MONITORING AND MAINTENANCE MANUAL
FOR THE
OSWEGO CASTINGS SITE
SITE NO. 7-38-033
OSWEGO COUNTY, NEW YORK

OCTOBER 2001

Prepared for:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Division of Environmental Remediation
625 Broadway
Albany, New York 12233-7013

TABLE OF CONTENTS

1. INTRODUCTION

This is the Monitoring and Maintenance Manual for post-remediation concrete slab maintenance and groundwater monitoring at the Oswego Castings Site (No. 7-38-033) in Oswego, Oswego County, New York.

The remainder of this section describes the Oswego Castings project and the purpose of this manual; Section 2 provides background information on the site, Section 3 describes the monitoring process; Section 4 describes site inspection and maintenance activities; and Section 5 presents health and safety issues and procedures for the site.

1.1 PROJECT DESCRIPTION

The Oswego Castings Site is an inactive hazardous waste site. A Remedial Investigation/Feasibility Study was performed which resulted in a March 1997 Record of Decision which selected excavation and removal of contaminated soils and sediments, along with consolidation and covering of foundry wastes below 10 ppm PCBs. During implementation of the original remedy significant additional contamination was discovered under the buildings and in the yard area, which resulted in the creation of operable unit 2. The remedy was amended to include the installation of a concrete cap and consolidation of PCB contaminated (less than 10 ppm) soils and sediments in the former cooling water pond. The work was completed in 2001 and the site is in the monitoring and maintenance phase.

1.2 PURPOSE OF THE MAINTENANCE AND MONITORING MANUAL

This Maintenance and Monitoring Manual will be used as a tool to monitor and evaluate the performance and effectiveness of the selected remedial action. The performance and effectiveness is evaluated by monitoring the integrity of the concrete cap, former landfill and cooling water pond covers and contaminants of concern contained in groundwater. The manual is intended to provide detailed guidance and direction for the processes of:

- Sampling;
- Analysis;
- Site Inspections; and
- Maintenance.

Note that the current site occupant and its successors has a maintenance agreement and

deed restriction related to the site remedy. Great Lakes Veneer is responsible for routine and periodic maintenance of the installed slab, along with any repairs to damage of the slab which is the fault of Great Lakes Veneer. Therefore, the annual inspections performed by the Department must evaluate their performance with respect to the maintenance agreement and determine the need for any repairs beyond routine maintenance.

2. SITE INFORMATION

2.1 SITE DESCRIPTION

The Oswego Castings site is a Class 2 site listed in the Registry of Inactive Hazardous Waste Disposal Sites in New York State. The site is approximately 10 acres in size (out of an overall property size of 23 acres) and is located on Mitchell Street in the City of Oswego, Oswego County. The site is located in a residential/commercial area.

2.2 SITE HISTORY

Oswego Castings, Inc., a subsidiary of Oberdorfer Foundries, Inc., operated an aluminum die casting facility at the site from 1956 to 1986, after which time foundry operations were discontinued and the equipment removed. During the operation of the foundry, the disposal of core sands and foundry wastes occurred behind the manufacturing buildings. In addition, PCBs were present in wastes discharged to the ground surface near the wetland via process line/septic tank discharge line. PCBs were present in the wastes and in surface soils and sediments at the site above 50 ppm. It is believed that the PCBs were introduced into the process from leaks in hydraulic equipment and from core sand binders and coatings applied to core sand surfaces. Before they were banned in 1977, PCBs were used in high temperature hydraulic fluids and casting agents because of their desirable heat resistant properties.

After the facility closed, PCBs were detected at the site during an investigation performed by a prospective buyer. Preliminary investigations of the facility were then performed by Oberdorfer Foundries starting in June 1988, which identified the presence of PCBs above the hazardous classification of 50 ppm. Based on these investigations, the facility was designated as a class 2 inactive hazardous waste site in June of 1989. Subsequently, the responsible party (PRP) and the Department completed a remedial investigation/feasibility study (RI/FS).

The selected remedy included:

- Removal and off-site disposal of surface soils and sediments contaminated with PCBs above 1 ppm.
- Removal and off-site disposal of subsurface soils and sediments contaminated with PCBs above 10 ppm.
- Remaining foundry wastes in the former landfill area containing PCBs below 10 ppm were to be consolidated and covered with a geotextile and stone cover.

The Record of Decision was signed on March 28, 1997.

The Department competitively bid a construction contract to implement the remedy and the majority of the contaminated soils and sediments identified in the RI/FS were removed from the site. However, it was discovered that the contamination extended under the sawmill building and across the yard area. Additionally, the water in the cooling water pond exceeded discharge limits and could not be

pumped directly to the downstream wetland without treatment. These discoveries greatly increased the scope of work and, therefore, the Department decided to address these areas in a second construction contract.

In between construction contracts, the Department conducted an interim remedial measure to remove contaminated ballast from the facility roof, since it was suspected that elevated PCB levels in the cooling water pond were the result of discharges from the roof drains.

2.3 SITE HYDROGEOLOGY

The March 1997 Record of Decision includes the following discussion related to groundwater.

