13} = 18.0 \geq 2.5$

USE $C_p = 0.8$

$P_d = 13 \times 0.75 = 9.75$ PSF

USE 10 PSF MINIMUM

CASE I

$W = 18.5 \times 9.0 \times 10$ PSF $= 1665$ lbs

$M = 1665 \times 18.5/2 = 15401$ lb-ft

"AREA" OF RING = $\pi d = \pi \times 9 = 28.3$ FT

"SECTION MODULUS" OF RING = $\frac{\pi d^2}{4} = \frac{\pi \times 9^2}{4} = 63.6$

LOAD AT BASE

WIND = $\frac{15401}{63.6} = 242$ lbs

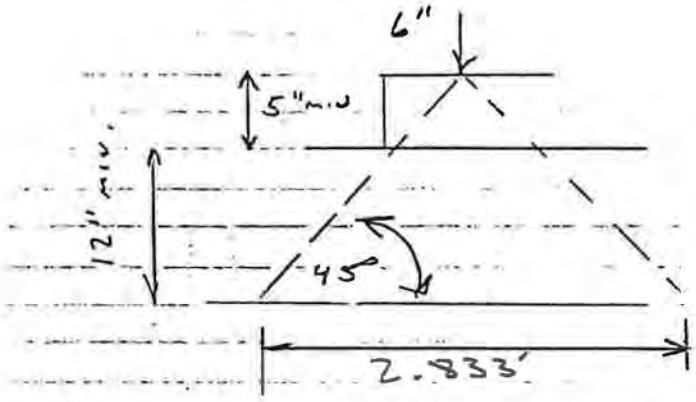
EMPTY = $\frac{6540}{28.3} = 231$ lbs

FULL = $\frac{65{,}000}{28.3} = 2297$ lbs

Empty − wind = 231 − 242 = 11 plf = (uplift)

Full + wind = 2297 + 242 = 2539 plf = (down)

∴ Assume minimal fastening to keep tank iron blowing over.



$2539 / 2.833 = 896$ psf

< 2000 psf

So OK

Case II

$W = 16.0' + 7.5' \times 10$ psf $= 1200$ lbs

$M = 1200 \times 16/2 = 9600$ lb-ft

"Area" $= \pi d = \pi \times 7.5 = 23.6$

"Section" $= \frac{\pi \times 7.5^2}{4} = 44.2$

Wind $= 9600 / 44.2 = 217$ plf

Empty $= 4600 / 23.6 = 195$ plf

Full $= 37{,}000 / 23.6 = 1568$

EMPTY - WIND = 195 - 217 = 22 PLF (UPLIFT)

FULL + WIND = 1568 + 217 = 1785 PLF (down)

OK IN COMPARISON TO CASE I

CASE III

W = 11.917 * 5 + 10 PSF = 596 lbs

M = 596 * 11.917/2 = 3551 lb-ft

"AREA" = πd = $\pi * 5$ = 15.7

"SECTION" = $\frac{\pi d^2}{4}$ = $\frac{\pi 5^2}{4}$ = 19.6

(1.4) To here

WIND = $3551 / 19.6$ = 181

EMPTY = 1725/15.7 = 110 PLF

FULL = 11500/15.7 = 732 PLF

EMPTY - WIND = 71 PLF UPLIFT

$71 * 15.7/2$ = 557 lbs

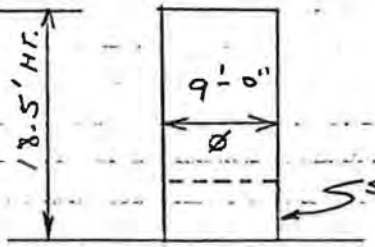
(1) - 5/8" Ø HILTI "KWIK BOLT"
GOOD FOR 1650 lbs TENSION
SO ASSUME OK

FULL + WIND = 913 PLF - OK IN COMPARISON TO CASE I

TANK FOUNDATIONS CHECK

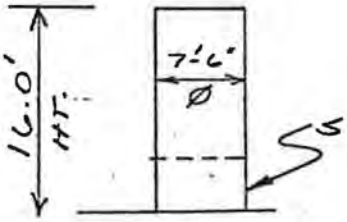
TANK SIZES:

CASE I 6000 GALLON



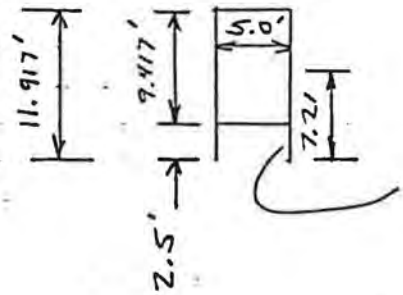
WT. EMPTY = 6540 lbs
EST. OPERATING WT = 65,000 lb

CASE II 3250 GALLON



WT. EMPTY = 4600 lbs
EST. op. WT = 37,000 lbs.

CASE III 1000. GALLON



WT. EMPTY = 1725 lbs
EST. op. WT = 11,500 lbs

CALCULATE BOCA WIND LOAD

WIND SPEED = 75 MPH

$P_d = P_e \; I^2 \; C_p$

P_e = 13 psf (EXP B 20'-40')

$I = 1.0$

$h/D = 12/5 = 2.4$ WORST CASE

$D\sqrt{P_e} = 5 * \sqrt{13} = 18.0 > 2.5$

USE $C_p = 0.8$

$P_d = 13 * 0.75 = 9.75$ psf

USE 10 PSF MINIMUM

CASE I

$W = 18.5 * 9.0 * 10$ psf $= 1665$ lbs

$M = 1665 * 18.5/2 = 15401$ lb-ft

"AREA" OF RING = $\pi d = \pi * 9 = 28.3$ FT

"SECTION MODULUS" OF RING = $\frac{\pi d^2}{4} = \frac{\pi * 9^2}{4} = 63.6$

LOAD AT BASE

WIND = $\frac{15401}{63.6} = 242$ lbs

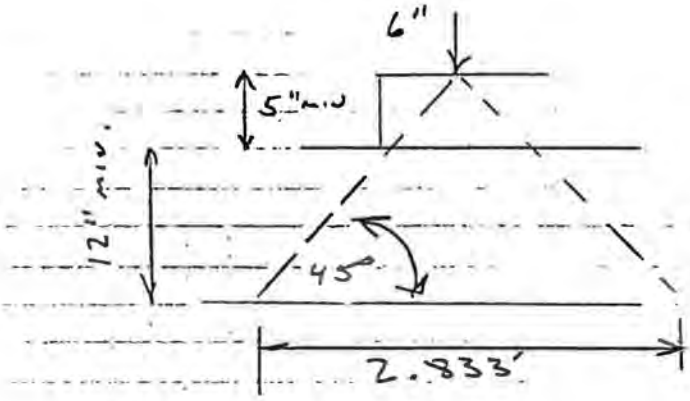
EMPTY = $\frac{6540}{28.3} = 231$ lbs

FULL = $\frac{65{,}000}{28.3} = 2297$ lbs

Empty − wind = 231 − 242 = 11 plf (uplift)

Full + wind = 2297 + 242 = 2539 plf (down)

∴ Assume minimal fastening to keep tank from blowing over.



$2539 / 2.833 = 896$ psf

< 2000 psf

So OK

Case II

$W = 16.0' + 7.5' + 10,$ psf $= 1200$ lbs

$M \doteq 1200 * 16/2 = 9600$ lb-ft

"Area" $= \pi d = \pi * 7.5 = 23.6$

"Section" $= \frac{\pi * 7.5^2}{4} = 44.2$

Wind $= 9600 / 44.2 = 217$ plf

Empty $= 4600 / 23.6 = 195$ plf

Full $= 37,000 / 23.6 = 1568$

EMPTY - WIND = 195 - 217 = 22 PLF (UPLIFT)

FULL + WIND = 1568 + 217 = 1785 PLF (DOWN)

OK. IN COMPARISON TO CASE I

CASE III

W = 11.917 * 5 + 10 PSF = 596 lbs

M = 596 * 11.917/2 = 3551 lb-ft

"AREA" = πd = $\pi * 5$ = 15.7

"SECTION" = $\frac{\pi d^2}{4}$ = $\frac{\pi 5^2}{4}$ = 19.6

To here (1.4)

WIND = $3551 / 19.6$ = 181

EMPTY = 1725/15.7 = 110 PLF

FULL = 11500/15.7 = 732 PLF

EMPTY - WIND = 71 PLF UPLIFT

$71 * 15.7/2$ = 557 lbs

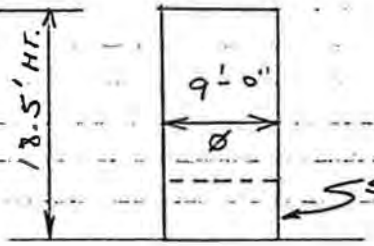
(1) - 5/8" Ø HILTI "KWIK BOLT"
GOOD FOR 1650 lbs TENSION
SO ASSUME OK

FULL + WIND = 913 PLF - OK IN COMPARISON TO CASE I

TANK FOUNDATIONS CHECK

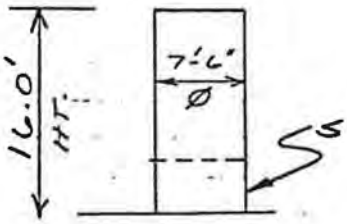
TANK SIZES:

CASE I 6000 GALLON



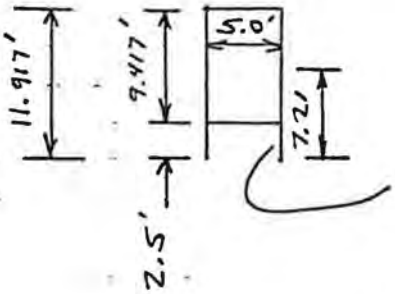
WT. EMPTY = 6540 lbs
EST. OPERATING WT = 65,000 lbs

CASE II 3250 GALLON



WT. EMPTY = 4600 lbs
EST. op. WT = 37,000 lbs.