Groundwater samples from monitoring wells located within and northeast of the core sand area indicate that the PCBs in soils are migrating to the groundwater. Four wells located in the vicinity of the core sand disposal area contained PCBs above the groundwater standard for PCBs of 0.1 ppb and levels ranged from <0.05 ppb to 4.6 ppb. A single well located in the wetland area down gradient from the outfall contained PCBs at 11 ppb.

Two wells located in the vicinity of the septic tank also show impacts to groundwater. The well down gradient of the tank contained PCBs at 1.2 ppb; the other well, located up gradient of the tank, contained total VOCs up to 217 ppb, but no PCBs.

The original four wells were decommissioned during contract one, but subsequently replaced with new wells during contract two (see Appendix A).

Native overburden soils on the site are primarily unconsolidated glacial sediments or till. The permeability, or ability to transport water, is low in these materials (K = 0.0000062 cm/sec) and higher in the landfill materials (K = 0.00046 cm/sec). Groundwater occurs at shallow depths across the site, and was observed to vary from ground surface to 3 to 4 feet deep. Based on the groundwater elevation data, the local groundwater flow is from the south and north, with convergence towards the landfill area. From there, discharge is to the east into the wetland, where the ground elevation is about 7 feet lower than the surface of the core sand disposal area.

3. SAMPLING, ANALYSIS, AND DATA REPORTING

This section describes the environmental monitoring program for the Oswego Castings Site. The elements of the environmental monitoring plan are sampling, analyses, quality assurance/quality control (QA/QC), and data reporting for groundwater.

3.1 ENVIRONMENTAL SAMPLING PROCEDURES

Implementation of proper sampling procedures has a significant effect on the quality of the analytical data. Therefore, the samplers should be well-trained and familiar with sampling protocol. Sampling should be done in teams of two or more samplers. The minimum required experience and qualifications of samplers should include:

- Proper Occupational Safety and Health Act (OSHA) health and safety training and medical monitoring (29 CFR 1910.120);
- At least one of the team samplers should have one year of sampling experience.

The environmental sampling procedures provided below were developed based on site-specific information.

3.1.1 Groundwater Sampling Procedures

The initial groundwater monitoring network will consist of the four existing monitoring wells. Appendix A contains the boring logs for the monitoring wells. The groundwater monitoring network is intended to be dynamic, and a periodic (i.e., annual) evaluation should be made as to the usefulness of the data derived from the network. If it is determined that the water quality data from a well does not change significantly from one sampling event to another, that well could be considered for removal from the network. Evaluation of data is discussed in Section 3.3.

Groundwater samples will be collected and analyzed as detailed in Section 3.2. Sampling of the monitoring wells will consist of:

- Measurement of depth-to-water level and total depth of the well (to calculate well volume);
- Evacuation of static water (purging); and
- Sample collection.

These activities are described below:

3.1.1.1 Water Level Measurement and Well Volume Calculation

Water level measurements will be collected from each of the monitoring wells prior to purging and sampling. The measurements will be recorded using the following procedures:

- Record date, time, weather conditions, and any other well-specific pertinent information;
- Locate reference mark at the top of the well casing;
- Lower electronic water level indicator probe into well, making sure the cord attached to the probe does not scrape the sides of the well casing;
- When an audible signal is detected, stop lowering the probe;
- Raise the probe until the audible signal ceases;
- Lower probe slowly again, stopping as soon as an audible signal is detected;
- Hold cord to side of well casing where reference mark is etched;
- Record measurement (to the nearest 0.01 foot) as depth to water in field logbook.
- Repeat procedure three times for consistency; measurement should remain constant;
- Record the total depth of the well (to the nearest 0.01 foot) by lowering the probe to the bottom of the well and positioning the cord next to the reference mark on the well casing and measuring; and
- After completing both measurements at each well, decontaminate the probe to avoid any possible cross-contamination (see Section 3.1.5).

3.1.1.2 Purging

Before a groundwater sample is collected, the static water must be purged from the well to ensure that a representative groundwater sample is obtained. Three to five well volumes must be purged before collecting a sample.

Prior to sampling each well, bailers must be properly decontaminated to prevent contamination from previous sampling events (see Section 3.1.5). Water removed during purging should be disposed of as detailed in Section 3.3.3.

3.1.1.3 Sampling

Groundwater temperature, pH, specific conductance, and turbidity will be measured prior to sampling. Sampling will be performed as follows:

- Polyethylene sheeting (or similar covering) will be placed on the ground to avoid surface contamination, if necessary;
- All samples must be collected within 24 hour of purge.
- Observed physical characteristics (e.g., color, sheen, odor, clarity) of the groundwater at the time of sampling will be recorded qualitatively; and
- Weather conditions (i.e., air temperature, sky conditions, recent precipitation, drought conditions) at the time of sampling will be recorded.
- Sampling should not be conducted until the NTUs are below 50, and the temperature, pH and specific conductance have stabilized to within 10% for three consecutive readings.

Required sample containers and volumes are presented in Table 3-1. Required sample preservation and holding times are presented in Table 3-2. Analyses will be performed on unfiltered samples.

3.1.2 Decontamination Procedures

Sampling methods and equipment should be chosen to minimize decontamination requirements and prevent the possibility of cross-contamination.

Sampling equipment, including bailers, will be decontaminated by removal of foreign matter, followed by high-pressure steam cleaning, or by the following procedure when a steam cleaner is unavailable:

- Washing in a trisodium phosphate (TSP) solution;
- Rinsing with potable water;
- Rinsing with deionized water; and

- Air drying.

3.1.3 Sample Custody

This section describes procedures for sample chain-of-custody to be followed by sampling personnel. The purpose of these procedures is to ensure that the integrity of the samples is maintained during their collection and transportation. All chain-of-custody requirements comply with EPA-recommended sample-handling protocol for the Contract Laboratory Program (CLP) program.

Sample identification documents must be carefully prepared so that sample identification and chain-of-custody can be maintained and sample disposition controlled. Sample identification documents include field notebooks, field sample maps, sample labels, custody seals, and chain-of-custody records. An example custody form is given in Figure C.1.

The primary objective of the chain-of-custody procedures is to provide an accurate written record that can be used to trace the possession and handling of a sample from the moment of its collection through its analyses. A sample is in custody if it is:

- In someone's physical possession;
- In someone's view;
- Locked up; or
- Kept in a secured area that is restricted to authorized personnel.

Field Custody Procedures

- Sample bottles must be obtained precleaned from the analytical laboratory or directly from a retail source. Coolers or boxes containing cleaned bottles should be sealed with a custody seal during transport to the field or while in storage prior to use.
- As few persons as possible should handle samples.
- The sample collector is personally responsible for the care and custody of samples collected until they are transferred to another person or dispatched properly under chain-of-custody rules.
- The sample collector will record sample data in the field notebook.

Sample Tags and Labels

Sample tags and labels attached to or affixed around the sample container must be used to properly identify all samples taken in the field. The sample tags and labels are to be placed on the bottles so as not to obscure any quality assurance/quality control (QA/QC) data on the bottles; sample information must be printed in a legible manner using waterproof ink. Field identification must be sufficient to enable cross-reference with the logbook (i.e., the sample label on the jar must agree with the description of the sample in the logbook). For chain-of-custody purposes, all QC samples are subject to exactly the same custodial procedures and documentation as real samples.

Custody Seals

Custody seals are preprinted adhesive-backed seals with security slots designed to break if the seals are disturbed. A custody seal is placed over the cap of individual sample bottles by the sampling technician. Sample shipping containers (coolers, cardboard boxes, etc., as appropriate) are sealed in as many places as necessary to ensure security. Seals must be signed and dated before use. Strapping tape should be placed around the lid to ensure that seals are not accidentally broken during shipment and in a manner that allows easy removal by laboratory personnel. On receipt at the laboratory, the custodian must check (and certify) that seals on boxes and bottles are intact.

Chain-of-Custody Record

The chain-of-custody record must be fully completed in duplicate, using black carbon paper where possible, by the field technician who has been designated as responsible for sample shipment to the appropriate laboratory for analysis. In addition, if samples are known to require rapid turnaround in the laboratory, the person completing the chain-of-custody record should note these constraints in the "Remarks" section of the custody record.

Transfer of Custody and Shipment Procedures

- The coolers in which the samples are packed must be accompanied by a chain-of-custody record. When transferring samples, the individuals relinquishing and receiving them must sign, date, and note the time on the record. This record documents sample custody transfer.

- Samples must be dispatched to the analytical laboratory for analysis with a separate chain-of-custody record accompanying each shipment. Shipping containers must be sealed with custody seals for shipment to the laboratory. The

method of shipment, name of courier, and other pertinent information are entered in the "Remarks" section of the chain-of-custody record.

- All shipments must be accompanied by the chain-of-custody record identifying their contents. The original record accompanies the shipment, and one copy is retained by the sampling team leader.

- If sent by mail, the package is registered with return receipt requested. If sent by common carrier, a bill of lading is used. Freight bills, Postal Service receipts, and bills of lading are retained as part of the permanent documentation. Air bill numbers for express mail service must be written on chain-of-custody forms and in the field logbook.

- Samples must be shipped to the analytical laboratory within 24 to 48 hours from the time of collection.

3.2 ANALYTICAL PROGRAM

3.2.1 Analytical Methods and Sampling Intervals

Groundwater

Initially (after the remedy is substantially completed), all four wells will be sampled and analyzed for baseline PCBs. Subsequent monitoring will be conducted annually. Analyze using Method 8080 for PCBs.

After every round of sampling, the frequency of sampling, analytical parameters, and wells to be sampled should be reviewed and adjusted if necessary (see Section 3.3).

3.2.2 QA/QC Samples

Various types of field QC samples are used to check the cleanliness and effectiveness of field handling methods. Field QC samples provide quantitative and qualitative measures of precision, accuracy, representativeness, comparability, and completeness (PARCC) parameters. They are analyzed in the laboratory as samples, and their purpose is to assess the sampling and transport procedures as possible sources of sample contamination and document overall sampling and analytical precision. Field staff may add field blanks or duplicates if field circumstances are such that they consider normal procedures insufficient to prevent or control sample contamination or at the direction of NYSDEC. Detailed documentation of all field QC samples in the site logbooks is mandatory.