CASE III 1000 GALLON



WT. EMPTY = 1725 lbs
EST. op. WT = 11,500 lbs

CALCULATE BOCA WIND LOAD

WIND SPEED = 75 MPH

$P_d = P_e \; I^2 \; C_D$

P_e = 13 psf (EXP B 20'-40')

$I = 1.0$

$h/D = 12/5 = 2.4$ WORST CASE

$D\sqrt{P_e} = 5 * \sqrt{13} = 18.0 > 2.5$

USE $C_D = 0.8$

$P_d = 13 * 0.75 = 9.75$ psf

USE 10 psf MINIMUM

CASE I

$W = 18.5 * 9.0 * 10$ psf $= 1665$ lbs

$M = 1665 * 18.5/2 = 15401$ lb-ft

"AREA" OF RING = $\pi d = \pi * 9 = 28.3$ FT

"SECTION MODULUS" OF RING = $\frac{\pi d^2}{4} = \frac{\pi * 9^2}{4} = 63.6$

LOAD AT BASE

WIND = $\frac{15401}{63.6} = 242$ lbs

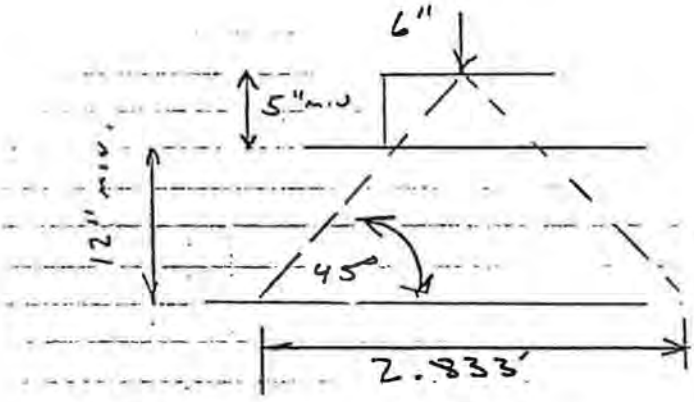
EMPTY = $\frac{6540}{28.3} = 231$ lbs

FULL = $\frac{65{,}000}{28.3} = 2297$ lbs

Empty − wind = 231 − 242 = 11 plf (uplift)

Full + wind = 2297 + 242 = 2539 plf (down)

∴ Assume minimal reinforcing to keep tank from blowing over.



$2539 / 2.833 = 896$ psf

< 2000 psf

So OK

Case II

$W = 16.0' * 7.5' * 10$ psf $= 1200$ lbs

$M = 1200 * 16/2 = 9600$ lb-ft

"Area" $= \pi d = \pi * 7.5 = 23.6$

"Section" $= \frac{\pi * 7.5^2}{4} = 44.2$

Wind $= 9600 / 44.2 = 217$ plf

Empty $= 4600 / 23.6 = 195$ plf

Full $= 37{,}000 / 23.6 = 1568$

EMPTY - WIND = 195 - 217 = 22 PLF (UPLIFT)

FULL + WIND = 1568 + 217 = 1785 PLF (down)

OK IN COMPARISON TO CASE I

CASE III

W = 11.917 * 5 * 10.00 = 596 lbs

M = 596 * 11.917/2 = 3551 lb-ft

"AREA" = πd = $\pi * 5$ = 15.7

"SECTION" = $\frac{\pi d^2}{4}$ = $\frac{\pi 5^2}{4}$ = 19.6

(P.4) to take

WIND = $3551 / 19.6$ = 181

EMPTY = 1725/15.7 = 110 PLF

FULL = 11500/15.7 = 732 PLF

EMPTY - WIND = 71 PLF UPLIFT

$71 * 15.7/2$ = 557 lbs

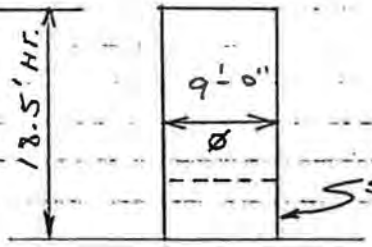
(1) - 5/8" Ø HILTI "KWIK BOLT"
GOOD FOR 1650 lbs TENSION
SO ASSUME OK

FULL + WIND = 913 PLF — OK IN COMPARISON TO CASE I

TANK FOUNDATIONS CHECK

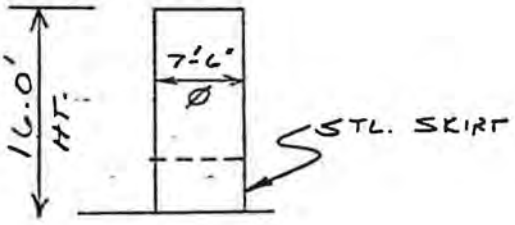
TANK SIZES:

CASE I 6000 GALLON



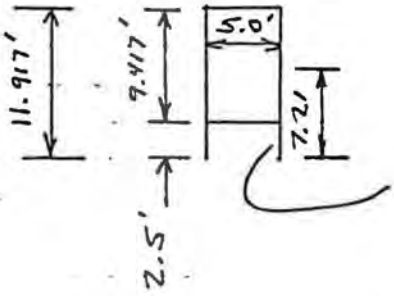
WT. EMPTY = 6540 lbs
EST. OPERATING WT = 65,000 lb

CASE II 3250 GALLON



WT. EMPTY = 4600 lbs
EST. op. WT = 37,000 lbs.

CASE III 1000. GALLON



WT. EMPTY = 1725 lbs
EST. op. WT = 11,500 lbs

CALCULATE BOCA WIND LOAD

WIND SPEED = 75 MPH

$P_d = P_e \, I^2 \, C_p$

P_e = 13 PSF (EXP B 20'-40')

$I = 1.0$

$h/D = 12/5 = 2.4$ WORST CASE

$D\sqrt{P_e} = 5 * \sqrt{13} = 18.0 \geq 2.5$

USE $C_p = 0.8$

$P_d = 13 * 0.75 = 9.75$ PSF

USE 10 PSF MINIMUM

CASE I

$W = 18.5 * 9.0 * 10$ PSF $= 1665$ lbs

$M = 1665 * 18.5/2 = 15401$ lb-ft

"AREA" OF RING = $\pi d = \pi * 9 = 28.3$ FT

"SECTION MODULAS" OF RING = $\frac{\pi d^2}{4} = \frac{\pi * 9^2}{4} = 63.6$

LOAD AT BASE

WIND = $\frac{15401}{63.6} = 242$ lbs

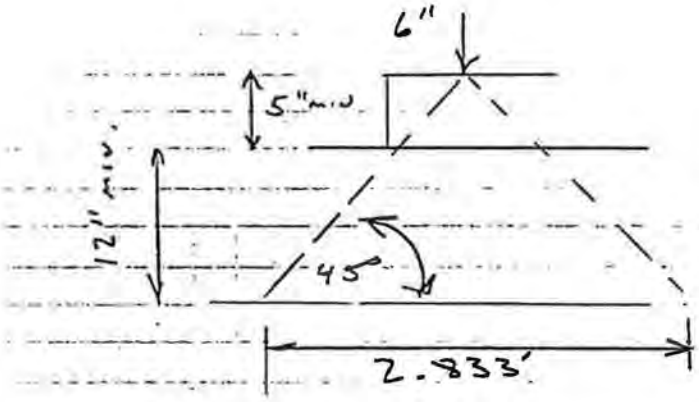
EMPTY = $\frac{6540}{28.3} = 231$ lbs

FULL = $\frac{65{,}000}{28.3} = 2297$ lbs

EMPTY − WIND = 231 − 242 = 11 PLF (UPLIFT

FULL + WIND = 2297 + 242 = 2539 PLF (DOWN

∴ ASSUME MINIMAL FASTENING TO KEEP TANK FROM BLOWING OVER.



$2539 / 2.833 = 896$ PSF

< 2000 PSF

So OK

CASE II

$W = 16.0' \times 7.5' \times 10 \text{ PSF} = 1200$ lbs

$M \doteq 1200 \times 16/2 = 9600$ lb-ft

"AREA" = $\pi d = \pi \times 7.5 = 23.6$

"SECTION" = $\frac{\pi \times 7.5^2}{4} = 44.2$

WIND = $9600 / 44.2 = 217$ PLF

EMPTY = $4600 / 23.6 = 195$ PLF

FULL = $37{,}000 / 23.6 = 1568$

EMPTY - WIND = 195 - 217 = 22 PLF (UPLIFT)

FULL + WIND = 1568 + 217 = 1785 PLF (down)

OK IN COMPARISON TO CASE I

CASE III

W = 11.917 * 5 + 10 PSF = 596 lbs

M = 596 * 11.917/2 = 3551 lb-ft

"AREA" = πd = $\pi * 5$ = 15.7

"SECTION" = $\frac{\pi d^2}{4}$ = $\frac{\pi 5^2}{4}$ = 19.6

To here (1.8)

WIND = $3551 / 19.6$ = 181

EMPTY = 1725/15.7 = 110 PLF

FULL = 11500/15.7 = 732 PLF

EMPTY - WIND = 71 PLF UPLIFT

$71 * 15.7/2$ = 557 lbs

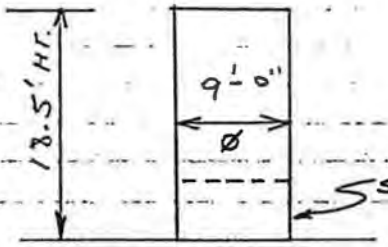
(1) - 5/8" Ø HILTI "KWIK BOLT"
GOOD FOR 1650 lbs TENSION
SO ASSUME OK

FULL + WIND = 913 PLF - OK IN COMPARISON TO CASE I

TANK FOUNDATIONS CHECK

TANK SIZES:

CASE I 6000 GALLON



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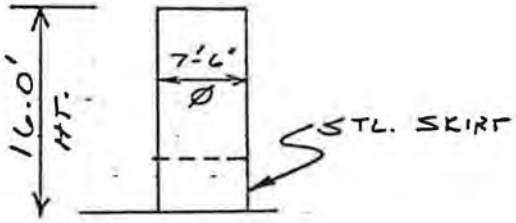
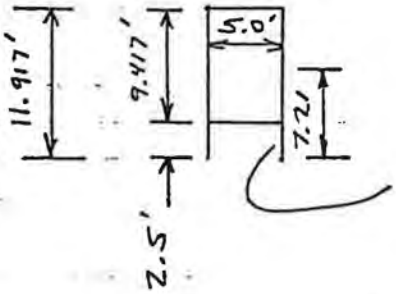
CASE II 3250 GALLON



WT. EMPTY = 4600 lbs
EST. op. WT = 37,000 lbs.

CASE III 1000. GALLON



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CALCULATE BOCA WIND LOAD

WIND SPEED = 75 MPH

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USE $C_p = 0.8$

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CASE I

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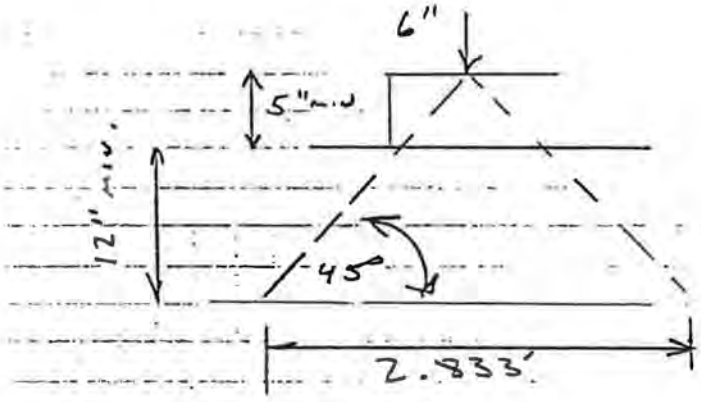

$2539 / 2.833 = 896$ PSF

< 2000 PSF

SO OK

CASE II

$W = 16.0' * 7.5' * 10.0 PSF = 1200$ lbs

$M = 1200 * 16/2 = 9600$ lb-ft

"AREA" $= \pi d = \pi * 7.5 = 23.6$

"SECTION" $= \frac{\pi * 7.5^2}{4} = 44.2$

WIND $= 9600 / 44.2 = 217$ PLF

EMPTY $= 4600 / 23.6 = 195$ PLF

FULL $= 37{,}000 / 23.6 = 1568$

EMPTY - WIND = 195 - 217 = 22 PLF (UPLIFT)

FULL + WIND = 1568 + 217 = 1785 PLF (down)

OK IN COMPARISON TO CASE I

CASE III

W = 11.917 * 5 + 10 PSF = 596 lbs

M = 596 * 11.917/2 = 3551 lb-ft

"AREA" = πd = $\pi * 5$ = 15.7

"SECTION" = $\frac{\pi d^2}{4}$ = $\frac{\pi 5^2}{4}$ = 19.6

to here (1.4)

WIND = $3551 / 19.6$ = 181

EMPTY = 1725/15.7 = 110 PLF

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EMPTY - WIND = 71 PLF UPLIFT

$71 * 15.7/2$ = 557 lbs

(1) - 5/8" Ø HILTI "KWIK BOLT"
GOOD FOR 1650 lbs TENSION
SO ASSUME OK

FULL + WIND = 913 PLF - OK IN COMPARISON TO CASE I

SQUIRT CALCULATION

The purpose of this demonstration is to predict the distance a liquid stream will travel from an opening. This is important when considering the possible failure of a tank or container under a worst-case scenario. The secondary containment system must be capable of containing a squirt release.

The container storage areas at Gage will include both a single and double layer of drums stored on pallets. For this squirt demonstration the following assumptions have been made:

1. Atmospheric pressure exists inside the drum at the time of a leak.
2. The drums are filled to the top.
3. Viscosity losses are zero.
4. The discharge coefficient for an orifice $C_v = 0.94$.

Using Bernoulli's Equation: $V_1^2/2g + P_1/W + Z_1 = V_2^2/2g + P_2/W + Z_2$

Refer to Figure 1:

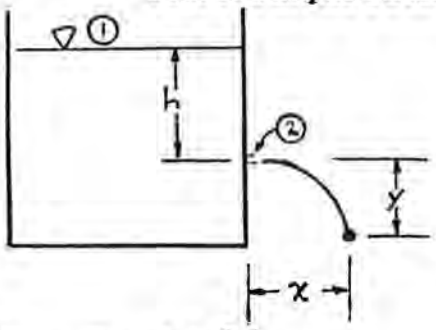
- with a point of reference through the opening (point 2)

$Z_1 = h$
$Z_2 = 0$
$V_1 = 0$
$P_1/W = P_2/W = 0$

$V_2 = C_v \sqrt{2gh}$

where C_v = discharge coefficient
= 0.94 (typical)

Figure 1
Path of a Liquid Stream



x - coordinate at $t = V_x t = t\, C_v\, (2gh)^{0.5}$

y - coordinate at $t = V_{avg} t = g\, t^2/2$ where V_{avg} = average velocity

solving for $x = (4y\, C_v^2 h)^{0.5}$

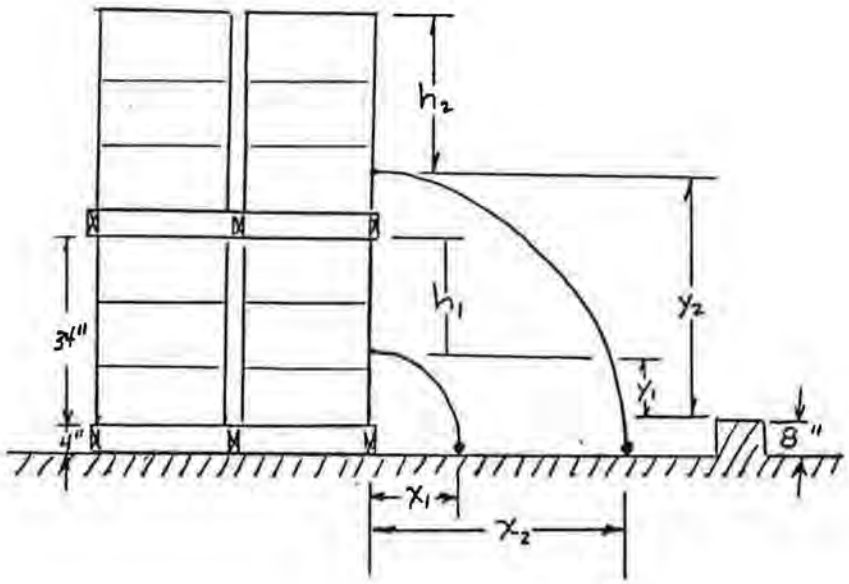


Figure 2
Drum Stacking Arrangement

Table 1
Calculation of Squirt

	h(ft)	y(ft)	x(ft)
Top of Drum	0	6.07	0.00
Top Pallet	0.5	5.57	3.14
	1.0	5.07	4.23
	1.5	4.57	4.92
	2.0	4.07	5.36
Top Pallet	2.5	3.57	5.62
Bottom of Drum	2.83	3.24	5.69
Top of Drum	0	2.91	0.00
Lower Pallet	0.5	2.41	2.06
	1.0	1.91	2.60
	1.5	1.41	2.73
	1.75	1.16	2.68
	2.0	0.91	2.54
Lower Pallet	2.5	0.41	1.90
Bottom of Drum	2.83	0.08	0.89

Where:

h = liquid head above orifice
y = vertical distance from orifice to top of curb
x = horizontal distance liquid travels
$= (4yC_v^2h)^{0.5}$

Conclusions:

1. If the drums are stacked only one high on a pallet, they must be placed at least 2.73 feet from the edge of a 3-inch curb to prevent a liquid stream from possibly squirting over it.

2. If the drums are stacked two high on pallets, they must be placed at least 5.7 feet from the edge of a 3-inch curb to prevent a liquid stream from possibly squirting over it.