Field QC samples and the frequency of analysis for this project are summarized in Table 3-3 and briefly described below.

- **Trip Blanks** are blank samples that assess possible volatile organic contamination from transport conditions. Trip blanks are prepared at the laboratory prior to the sampling event and shipped with the sample bottles. Trip blanks are prepared by adding organic-free water to a 40-ml VOA vial. One trip blank will be used with every batch of water samples shipped for volatile organic analysis. Each trip blank will be transported to the sampling location, handled like a sample, and returned to the laboratory for analysis without being opened in the field.

- **Field Equipment/Rinsate Blanks** are blank samples designed to demonstrate that sampling equipment has been properly prepared and cleaned before field use and that cleaning procedures between samples are sufficient to minimize cross-contamination. Rinsate blanks are prepared by passing analyte-free water over sampling equipment and analyzing the samples for all applicable parameters. If a sampling team is familiar with a particular site, its members may be able to predict which areas or samples are likely to have the highest concentration of contaminants. Unless other constraints apply, these samples should be taken last to avoid excessive contamination of sampling equipment.

- **Field Duplicates** consist of a set of two samples collected independently at a sampling location during a single sampling event. Field duplicates can be sent to the laboratory so that they are indistinguishable from other analytical samples and personnel performing the analyses are not able to determine which samples are field duplicates. Field duplicates are designed to assess the consistency of the overall sampling and analytical system.

3.2.3 Laboratory Qualification

The analytical laboratory to be used for the analyses must maintain NYSDOH Environmental Laboratory Approval Program (ELAP) certification for all subcategories of solid and hazardous waste including NYSDEC Analytical Services Protocol (ASP) Contract Laboratory Program (CLP) metals. The ELAP quality assurance objectives should be met for all analyses.

3.2.4 Data Reporting and Record Keeping

All environmental monitoring results must be reported to NYSDEC within 90 days of the conclusion of sample collection, unless more rapid reporting is required to address an imminent environmental or public health concern. Reporting must include:

- Groundwater Sampling Log Sheet (Figure C.2) which is to be used during groundwater sampling events.

- Analytical results table with date of sample collection, analytical result, sample point designation, applicable water quality standards, method detection limits (MDLs), and Chemical Abstract Service (CAS) numbers for all parameters analyzed;

- Tables or graphical representations comparing current analytical results with past results and upgradient results;

- A graphic interpretation regarding groundwater flow based on water level measurements using 11- by 17- inch scaled site maps;

- A summary of contraventions of water quality standards and/or significant increases in concentrations above existing water quality standards;

- Discussion of results and proposed modifications to the analytical schedules; and

- QA/QC documentation and data quality assessment report.

An annual report must be submitted. This report must contain a summary of environmental quality information as stated above with special note of any changes in quality that occurred during the year. An annual evaluation of data usability and recommendations to NYSDEC/NYSDOH regarding modifications to this O&M Manual should be included. Reports should be sent to:

Gerald Rider, P.E.
Chief, Operation and Maintenance Section
Bureau of Hazardous Site Control
Department of Environmental Remediation
NYSDEC
625 Broadway
Albany, New York 12233-701 3

Reginald Parker, P.E.
RHWE
NYSDEC - Region 7
615 Erie Boulevard West
Syracuse, New York 13204-2400

Gary Robinson
Public Health Specialist
NYSDOH
217 South Salina Street
Syracuse, New York 13202

Field activities should be documented in a field sampling logbook, a copy of which should also be submitted with the reports.

3.3 EVALUATION OF MONITORING REPORTS

The four wells that make up the groundwater monitoring network, and the analyses of samples from these points will provide comprehensive data about the quality of the groundwater at the Oswego Castings Site. After the first-year sampling data have been received, NYSDEC and NYSDOH should perform an evaluation of the usefulness of the data derived from the sample points. This evaluation should review the data with regard to sampling frequency, analysis performed, and sample location. If it is apparent that an analyte or group of analytes consistently meets the cleanup goals (groundwater standards), then these analytes should no longer be analyzed for. If it is determined that the data from a point do not change significantly from one sampling event to another, and if the data meets the cleanup goals, that point could be considered for removal the list of sample points.

NYSDEC and NYSDOH should make a determination from the data to either continue sampling at the same or a different frequency. An annual evaluation of the data should be conducted as described above.

As remove monitoring wells are removed from the monitoring network, they should be properly decommissioned following the NYSDEC Groundwater Monitoring Well Decommissioning Procedures, October 1996.

TABLE 3-1

SAMPLE CONTAINERS AND VOLUMES FOR WATER SAMPLES

Type of Analysis	**Type and Size of Container**	**Number of Containers and Sample Volume (per sample)**
Extractable Organics, Pesticides/PCBs	1 liter bottles with Teflon-lined caps	Two; fill completely

Note: When project-specific laboratory QC samples are required for every 20 samples per matrix per week, a double volume of the sample should be collected and labeled as the matrix spike/matrix spike duplicate.