HANDS & ASSOCIATES, INC.
500 Griswold, Suite 1650
Detroit, MI 48226
Phone (313)-963-8870
Fax (313) 963-8876

Certification of Capability to Manage Waste

Hands & Associates, Inc. hereby provides this certification to manage waste for Gage Products Company for those areas outlined in the Company's renewal application. This certification is in accordance with State of Michigan Regulations (Part 111, Act 451, R. 324.11123(iii) which reads "*A certification of the treatment, storage, or disposal facility's capability of treating, storing, or disposing of hazardous waste in compliance with this part.*" This certification will cover the applicable areas of the plant as outlined in the application including; 1) LSF Building – Hazardous Waste drum storage, and 2) Tank Farm Storage.

I have reviewed the documentation and visited the Limited Storage Facility (LSF) at Gage Products Company located in Ferndale, MI. I certify that to the best of my knowledge the LSF is capable of storing and managing the hazardous waste materials as outlined this renewal application.

By:

Lawrence M. Hands, P.E.

Lawrence M Hands

Signature, Lawrence M. Hands, PE

Date Jan 25, 2013 Registration No. 6201028820

State Michigan

I

OPERATING LICENSE APPLICATION FORM FOR
HAZARDOUS WASTE TREATMENT, STORAGE, AND DISPOSAL FACILITIES

Application Section: L

(Form EQP 5111 (Rev 10/2010) ITEM XIV: OTHER REQUIRED ATTACHMENTS

B. Supplemental Information

8. Capability certification/compliance schedule)

Certification of Capability to Manage Waste
Supplemental Information

The following information is provided in support of the Certification of Capability.

1.0 General Information

In accordance with MI Public Act 451 Rule 324 Part 11123(iii) the following areas were reviewed in certifying that the Gage Products Facility is capable of treating, storing, or disposing of hazardous waste in compliance with this part: Limited Storage Facility (LSF) Drum Storage and Tank Farm Storage.

Certification support includes: familiarity with site operations for approximately 20 years (with recent site inspection conducted on January 17, 2013); review of AST inspection records and reports; review of daily and weekly equipment inspection forms; interviews with site personnel; review of ROP and Subpart BB and Subpart CC Documents.

2.0 LSF Drum Storage

The LSF drum storage area was inspected by Hands & Associates, Inc. (HANDS) periodically over several years and most recently on 1/17/13. The LSF drum storage area was found to be adequately bermed to prevent spill migration, and with a containment sump present. The area was covered, with no evidence of spills. This area is capable of storing and handling hazardous waste as described in this application.

3.0 LSF Tank Farm/Storage Tank System

The LSF tank area was inspected by Hands & Associates, Inc. (HANDS) periodically over several years and most recently on 1/17/13. The LSF tank farm area was found to be adequately contained by concrete secondary containment walls to prevent spill migration, and with a containment sump present. The Gage LSF was constructed with a sealant applied to the concrete secondary containment to prevent spills from penetrating the concrete. In addition, the tank farm dike is constructed with micro silica-filled concrete that makes it more impervious. The containment structure is well maintained for ensuring integrity.

Review of LSF tank ultrasound thickness testing conducted on June 23, 2011 by TSP Environmental, Inc. which was based on the requirements of API-653, the reports state that all LSF tanks and associated piping systems were certified fit for service.

A tank inspection and associated piping/valves/pumps inspection program is implemented and maintained such that this area is capable of storing and handling hazardous waste as described in this application.

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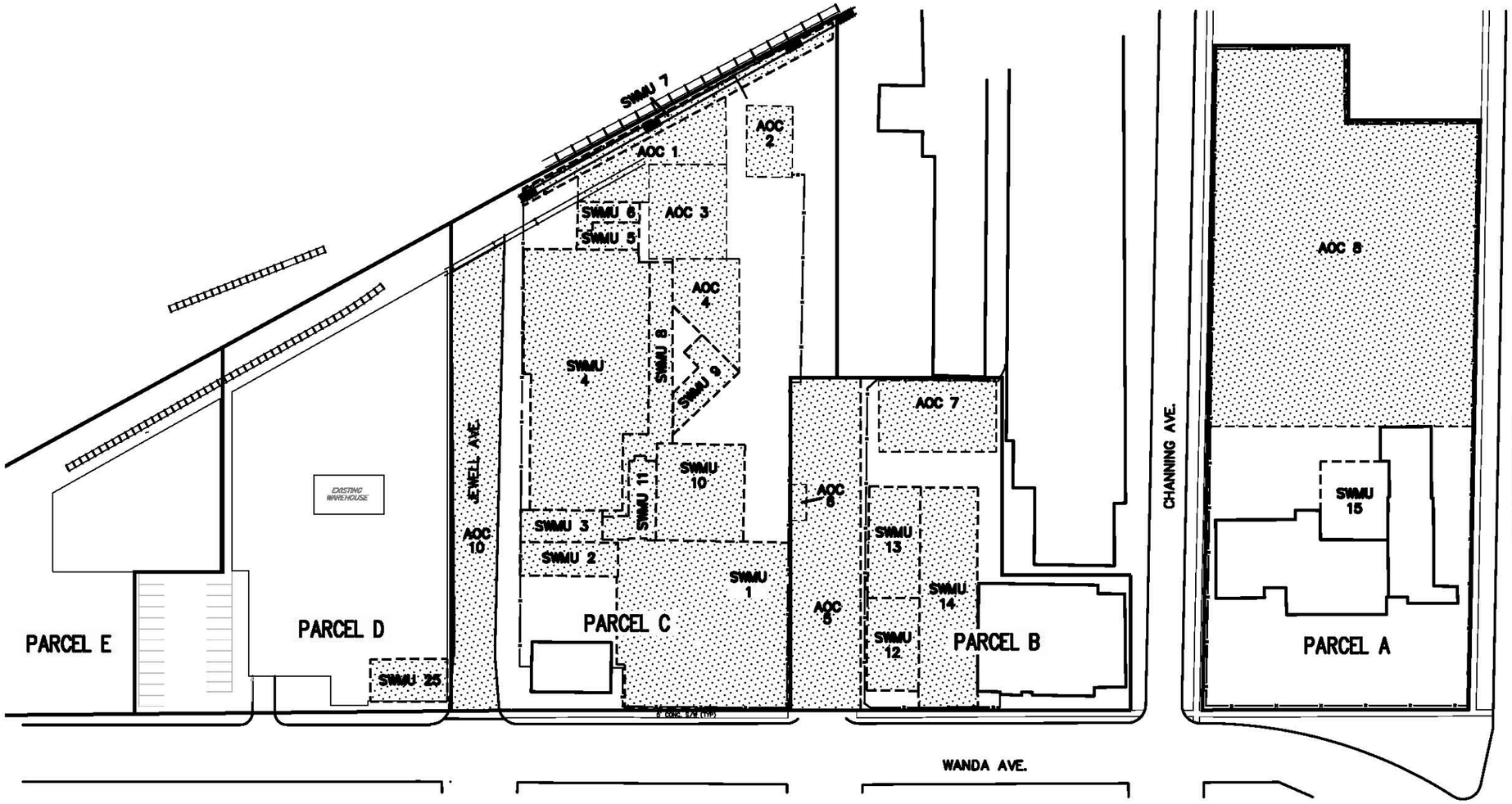

SOLID WASTE MANAGEMENT UNITS

SWMU 1	TOTE AND DRUM STORAGE AREA
SWMU 2	TRUCK WELL
SWMU 3	FORMER UNDERGROUND STORAGE TANK AREA BY THE TRUCK WELL
SWMU 4	BULK TANK STORAGE AREA
SWMU 5	GENERATED HAZARDOUS WASTE STORAGE AREA
SWMU 6	LIMITED STORAGE AREA TANKS
SWMU 7	RAILROAD LOADING/UNLOADING AREA
SWMU 8	FORMER PIPING AREA
SWMU 9	FORMER UNDERGROUND STORAGE TANK AREA BY FILL HOUSE 2
SWMU 10	TANK WAGON LOADING/UNLOADING AREA
SWMU 11	FILL HOUSE 1
SWMU 12	FILL HOUSE 6
SWMU 13	FORMER UNDERGROUND STORAGE TANK AREA BY FILL HOUSE 6
SWMU 14	TANKER OFF-LOADING AREA
SWMU 15	FORMER UNDERGROUND STORAGE TANK AREA ON PARCEL A
SWMU 25	FLOOR DRAINS THAT CONNECT TO THE POTW

AREAS OF CONCERN

AOC 1	FORMER GENERATED HAZARDOUS WASTE STORAGE AREA
AOC 2	FORMER STORAGE AREA AT THE BOILER BUILDING
AOC 3	BACK STORAGE AREA
AOC 4	FORMER STEAM-OUT AND STORAGE AREA
AOC 5	UNPAVED AREA OF SILMAN AVE.
AOC 6	SILMAN AVE. SEWERS
AOC 7	COVERED STORAGE AREA
AOC 8	OPEN AREA ON PARCEL A
AOC 10	JEWELL AVENUE

0 50 100 200

SCALE IN FEET

HORIZON ENVIRONMENTAL

PROJECT NUMBER: GAG-0101

GAGE PRODUCTS COMPANY
FERNDALE, MICHIGAN

LOCATIONS OF SOLID WASTE MANAGEMENT UNITS AND AREAS OF CONCERN

FIGURE: 0-15

FEBRUARY 2012

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Current and historic land use, existing or proposed zoning regulations, and ownership patterns in and around the Gage facility are detailed in Section J, Environmetnal Assessment and shown on Figure O-14.

O-1 b (vii) Critical Habitats and Endangered Species

Habitat critical to the survival of local species and any rare or endangered plant or animal species in the area surrounding the Gage facility are discussed in Section J, Environmental Assessment. There is no evident of critical habitats or endangered species near the Gage facility.

O-1 c Characterization of Potential or Actual Sources of Contamination

This section describes actual or potential sources of contamination at the Gage facility that are subject to the corrective action requirements of Part 111 of Act 451. These sources include WMUs that are discernible units at which contaminants have been placed at any time, or at which contaminants have been released, or at which there is a threat of release regardless of the intended use of such unit. These sources also include areas of concern that are those units which do not meet the definition of WMU, but which may have released contaminants to the environment on a non-routine basis, or which may present an unacceptable risk to public health, safety, welfare, or the environment.

The U.S. EPA conducted a RCRA Facility Assessment (RFA) of the Gage facility in 1992. This RFA resulted in the identification of 15 Solid Waste Management Units (SWMUs) and eight Areas of Concern (AOCs) on Parcels A, B, and C. The locations of the SWMUs and AOCs identified by the U.S. EPA are shown on Figure O-15. In October 1993, an Environmental Assessment of Parcel D was performed, and several of the observations noted in the assessment were identified by MDEQ as SWMUs or AOCs. No SWMUs or AOCs have been identified on Parcel E. A description of each area is provided in the following sections. These descriptions are based on: 1) information obtained during a site visit and interviews of long-time Gage employees (Marvin Geary, Matt Partridge, and Sharon Stahl) conducted by Horizon personnel in June 1995; 2) information contained in the RFA document (U.S. EPA, 1992); and 3) information contained in the Environmental Assessment document for Parcel D (WWES, 1993).

O-1 c (i) Former Underground Storage Tank Area on Parcel A

Unit Characteristics

According to Gage facility records, three USTs were located in the former underground storage tank area on Parcel A (SWMU 15). These USTs were present on the property at the time that Gage purchased the former Wanda School property in 1978. The available information regarding these USTs is presented on Table O-1 and below:

UST	Capacity *(gallons)*	Contents	Material of Construction	Age at Removal *(years)*	Year Removed
A	6,000	Formaldehyde	Fiberglass	8-13	1985
B	6,000	Glycol	Steel	8-13	1985
C	3,000/3,000*	B-300 soap/Pine oil	Steel	8-13	1985

* This tank had two compartments of equal size.

Waste Characteristics and Management

No wastes were managed in these USTs.

History of Releases or Potential to Release

In 1984, Tank A failed a pressure-test and was immediately emptied. Gage personnel removed all three USTs in 1985. In accordance with standard UST closure practices at the time, a representative of the City of Ferndale's Fire Department made a site inspection to confirm that the USTs had been removed, and to witness that the UST excavations were free of contamination and properly closed. The Fire Marshal did not require the analysis of soil samples as part of the inspection.

The RFA states that floating organic solvents were detected in tank monitoring wells in this area in the past. However, this statement does not apply to this UST area because: 1) the USTs did not contain organic solvents; 2) the 1986 report by OHM did not identify this area as an area of concern (OHM, 1986); 3) the City of Ferndale's Fire Marshal Department witnessed the clean closure of the UST area; and 4) a 1990 investigation of the UST area did not identify contamination. To elaborate, in 1990 two soil borings (TSB-1 and TSB-2) were installed in this former UST area to a depth of 12.5 feet. A total of five soil samples were collected from various depths in these borings and analyzed for VOCs (EPA Methods 8010 and 8020) to document soil conditions in the area. Because none of these chemicals were detected in the soil samples and the boring logs did not indicate the presence of impacted soil, the report of the investigation concluded that the previous location of USTs did not appear to be an on-going source of contamination (WWES, 1990; Attachment O-1).

O-1 c (ii) Open Area on Parcel A

Unit Characteristics

The open area on Parcel A (AOC 8) is used for employee parking, storage of old equipment including empty containers, and temporary storage of empty semi-truck trailers and tankers awaiting return to customers.

Waste Characteristics and Management

There are no wastes managed in this unit.

History of Releases or Potential to Release

The only known release in this area occurred in April of 1993 when approximately 45 gallons of rain water spilled from a tote to the ground. The affected soil was excavated and disposed off-site. Half of the area is paved with asphalt and the other half is bare ground. This area has been used for parking and storage since the parcel's purchase in 1978.

In the early 1980's, 15 55-gallon drums were excavated from the western edge of this area (near GMW-1; Figure O-3) by Gage personnel. The contents of these drums are unknown. However, the drums were disposed off-site in a licensed landfill by EETCO. In 1985, OHM installed a soil boring at GMW-1 to a depth of 30 feet. The boring log indicates that an organic odor was detected between depths of four to 10.5 feet. The boring was then backfilled to a depth of 15 feet and a 10 foot well screen was installed (OHM, 1986; Attachment O-1). Low levels of VOCs have been historically detected in GMW-1 and are summarized on Table O-3a.

O-1 c (iii) Fill House 6

Unit Characteristics

Fill House 6 (SWMU 12) contains solvent blending operations in which the raw material solvents are blended into products in one of several mixing tanks and dispensed into 550-gallon totes or 55-gallon drums.

Waste Characteristics and Management

Each mixing tank is cleaned with solvent between batches and the resulting waste is drained through a pipe at the base of the tank into a 5-gallon pail. This waste material is then accumulated in a 55-gallon drum for off-site disposal. The EPA hazardous

waste numbers of waste managed in this area are primarily D001, F003, and F005, but also may include D018 and D035.

History of Releases or Potential to Release

Fill House 6 has been operated since 1982. According to Gage personnel, there have been no known releases from this area. During the 1992 RFA site inspection, the concrete floor of Fill House 6 was noted to be stained and cracked.

Soil borings SB-2, TSB-4, and SB-12 (Figure O-3) were installed in the vicinity of Fill House 6 in 1989, 1990, and 1992, respectively. Monitoring well GMW-6 (Figure O-6) was also installed in 1989. SB-2 was installed to a depth of 60 feet and soil samples were collected for visual classification of soil. Soil samples were not collected for laboratory analysis. However, because a sufficient saturated thickness was encountered within the fill at SB-2, monitoring well GMW-6 was installed at this location. The boring log sheet and well construction details are contained in Attachment O-1. Low levels of organic compounds have been historically detected in GMW-6 and are summarized on Table O-3.

Soil boring TSB-4 was installed to a depth of 10.5 feet and three soil samples were collected from varying depths for laboratory analysis of VOCs (EPA Method 8010 and 8020). None of these compounds were detected in any of the soil samples (WWES, 1990b).

Soil boring SB-12 was installed to a depth of 30 feet and soil samples were collected for visual classification, headspace soil gas screening with a PID, and physical laboratory testing. Soil samples were not collected for laboratory analysis. PID readings were similar to or below those of TSB-4 which correlated to levels below laboratory detection limits. The boring log sheet is contained in Attachment O-1.

O-1 c (iv) Former Underground Storage Tank Area by Fill House 6

Unit Characteristics

According to Gage facility records, three UST systems were located in the former underground storage tank area by Fill House 6 (SWMU 13). The available information regarding these USTs is presented on Table 1 and below:

UST	Capacity *(gallons)*	Contents	Materials of Construction	Age at Removal *(years)*	Year Removed
D	6,000	Leaded gasoline	Steel	10	1987
E	10,000	Unleaded gasoline	Steel	10	1987
F	10,000	#2 Diesel fuel	Steel	10	1987

Waste Characteristics and Management

No wastes were managed in these tanks.

History of Releases or Potential to Release

In 1984, these USTs passed a pressure test indicating that a release had not occurred from the tanks. Gage personnel removed all three USTs in 1987. In accordance with standard UST closure practices at the time, a representative of the City of Ferndale's Fire Marshal Department made a site visit to inspect that the USTs had been removed, and to witness that the UST excavations were free of contamination and properly closed. The Fire Marshal did not require the analysis of soil samples as part of the inspection.

The RFA states that floating organic solvents were detected in tank monitoring wells in this area in the past. However, this statement does not apply to this UST area because: 1) the USTs contained fuel, not organic solvents; 2) the 1986 report by OHM did not identify this area as an area of concern (OHM, 1986); 3) the City of Ferndale's Fire Marshal Department witnessed the clean closure of the UST area; and 4) subsequent investigation of the UST area did not identify contamination.

O-1 c (v) Tanker Off-Loading Area

Unit Characteristics

The tanker off-loading area is located immediately north of Fill House 6 (SWMU 14). Tanker trucks containing raw material (i.e., solvent) are parked in this area while the contents are off-loaded into Fill House 6. This area has been operated in conjunction with Fill House 6 since 1982.

Waste Characteristics and Management

According to Gage personnel, there have been no known releases from this area and wastes are not managed in this area.

History of Releases or Potential to Release

During the 1992 RFA site inspection, the concrete pad of the tanker off-loading area was noted to have unsealed joints and some cracks, but no staining. The RFA states that the release potential to all media is low in this area. This statement has been confirmed by investigation of the area.