TABLE 3-2

SAMPLE PRESERVATION AND HOLDING TIMES FOR SOIL AND WATER SAMPLES

Parameter	Preservative	Maximum Holding Time[a]	
		Soil	Water
PCBs/Pesticides	Cool to 4° C	Extract within 5 days, analyze within 40 days	Extract within 5 days, analyze within 40 days

[a]Holding times are based on verified time of sample receipt (VTSR).

TABLE 3-3 FIELD QC SAMPLES	
Ground and Surface Water and Leachate	
Field duplicate	One/matrix/20 samples (for each analysis)
Trip blank	One/day/water matrix (for volatiles only)
Rinsate blank[a]	One/matrix/20 samples or per sampling event (for each analysis)
Sediments	
Field duplicate	One/matrix/20 samples (for each analysis)

Note: Aqueous blanks shipped with solid samples will be analyzed as water without quality control. Blanks will not be labeled as "solids".

[a]Rinsate blanks are required only for groundwaters where bailers are being decontaminated between samples.

Figure C.1
Sample Chain of Custody Record

CHAIN-OF-CUSTODY

Page ____ of ____

Project No:	Project Name:	Project Manager:	REMARKS
Samplers: (Signatures)		Field Team Leader:	

STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP	GRAB	A/R	SAMPLE INFORMATION EXPECTED COMPOUNDS	STATION LOCATION	NUMBER OF CONTAINERS	REMARKS

Relinquished By: (Signature)	Date/Time	Received By: (Signature)	Relinquished By: (Signature)	Date/Time	Received By: (Signature)	Ship Via	
Relinquished By: (Signature)	Date/Time	Received By: (Signature)	Relinquished By: (Signature)	Date/Time	Received By: (Signature)	BL/Airbill Number	Date
Relinquished By: (Signature)	Date/Time	Received for Laboratory By: (Signature)	Relinquished By: (Signature)	Date/Time	Received for Laboratory By: (Signature)		

Distribution: Original Accompanies Shipment Copy to Coordinator Field Files
*See CONCENTRATION RANGE on back of form.

SAMPLE CHAIN-OF-CUSTODY RECORD

FIGURE C.2
SUMMARY OF MONITORING WELL DATA- FIELD SHEET

OSWEGO CASTINGS SITE
GROUNDWATER SAMPLING
Date _____
ANALYSIS FOR PCBs

WELL NO.	BOTTOM DEPTH TOC (FT.)	GW ELEV. TOC (FT.)	AMOUNT OF H_2O (FT.)	WATER PURGED (GAL.)	TIME SAMPLED (HRS.)	TURBIDITY (ntu)	COMMENTS/ OBSERVATIONS
MW-1							
MW-2							
MW-3							
MW-4							

.5 GAL PER FT. WATER = 3 VOLUMES FOR A 2" I.D. MONITORING WELL

The wells were purged of a minimum of three volumes of water. The wells were allowed to settle and a sample was collected. All shallow wells were purged with bottom loaded bailers. Deep wells were purged using a high volume parastallic pump. In general, all wells showed little if any draw down during purging. All samples were collected using detected bailers. At the time of sample collection, a turbidity measurement was made. Samples were collected in 1 liter plastic containers and preserved with HNO_3, and transported to the laboratory.

4. SITE INSPECTION AND MAINTENANCE

Recommended inspection and maintenance items and actions are presented in this section for the Oswego Castings Site.

4.1 GENERAL

The Oswego Castings Site should be inspected annually and at every sampling event and the Inspection Report Form (at the end of this section) properly completed. These inspections should determine the overall condition of the site and note any changes in use of the property. Routine maintenance should also be evaluated during these inspections. A summary report should also be prepared describing the results of the inspection and sampling. The documentation of the inspections and the summary report are discussed in Section 4.2.

4.1.1 Concrete Slab

Purpose

Operable Unit 2 included the installation of a concrete slab in the yard area to prevent contact with PCB contaminated soils above 50 ppm. Also, the existing buildings (related to the former Oswego Castings operations) serve the same purpose with respect to PCB contaminated soils beneath them.

Inspection and Maintenance

The inspections should evaluate the site occupant's performance with respect to 1) routine care of the slab surface (including sweeping and washing with conventional cleaners and detergents) and 2) excessive loading and impacts to the constructed slab are being minimized to the fullest extent practical. All abrasive grit should be removed and corrosive spills wiped up as soon as possible. The site occupant should be notified in writing of any deficiencies in these areas.

Inspect periodically for wear and breaks or gouges in the surface. Conditions of spalling, scaling or cracking should be noted and documented. Note that it might be necessary to isolate damaged areas and restrict activities which may cause further damage prior to repairs be completed.

Particular close attention should be paid to all joints and joint sealants. Note that correct sealant application and maintenance minimize infiltration of surface water and incompressible

materials. Sealants can lose bond with joint reservoir sidewalls or lose internal bond and split open, along with loss of flexibility through natural aging and long term exposure to oxygen, ozone and sunlight. To extend pavement life, joint sealants must be replaced periodically and, therefore, the condition of joints and joint sealants should be evaluated during every inspection.