O-1 c (vi) Unpaved Area of Silman Avenue

Unit Characteristics

The area identified in the RFI as the "Unpaved Area of Silman Avenue" is located immediately south of Fill House 6 and north of the Tote and Drum Storage Area (AOC 5). Silman Avenue is a public road which vehicles traverse on their way to and from the Gage facility and the Alpha & Omega facility located immediately west of the Gage facility. This road was paved in 1995. Portions of this area are also used for the temporary storage of empty semi-truck trailers and tankers awaiting return to customers.

Waste Characteristics and Management

According to Gage personnel, wastes are not managed in this area. Material handling areas on either side of Silman Avenue have been curbed since 1987 to prevent the release of any potential spills in these areas to Silman Avenue.

History of Releases or Potential to Release

According to Gage personnel, there have been no known releases to this area. Soil boring SB-4 (Figure O-3) was installed near Silman Avenue to a depth of 9.5 feet in 1989 and soil samples were collected for visual classification and headspace soil gas screening with a PID. Soil samples were not collected for laboratory analysis. PID readings were well below those of TSB-4 which correlated to non-detectable levels of VOCs in laboratory analyses. The boring log sheet for SB-4 is contained in Attachment O-1.

O-1 c (vii) Silman Avenue Sewers

Unit Characteristics

Two sewer catch basins are located on the south side of Silman Avenue (AOC 6). Both sewers have perforated cast iron covers and drain Silman Avenue.

Waste Characteristics and Management

According to Gage personnel, there have been no known releases to these sewers.

History of Releases or Potential to Release

Material handling areas on either side of Silman Avenue have been curbed since 1987 to prevent the release of any potential spill in these areas to Silman Avenue and its sewers.

Soil boring SB-10 was installed to a depth of 30 feet in 1992 and soil samples were collected for visual classification, headspace soil gas screening with a PID, and physical laboratory testing. Soil samples were not collected for laboratory analysis. PID readings were elevated to a depth of seven feet and an odor was noted on the boring log sheet at these depths. The boring log sheet for SB-10 is contained in Attachment O-1.

O-1 c (viii) Covered Storage Area

Unit Characteristics

The Covered Storage Area (AOC 7) is located west of Fill House 6. This area is enclosed on three sides and is open on the fourth side for access. Raw material and product are stored in this area in pails, bags, and 55-gallon drums.

Waste Characteristics and Management

At one time hazardous waste drums were stored in this area. The EPA hazardous waste numbers of waste that was managed in this area were D001, D002, F003, F005, D018, and D035. The drums were stored on the concrete floor.

History of Releases or Potential to Release

The Covered Storage Area was constructed in approximately 1981-1982. According to Gage personnel, there have been no known releases from this area. During the 1992 RFA site inspection, the concrete floor was noted to have unsealed joints and some

cracks, but no staining.

The RFA states that the release potential to all media is low in this area. This statement was confirmed by an investigation of the area in 1992 in which soil boring SB-12 (Figure O-3) was installed to a depth of 30 feet and soil samples were collected for visual classification, headspace soil gas screening with a PID, and physical laboratory testing. Soil samples were not collected for laboratory analysis. PID readings were similar to or below those of other soil samples which correlated to levels below laboratory detection limits. The boring log sheet is contained in Attachment O-1.

O-1 c (ix) Tote and Drum Storage Area

Unit Characteristics

The Tote and Drum Storage Area is located at the corner of Silman and Wanda Avenues (SWMU 1).

Waste Characteristics and Management

Finished product is stored in this area in 55-gallon drums and 550-gallon totes prior to shipment to customers. Some empty tanks are also stored in this area. Totes were also occasionally steam-cleaned in this area

A 6 to12 inch thick concrete pad was installed in this area in approximately 1980. Secondary containment was installed around the storage area pad in 1994 in the form of a 6-inch concrete curb and rolled access ramps. The RFA report states that at the time of the visual site inspection, the concrete pad had many unsealed joints and some cracks.

Drums are stored on wooden pallets or on the concrete pad and stacked up to two layers high. Tote tanks are 550-gallon stainless steel or aluminum rectangular tanks which are stored upright on legs. The Tote and Drum Storage Area is used to store final product, not wastes. No wastes are managed in this area.

History of Releases or Potential to Release

According to Gage personnel, there have been no known releases from this area. During the 1992 RFA site inspection, no evidence of releases was noted.

Soil borings SB-4, SB-10, and SB-11 (Figure O-3) were installed in or near the Tote and Drum Storage Area in 1989 and 1992. Monitoring well GMW-3 (Figure O-3) was installed in 1985. Soil boring SB-4 was installed to a depth of 9.5 feet and soil samples were collected for visual classification and headspace soil gas screening with a PID. Soil samples were not collected for laboratory analysis. PID readings were well below

those of other soil samples which correlated to non-detectable levels of VOCs in laboratory analyses. The boring log sheet for SB-4 is contained in Attachment O-1.

Soil boring SB-10 and SB-11 were installed to a depth of 30 feet and soil samples were collected for visual classification, headspace soil gas screening with a PID, and physical laboratory testing. Soil samples were not collected for laboratory analysis. PID readings were elevated to a depth of seven feet in SB-10 and an odor was noted on the boring log sheet at these depths. PID readings were elevated to a depth of 20 feet in SB-10 and a slight odor was noted on the boring log sheet immediately below the concrete. The boring log sheet for SB-10 and SB-11 are contained in Attachment O-1.

Monitoring well GMW-3 was installed at the southeast corner of Parcel C in 1985. The log sheet and well construction details are contained in Attachment O-1. Low levels of organic compounds have been historically detected in GMW-3 and are summarized on Table O-3a.

O-1 c (x) Truck Well

Unit Characteristics

The Truck Well (SWMU 2) consists of a sloped concrete truck ramp with space for two trucks and adjoining retaining walls.

Waste Characteristics and Management

Finished product is loaded from the Tote and Drum Storage Area onto trucks in this area for shipment off-site. No wastes are handled in this area.

History of Releases or Potential to Release

According to Gage personnel there have been no known releases in this area. During the 1992 RFA site inspection, some staining, unsealed joints and cracks were noted in the Truck Well. No quantitative information is available for environmental media in the Truck Well area (TSB-3 was installed north of the Truck Well but was located within a tank vault).

O-1 c (xi) Former Underground Storage Tank Area by the Truck Well

Unit Characteristics

According to Gage facility records, five UST systems were located in the Former Underground Storage Tank Area by the Truck Well (SWMU 3). The available information regarding these USTs is presented on Table O-1 and below:

UST	Capacity *(gallons)*	Contents	Material of Construction	Age at Removal *(years)*	Year Removed
47	6,000	Mineral seal oil	Steel	8-13	1987
48	6,000	#4550 Solvent/ petroleum distillate	Steel	6-11	1987
49	6,000	Methanol	Steel	8-13	1987
50	6,000	Hydrocarbon solvent	Steel	8-13	1987
51	6,000	Hydrocarbon solvent	Steel	8-13	1987

Waste Characteristics and Management

No wastes were managed in these tanks.

History of Releases or Potential to Release

During a 1984 UST investigation, Tank 48 failed a pressure-test and free product was discovered in three monitoring wells (TMW-1, 2 and 3; no longer present at the site) placed within the tank area. Tank 48 was immediately emptied and a free product recovery system was established using the three monitoring wells (OHM, 1986). Gage personnel removed all five USTs in 1987. In accordance with standard UST closure practices at the time, a representative of the City of Ferndale's Fire Department inspected the site to confirm that the USTs had been removed, and to witness that the UST excavations were free of contamination and properly closed. The Fire Marshal did not require the analysis of soil samples as part of the inspection.

In 1990 soil boring TSB-3 was installed in this former UST area to a depth of 10.5 feet. Two soil samples were collected from this boring (one shallow and one deep) and analyzed for VOCs (EPA Methods 8010 and 8020) to document soil conditions in the area. Although some VOCs were detected in the soil samples, the report of the investigation concluded that the previous location of USTs did not appear to be an on-going source of contamination (WWES, 1990). The analytical results for TSB-3 are summarized on Table O-2.

O-1 c (xii) Bulk Tank Storage Area

Unit Characteristics

The Bulk Tank Storage Area (SWMU 4) has been used to store finished product since the early 1950's. Secondary containment for this tank farm was originally provided by

an earthen berm which was replaced with five to eight-foot high concrete containment walls in 1985. In the early 1980's, a concrete containment floor was installed. During the 1992 RFA, some of the secondary containment joints were thought to be unsealed, and cracks/deterioration were observed in the secondary containment structure. However, Gage personnel state that the integrity of the containment floor is continually monitored and repaired as necessary. Currently, the concrete dike is lined with a high density polyethylene liner which is inspected and maintained.

The Bulk Tank Storage Area currently contains 89 aboveground storage tanks of various ages which are used to store finished product prior to packaging. The tanks in this area are constructed of carbon or stainless steel and have capacities ranging from 1,000 gallons to 29,000 gallons. Permanent pipelines connect the tanks to the mixing and filling operations.

Waste Characteristics and Management

The Bulk Tank Storage Area is used to store raw materials, intermediate and finished product, not wastes. No wastes are managed in this area.

History of Releases or Potential to Release

During the 1992 RFA site inspection, some staining was noted on the concrete pad in the tank farm and where the ancillary piping from the tank farm entered Fill House 1 (SWMU 11).