Any failures of the slab must be evaluated with respect to cause and recommendations provided in the summary report.

Existing buildings should be inspected to determine if any change in use adversely impacts the final remedy.

4.1.2 Former Cooling Water Pond and Landfill Cover Systems

Purpose

The area of the former cooling water pond was used to consolidate soils and sediments contaminated with PCBs below 10 ppm. A geotextile and 12 inches of clean material were placed on top of consolidated materials. During construction, Great Lakes Veneer expressed concerns with the Department's intent to leave the area one foot higher than surrounding grade to allow for settling. In return for minimizing the final elevation to the extent practical, Great Lakes Veneer agreed to placing additional clean materials as needed to account for settling. The former cooling water pond area should not be allowed to settle below the surrounding grade as this would allow significant surface run off to infiltrate into the consolidated materials.

The remaining foundry wastes in the landfill area containing PCBs below 10 ppm were left in place, graded for drainage and covered with a geotextile and six inches of stone.

Inspection and Maintenance

Inspection of these cover systems should focus on the existence of adequate stone cover (i.e., no visible geotextile), positive drainage and changes in site use which adversely impact their integrity.

Recommended maintenance actions would include replacement of damaged or missing geotextile and/or placing additional stone.

4.1.3 Groundwater Monitoring System

Purpose

The groundwater monitoring system consists of four wells. The purpose of this system is to provide points at which the groundwater characteristics can be determined.

Determination of groundwater characteristics is discussed in Section 3.

Inspection and Maintenance

Inspection of the groundwater monitoring system should focus on the following areas:

- Caps;
- Lock;
- Surface seals/pads;
- Markings.

Recommended maintenance actions for these areas are presented in Table 4-1.

4.2 INSPECTION AND MAINTENANCE

Routine inspection and maintenance of the former cooling water pond and landfill cover systems should include a check of the integrity of the geotextile and stone, along with drainage and erosion conditions.

Routine inspection and maintenance of the concrete slab should include inspection for wear and breaks or gouges in the concrete surface; any conditions of spalling, scaling or cracking; and the integrity of joints and joint sealants. Any excessive loading or impacts to the slab should be noted. Periodic replacement of joint sealants must be considered to extend pavement life.

Routine inspection and maintenance of the groundwater monitoring system should include a check of the integrity of caps, locks, surface soils and markings, along with lubrication of the locking mechanisms. Photo documentation is recommended to augment the inspection and maintenance checklist. The site inspector should have the following items for inspection:

- Appropriate health and safety equipment;
- Flashlight;
- Keys for all locks;
- Lock lubricant;

- Survey tape (50- or 100-foot);
- Camera; and
- Logbook.

The attached checklist should be used to conduct and record maintenance items and inspection results. Completed checklists and brief site visit report should be distributed as described in this plan.

Each year, a summary report should be prepared, which includes the following:

- Brief overview;
- Results of inspections during the year;
- Maintenance actions completed;
- Monitoring events completed;
- Results of monitoring and sampling;
- Detailed information on quantity and final disposal of wastes generated;
- Discussion of significant events (i.e., emergencies, severe weather) and observed effect on the site; and
- Summary and recommendations.

4.3 DISPOSAL OF WASTES

4.3.1 Monitoring/Sampling-Derived Waste

Well purge water and liquid decontamination wastes may be disposed of on-site due to the low level of contaminants expected at the site. All expendable materials (e.g., Tyvek, gloves, etc.) generated during sampling should be bagged and disposed off site as solid waste.

TABLE 4-1

GROUNDWATER MONITORING SYSTEM MAINTENANCE ITEMS
OSWEGO CASTINGS SITE
NYSDEC SITE NO. 7-38-033

Inspection Area	Item Noted	Action	Preventive Maintenance
1. Caps	a. Cracked or broken	• Replace.	• Check during sampling
2. Locks	a. Will not open b. Rusted c. Different key for each well	• Break open and replace. • Replace with the same lock number.	• Lubricate during sampling
3. Surface seals	a. Cracked	• Re-grout.	• Inspect during sampling
4. Markings	a. None b. Mislabeled	• Remark.	
5. Water Level	a. Dry b. Silted in or blocked	• DEC/DOH to determine if redrilling to a greater depth is warranted. • DEC/DOH to determine if redrilling is warranted. • Abandon in-place and/or install new well.	• Check during sampling

DATE _____

OSWEGO CASTINGS SITE #7-38-033
INSPECTION REPORT FORM

OVERALL SITE

			COMMENTS?
Drainage Problems	Yes	No	
Erosion Problems	Yes	No	
Note any changes in use of the property			