Soil borings TSB-3 and SB-14 (Figure O-3) were installed in or near the Bulk Tank Storage Area in 1990 and 1992, respectively. Soil boring TSB-3 was installed in the former UST area located immediately east of the Bulk Tank Storage Area to a depth of 10.5 feet. Two soil samples were collected from this boring (one shallow and one deep) and analyzed for VOCs (EPA Methods 8010 and 8020) to document soil conditions in the area (WWES, 1990). A few VOCs were detected in the soil samples at relatively low concentrations (Table O-2).

O-1 c (xiii) Generated Hazardous Waste Storage Area

Unit Characteristics

The Generated Hazardous Waste Storage Area (SWMU 5) has been used since 1987 to store hazardous waste generated on-site from Gage's recycling processes. Three aboveground storage tanks are located in this area. The capacities of these tanks are 9,000, 11,000 and 15,000 gallons, respectively. The floor and 5-foot walls of the secondary containment unit are lined with 6 inches of micro-silica concrete. Permanent pipelines connect the tanks to the remanufacturing operation.

Waste Characteristics and Management

The EPA hazardous waste numbers of waste managed in this area are D001**,** D005, D007, D008, D018, D035, F003, and F005.

History of Releases or Potential to Release

According to Gage personnel, there have been no known releases from this area. During the 1992 RFA site inspection, the flashing around the base of the 15,000-gallon tank was observed to be dented. No quantitative information is available for environmental media in the immediate vicinity of the Generated Hazardous Waste Storage Area.

O-1 c (xiv) Limited Storage Area Tanks

Unit Characteristics

Under the terms of Gage's LSF operating license, waste is stored in five aboveground storage tanks with capacities ranging from 1,000 to 6,000 gallons. Permanent pipelines connect the tanks to the adjacent Gage LSF. The concrete floor and 5-foot walls of the unit's secondary containment system are lined with 6 inches of micro-silica concrete.

Waste Characteristics and Management

The primary EPA hazardous waste numbers of wastes managed in this area are D001, D005, D007, D008, F003, and F005.

History of Releases or Potential to Release

No releases have occurred from this unit. Based on the design, operational history, and physical integrity of the unit, as described in Section J, Environmental Assessment, releases from these tanks are not likely.

O-1 c (xv) Railroad Loading/Unloading Area

Unit Characteristics

The Railroad Loading/Unloading Area (SWMU 7) extends along the railroad spur on the southwest corner of the Gage facility. In this area rail cars were unloaded of raw material through aboveground and underground pipelines extending to the Bulk Tank Storage Area where the material was stored. The rail spur was upgraded in 1998 to include catch basins under both sidings indented to collect potential releases from rail

cars during loading and unloading activities. These catch basins are connected to two 15,000 gallon secondary containment vessels.

Waste Characteristics and Management

According to Gage personnel, wastes were shipped from the upgraded Railroad Loading/Unloading Area to cement kilns for disposal. The EPA hazardous waste numbers of waste managed in this area are D001**,** D005, D007, D008, D018, D035, F003, and F005.

History of Releases or Potential to Release

According to Gage personnel, there have been no known releases in this area with the exception of *de minimis* spills associated with material handling practices (e.g., disconnecting hoses) when transferring raw materials before the upgrade occurred. The RFA report noted that the soil in this area was stained.

Soil boring C-SB-1 and monitoring wells GMW-4 and GMW-7 (Figure O-3) were installed in the vicinity of the Railroad Loading/Unloading Area. Soil boring C-SB-1 was installed to a depth of 10.5 feet and four soil samples were collected from varying depths for laboratory analysis of VOCs (EPA Method 8010 and 8020). Nine VOCs were detected in these soil samples (WWES, 1990) at relatively low concentrations (Table 0-2). The boring log is contained in Attachment O-1.

Monitoring well GMW-4 was originally installed in 1985 (OHM, 1986) and replaced in 1989 (WWES, 1990). Monitoring well GMW-7 was installed in 1990 (WWES, 1990). The boring logs and well construction details are contained in Attachment O-1. Several organic compounds have been historically detected in GMW-4 and GMW-7 and are summarized on Table O-3.

O-1 c (xvi) Former Piping Area

Unit Characteristics

The Former Piping Area (SWMU 8) extends along the north side of the Bulk Tank Storage Area. Historically, pipelines in this area were located on the surface of the ground and were used to convey raw material and finished product between the Bulk Tank Storage Area (SWMU 4) and Fill House No.1 (SWMU 11). These pipelines were replaced with aboveground elevated pipelines in 1991. A conveyor belt is presently located in this area and is used to transport clean, unused drums to Fill House No.1. Soil in this area is either covered with gravel or concrete.

Waste Characteristics and Management

The Former Piping Area was used to convey raw material and final product only. No wastes were managed in this area.

History of Releases or Potential to Release

According to Gage personnel, there were no known releases in this area. During the 1992 RFA site inspection, stained soil was observed in this area. Soils were excavated and sent to a licensed landfill in 2012 when portions of this area were paved. No quantitative information is available for environmental media in the immediate vicinity of the Former Piping Area.

O-1 c (xvii) Former Underground Storage Tank Area by Fill House 2

Unit Characteristics

According to Gage facility records, six USTs were located in the Former Underground Storage Tank Area by Fill House 2 (SWMU 9). The available information regarding these USTs is presented on Table O-1 and below:

UST	Capacity *(gallons)*	Contents	Material of Construction	Age at Removal *(year)*	Year Removed
41	3,000	Antifreeze	Steel	9-14	1987
42	3,000	Ethyl acetate	Steel	11-16	1987
43	1,500	n-Butanol	Steel	11-16	1987
44	1,500	Ethylene glycol monobutyl ether	Steel	11-16	1987
45	1,500	Diacetone alcohol	Steel	11-16	1987
46	1,500	Chlorobenzene or ethyl acetate	Steel	11-16	1986

Waste Characteristics and Management

No wastes were managed in these tanks.

History of Releases or Potential to Release

During a 1984 UST investigation, Tank 41 failed a pressure-test and free product was discovered in monitoring wells placed within the tank area. Tank 41 was immediately emptied and a ground water collection trench system was subsequently installed across Parcel C (OHM, 1986). Gage personnel removed all six USTs in 1986 and 1987. In

accordance with standard UST closure practices at the time, a representative of the City of Ferndale's Fire Department inspected the site to confirm that the USTs had been removed, and to witness that the UST excavations were free of contamination and properly closed. The Fire Marshal did not require the analysis of soil samples as part of the inspection. Construction on Fill House 2 began in 1987 following removal of the six USTs.

In 1990 soil boring TSB-5 (Figure O-3) was installed in this former UST area to a depth of 10.5 feet. Five soil samples were collected from this boring at varying depths and analyzed for VOCs (EPA Methods 8010 and 8020) to document soil conditions in the area. Although some VOCs were detected in the soil samples, the report of the investigation concluded that the previous location of USTs did not appear to be an on-going source of contamination (WWES, 1990). The analytical results for TSB-5 are summarized on Table O-2.

O-1 c (xviii) Tank Wagon Loading /Unloading Area

Unit Characteristics

The Tank Wagon Loading/Unloading Area (SWMU 10) is located immediately north of Fill House 1 (SWMU 11; Figure O-15). Up to four tanker trucks can be parked in this area at one time while one of the following activities takes place:

- Finished product is loaded into the tankers from the tank farm through Fill House 1;
- Raw material (i.e., solvent) is off-loaded into the tank farm through Fill House 1; or,
- Spent solvent is off-loaded into the Remanufacturing Building (formerly known as Fill House 2) for recycling from the two most western truck bays.

Waste Characteristics and Management

The primary EPA hazardous waste numbers of waste managed in this area are D001, F001, F002, F003, and F005.

History of Releases or Potential to Release

This area has been operated in conjunction with Fill House 1 since 1951. Release controls include a concrete floor with a 200-gallon capacity dry sump, a galvanized metal roof to prevent precipitation run-off, dry disconnect couplings, and the placement of 5-gallon metal containers beneath the hose connections of trucks to contain leakage. According to Gage personnel, releases from this area have been limited to *de minimis* spills associated with material handling practices (e.g., disconnecting hoses) and were contained by either the 5-gallon containers or the dry sump. During the 1992 RFA site

inspection, unsealed joints and staining were noted on the concrete pad, purple-gray paint was noted on several connections between pipes and hoses, and minor leaking was noted at two hose connections from Fill House 1. These minor leaks were contained by the dry sump. No quantitative information is available for environmental media in the immediate vicinity of the Tank Wagon Loading/Unloading Area.

O-1 c (xix) Fill House 1

Unit Characteristics

Fill House 1 (SWMU 11) contains solvent blending operations in which the raw material solvents are blended into product in the adjacent tank farm in blending tanks and dispensed directly into 550-gallon totes and 55-gallon drums or through the Tank Wagon Loading/Unloading Area (SWMU 10) into tanker trucks. Each blending tank is cleaned with solvent between batches and the resulting waste is drained through a pipe at the base of the tank into a 5-gallon pail. This waste material is then accumulated in a 55-gallon drum for further reclamation on-site, or off-site disposal.

Waste Characteristics and Management

The EPA hazardous waste numbers of waste managed in this area are D001, D018, D035, F003, and F005.

History of Releases or Potential to Release

Fill House 1 has been in operation since 1951. According to Gage personnel, releases from this area have been limited to *de minimis* spills associated with material handling practices (e.g., disconnecting hoses). During the 1992 RFA site inspection, the concrete floor of Fill House 1 was noted to have unsealed joints.

Soil boring TSB-3 (Figure O-3) was installed in the former UST area located immediately south of Fill House 1 to a depth of 10.5 feet. Two soil samples were collected from this boring (one shallow and one deep) and analyzed for VOCs (EPA Methods 8010 and 8020) to document soil conditions in the area (WWES, 1990). A few VOCs were detected in the soil samples at relatively low concentrations (Table O-2).

O-1 c (xx) Former Generated Hazardous Waste Storage Area

Unit Characteristics

The Former Generated Hazardous Waste Storage Area (AOC 1) was part of a storage yard for 55-gallon drums which was used until the late 1980's.

Waste Characteristics and Management

Drums stored in this area included new, reconditioned, or empty (as returned from clients) drums. Drums of hazardous waste generated by the Gage facility were also stored in this area. The EPA hazardous waste numbers of waste managed in this area were D001, D002, F001, F002, F003, and F005. The area is currently the location where the Gage LSF was built in the early 1990's, and the railspur upgrade occurred in 1998.

History of Releases or Potential to Release

There were no reported releases in this area. Soil borings C-SB-1, SB-8 and monitoring well GMW-7 (Figure O-3) were installed in the Former Generated Hazardous Waste Storage Area in 1990 and 1992. Soil boring C-SB-1 was installed in 1990 to a depth of 10.5 feet and four soil samples were collected from varying depths for laboratory analysis of VOCs (EPA Method 8010 and 8020). Nine VOCs were detected in these soil samples (WWES, 1990) at relatively low concentrations (Table O-2). The boring log is contained in Attachment O-1.

Soil boring SB-8 was installed in 1992 to a depth of 30 feet and soil samples were collected for visual classification, headspace soil gas screening with a PID, and physical laboratory testing. Soil samples were not collected for laboratory analysis. Elevated PID readings were obtained in soil at a depth of 15 feet. The boring log sheet for SB-8 is contained in Attachment O-1.

Monitoring well GMW-7 was installed in 1990 (WWES, 1990). The boring logs and well construction details are contained in Attachment O-1. Several organic compounds have been historically detected in GMW-7 and are summarized on Table O-3a.

O-1 c (xxi) Former Storage Area at the Boiler Building

Unit Characteristics

The Former Storage Area at the Boiler Building (AOC 2) was the site of a dry storage warehouse used for the storage of primarily powders, pigments and other dry materials. According to Gage facility personnel, the only liquid known to have been stored in this

warehouse consisted of case oil for facility equipment. The Boiler Building was converted to this new use in 1991.

Waste Characteristics and Management

No wastes were managed in this area.

History of Releases or Potential to Release

During the 1992 RFA site inspection, no evidence of releases was noted in this area.

Soil borings SB-1, SB-9 and monitoring well GMW-5 (Figure O-3) were installed in the vicinity of the Former Storage Area at the Boiler Building in 1989 and 1992. SB-1 was installed to a depth of 55 feet and soil samples were collected and screened in the field for visual classification and the presence of VOCs. Soil samples were not collected for laboratory analysis. The boring log sheet is contained in Attachment O-1. Low levels of organic compounds have been historically detected in GMW-6 and are summarized on Table O-3a.

Soil boring SB-9 was installed in 1992 to a depth of 30 feet and soil samples were collected for visual classification, headspace soil gas screening with a PID, and physical laboratory testing. Soil samples were not collected for laboratory analysis. Elevated PID readings were obtained in soil to a depth of 10 feet. The boring log sheet for SB-9 is contained in Attachment O-1.

Monitoring well GMW-5 was originally installed in 1985 (OHM, 1986) and replaced in 1989 (WWES, 1990a). A few organic compounds have been sporadically detected in GMW-5 since 1985. The analytical results of the historical sampling of GMW-5 are summarized on Table O-3a.

O-1 c (xxii) Back Storage Area

Unit Characteristics

The Back Storage Area (AOC 3) was part of the drum storage yard. In 1987, a concrete pad with a central containment sump was installed in this area to store drums of hazardous waste. The 1992 RFA report noted that joints in the pad appeared to be unsealed. In 1994, a state-of-the-art hazardous waste limited storage facility (LSF) was constructed at this location.

Waste Characteristics and Management

The EPA hazardous waste numbers of waste managed in this area are D001, F003, and F005.

History of Releases or Potential to Release

According to Gage personnel, there were no known releases in this area. During the 1992 RFA site inspection, minor staining of the concrete pad was observed.

Soil borings SB-8 and SB-9 were installed in the vicinity of the Back Storage Area in 1992 to a depth of 30 feet and soil samples were collected for visual classification, headspace soil gas screening with a PID, and physical laboratory testing. Soil samples were not collected for laboratory analysis. Elevated PID readings were observed in SB-8 to a depth of 15 feet. Elevated PID readings were obtained in SB-9 to a depth of 10 feet. The boring log sheets for SB-8 and SB-9 are contained in Attachment O-1.

O-1 c (xxiii) Former Steam-Out and Storage Area

Unit Characteristics

According to Gage personnel, the Former Steam-Out and Storage Area (AOC 4) is misnamed because containers were not steam-cleaned in this area with the exception of one tote during a site inspection by the MDEQ. During installation of a steam line, product containers (i.e., totes and drums) were temporarily stored in this location for safety reasons. However, this area is not typically used for container storage. This area may have been an extension of the drum storage yard. The area is currently covered with concrete.

Waste Characteristics and Management

There is no waste stored in this area.

History of Releases or Potential to Release

According to Gage personnel, there were no known releases in this area. During the 1992 RFA site inspection, no evidence of releases was observed. No quantitative information is available for environmental media in the immediate vicinity of this area.

O-1 c (xxiv) Floor Drains that Connect to the POTW

Unit Characteristics

A 1993 Environmental Assessment of Parcel D noted that several floor drains were observed throughout the warehouse/process area and a former mechanical room, all of which were connected to the municipal wastewater treatment system.

Horizon's evaluation found no evidence to indicate that the sewer system was degraded or damaged. As part of the 1993 Environmental Assessment, an investigation of the site's sewer system was conducted in response to reported sewer odor problems at the site. It was determined that inadequate sewer traps allowed the backflow of sewer gases and odors from the municipal sewer system into the building. No integrity problems were identified with the sewer system. Furthermore, past site operations (i.e., beverage production) would not have involved the discharge of materials that could have resulted in damage to the sewer system (e.g., strong acids).

Waste Characteristics and Management

Information on the site's development and past operations indicates that materials discharged to the sewer system were primarily food grade and not hazardous materials.

History of Releases or Potential to Release

Because of the age of the building and the primary use of food-grade materials at the site, there was no evidence of a release or potential release of hazardous substances to the environment from floor drains at the Parcel D property.

The 2009 evaluation of Parcel D concluded that even though there was little potential for a release of hazardous materials to the environment as a result of past discharges to the sewer system on Parcel D, any concern in that regard would be addressed by the approved RFI work plan which included investigation of subsurface utility corridors where they leave the Gage property. The utility corridor investigation included the combined sewer that runs below the former Jewell Avenue roadway to Wanda Avenue. This sewer manages sanitary wastewater and storm water from both Parcels C and D, and as such, investigation of this utility corridor would address potential releases from both Parcels C and D. No additional investigation of the floor drains or sewer corridors associated with Parcel D was recommended.

O-1 c (xxv) Jewell Avenue

Unit Characteristics

In 1994, Gage acquired Jewell Avenue and closed this road to public use. During the 2009 site inspection, this drive appeared to have been recently rebuilt with concrete to support heavy truck traffic and sealed concrete joints to prevent releases to the environment.

Waste Characteristics and Management

A 1993 Environmental Assessment of Parcel D noted that the "MDNR file information indicates volatile organic, semi-volatile organic, and polychlorinated biphenyl compounds are present in perched ground water below the Gage facility. Ground-water movement below the Gage facility is reported to be to the southeast, in the general direction of Jewell Avenue…." No known waste were handled or stored in this area.

History of Releases or Potential to Release

The 2009 evaluation of Parcel D concluded that the approved RFI work plan included investigation of potential off-site migration of impacted ground water from the sewer corridor below the former Jewell Avenue roadway. The RFI investigation provided for the collection and analysis of environmental media at the point where the sewer system extended off-site at Wanda Avenue and was adequate to determine if impacted ground water had migrated onto the former Jewell Avenue roadway. No additional investigation of the former Jewell Avenue was recommended.

O-2 FACILITY'S ASSESSMENT OF KNOWN NATURE AND EXTENT OF CONTAMINATION

O-2 a Ground Water

O-2 a (i) Characterization History

Historical analytical data for Gage facility ground water were also consolidated and compared to cleanup criteria developed by the MDEQ for non-residential properties pursuant to Part 201 of Act 451. A summary of the historical analytical data for the facility's ground water is provided on Tables O-3a and O-3b. A summary of analytical data for the "effluent" (i.e., ground water) collected from the ground water collection trench is provided on Table O-5. Sample locations are shown on Figure O-2 (effluent samples were collected from the center catch basin of the ground water collection trench).