Groundwater Monitoring System Inspection Area	Item Noted	Action	Preventive Maintenance
1. Caps	a. Cracked or broken	• Replace.	• Check during sampling
2. Locks	a. Will not open b. Rusted c. Different key for each well	• Break open and replace. • Replace with the same lock number.	• Lubricate during sampling
3. Surface seals	a. Cracked	• Re-grout.	• Inspect during sampling
4. Markings	a. None b. Mislabeled	• Remark.	
5. Water Level	a. Dry b. Silted in or blocked	• DEC/DOH to determine if redrilling to a greater depth is warranted. • DEC/DOH to determine if redrilling is warranted. • Abandon in-place and/or install new well.	• Check during sampling

Summer Cooling Water Pond and Landfill Cover Systems	Item Noted	Action	Preventive Maintenance
13. Stone	• Geotextile visible	• Replace	• Check during sampling
Geotextile	• Damaged or missing	• Replace	• Check during sampling
Surface Elevation	• Settlement	• Place additional cover	• Check during sampling
Concrete Slab	Item Noted	Action	Preventive Maintenance
Surface	• Wear	• Note and monitor	• Routine sweeping and cleaning
Joints	• Degradation of seal	• Replace	• Routine cleaning
Integrity	• Spalling, scaling or cracking	• Repair •	• Proper maintenance of joint sealants. • Minimize excessive loads and impacts.

Inspector_____

5.0 HEALTH AND SAFETY

5.1 Summary

5.1.1 EMERGENCY CONTACTS

Fire Department	911
Police Department	911
NYSDEC - Region 7, Syracuse Office	315-426-7551
NYSDEC - Albany Office	518-402-9640
NYSDOH - Syracuse Office	315-426-7612

5.1.2 EMERGENCY PROCEDURES

Emergency procedures are described in Section 5.5.2.

5.1.3 SITE SPECIFIC HAZARDS AND TRAINING

Site Specific Hazards are described in Paragraph 5.2. The primary contaminant is PCBs.

For each sampling event, a Field Team Leader and Site Safety Officer should be designated. The Site Safety Officer will be responsible for providing site-specific training to all personnel that work at the site. This training will cover the following topics:

- Names of personnel responsible for site safety and health.
- Safety, health, and other hazards at the site.
- Proper use of personal protective equipment.
- Work practices by which the employee can minimize risk from hazards.
- Acute health effects of compounds at the site.
- Decontamination procedures.

GENERAL HEALTH AND SAFETY REQUIREMENTS

Personnel Protective Equipment

Level D protection will be worn for initial entry on-site and for all activities. Level D protection will consist of:

- Standard work clothes
- Steel-toe safety boots
- Safety glasses or goggles must be worn when splash hazard is present
- Nitrile outer gloves and PVC inner gloves must be worn during all sampling activities
- Hard hat (must be worn during all sampling activities)

AIR MONITORING

No air monitoring will be required during the sampling activities.

5.2 RISK ASSESSMENT

5.2.1 CHEMICAL HAZARDS

The chemical hazards associated with the site is presented in Appendix C.

5.2.2 RADIATION HAZARDS

No radiation hazards are known at the sites included in this project.

5.2.3 PHYSICAL HAZARDS

5.2.3.1 EXPLOSION

No explosive hazards are known to exist at this site.

5.2.3.2 HEAT STRESS

The use of protective equipment may create heat stress. Monitoring of personnel wearing personal protective clothing should commence when the ambient temperature is 70°F or above. Table 5.2.1 presents the suggested frequency for such monitoring. Monitoring frequency should increase as ambient temperature increases or as slow recovery rates are observed. Heat stress monitoring should be performed by a person with a current first aid certification who is trained to recognize heat stress symptoms. For monitoring the body's recuperative abilities to excess heat, one or more of the following techniques will be used. Other methods for determining heat stress monitoring, such as the wet bulb globe temperature (WBGT) Index from American Conference of Governmental Industrial Hygienist (ACGIH) TLV Booklet can be used.

To monitor the worker, measure:

- Heart rate. Count the radial pulse during a 30-second period as early as possible in the rest period.
- If the heart rate exceeds 100 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.
- If the heart rate still exceeds 100 beats per minute at the next rest period, shorten the following work cycle by one-third.
- Oral temperature. Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).

- If oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period.

- If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following cycle by one-third.

- Do not permit a worker to wear a semipermeable or impermeable garment when oral temperature exceeds 100.6°F (38.1°C).

- Prevention of Heat Stress - Proper training and preventative measures will aid in averting loss of worker productivity and serious illness. Heat stress prevention is particularly important because once a person suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat related illness. To avoid heat stress the following steps should be taken.

- Adjust work schedules.

- Modify work/rest schedules according to monitoring requirements. Mandate work slowdowns as needed.

- Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.

- Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.

- Maintain worker's body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat, i.d., eight fluid ounces (0.23 liters) of water must be ingested for approximately every eight ounces (0.23 kg) of weight lost. The normal thirst mechanism is not sensitive enough to ensure that enough water will be drunk to replace lost sweat. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:

- Maintain water temperature 50° to 60° F (10° to 16.6°C).

- Provide small disposal cups that hold about four ounces (0.1 liter).

- Have workers drink 16 ounces (0.5 liters) of fluid (preferably water or dilute drinks) before beginning work.

- Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight.

- Train workers to recognize the symptoms of heat related illness.

5.2.3.3 COLD-RELATED ILLNESS

If work on this project begins in the winter months, thermal injury due to cold exposure can become a problem for field personnel. Systemic cold exposure is referred to as hypothermia. Local cold exposure is generally called frostbite.

Hypothermia - Hypothermia is defined as a decrease in the patient core temperature below 96° F. The body temperature is normally maintained by a combination of central (brain and spinal cord) and peripheral (skin and muscle) activity. Interferences with any of these mechanisms can result in hypothermia, even in the absence of what normally is considered a "cold" ambient temperature. Symptoms of hypothermia include: shivering, apathy, listlessness, sleepiness, and unconsciousness.

Frostbite - Frostbite is both a general and medical term given to areas of local cold injury. Unlike systemic hypothermia, frostbite rarely occurs unless the ambient temperatures are less than freezing and usually less than 20°F. Symptoms of frostbite are: a sudden blanching or whitening of the skin; the skin has a waxy or white appearance and is firm to the touch; tissues are cold, pale, and solid.

Prevention of Cold-Related Illness - To prevent cold-related illness: Educate workers to recognize the symptoms of frostbite and hypothermia and identify and limit known risk factors: Assure the availability of an enclosed, heated environment on or adjacent to the site.

Assure availability of dry changes of clothing. Assure the availability of warm drinks.

Start (oral) temperature recording at the job site:

- At the Field Team Leader's discretion when suspicion is based on changes in a worker's performance or mental status.

- At a worker's request.

- As a screening measure, two times per shift, under unusually hazardous conditions (e.g., wind-chill less than 20°F, or wind-chill less than 30°F with precipitation).

- As a screening measure whenever any one worker on the site develops hypothermia.

- Any person developing moderate hypothermia (a core temperature of 92°F) cannot return to work for 48 hours.

TABLE 5.2.1

SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING
FOR FIT AND ACCLIMATIZED WORK AREAS

Adjusted Temperature[b]	Normal Work[c] Ensemble	Impermeable Ensemble
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5-90°F (30.8-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5-87.5°F (28.1-30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5-82.5°F (25.3-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5-77.5°F (22.5-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

---

a For work levels of 250 kilocalories/hour.

b Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F = ta °F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to prevent a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)

c A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

5.3 PERSONNEL PROTECTION AND MONITORING

5.3.1 MEDICAL SURVEILLANCE

Personnel involved in this operation must have undergone medical surveillance. Exams are to be conducted at 12-month intervals. The 12-month medical examination includes a complete medical and work history and a standard occupational physical, examination of all major organ systems, complete blood count with differential (CBC), and a SMAC/23 blood chemistry screen which includes calcium, phosphorous, glucose, uric acid, BUN, creatinine, albumin, SGPT, SGOT, LDH, globulin, A/G ratio, alkaline phosphatase, total protein, total bilirubin, triglyceride, cholesterol, and a creatinine/BUN ratio. Additionally a pulmonary function test will be performed by trained personnel to record Forced Vital Capacity (FVC) and Forced Expiratory Volume in second (FEVI.0). An audiogram and visual acuity measurement, including color perception, is provided. The medical exam is performed under the direction of a licensed Occupational Health Physician. A medical certification as to the fitness or unfitness for employment on hazardous waste projects, or any restrictions on his/her utilization that may be indicated, is provided by the physician. This evaluation will be repeated as indicated by substandard performance or evidence of particular stress that is evident by injury or time loss illness on the part of any worker.

5.3.2 SITE-SPECIFIC TRAINING

The Site Health and Safety Officer will be responsible for developing a site specific occupational hazard training program and providing training to all NYSDEC personnel that are to work at the site. This training will consist of the following topics:

- Names of personnel responsible for site safety and health.
- Safety, health, and other hazards at the site.
- Proper use of personal protective equipment.
- Work practices by which the employee can minimize risk from hazards.
- Safe use of engineering controls and equipment on the site.
- Acute effects of compounds at the site.
- Decontamination procedures.
- Upon completion of site-specific training, workers will sign the Site-Specific Training Form.

5.3.3 MONITORING REQUIREMENTS

There is no specific health and safety monitoring associated or anticipated to be conducted during the routine maintenance and monitoring of the site.

5.3.4 PERSONNEL PROTECTIVE EQUIPMENT

5.3.4.1 LEVEL D

Level D protection will be worn for all on-site activities. Level D protection will consist of:

- Standard Work Clothes
- Safety boots with steel-toes
- Nitrile outer and PVC inner gloves (must be worn during all sampling activities)
- Hard hat (must be worn during drilling and excavation activities)
- Splash goggles or safety glasses (where splash hazard is present)

5.4 WORK ZONES AND DECONTAMINATION

5.4.1 SITE WORK ZONES

To reduce the spread of hazardous materials by workers from the contaminated areas to the clean areas, work zones will be delineated at the site. The flow of personnel between the zones should be controlled. The establishment of the work zones will help ensure that personnel are properly protected against the hazards present where they are working, work activities and contamination are confined to the appropriate areas, and personnel can be located and evacuated in an emergency.

5.4.1.1 EXCLUSION ZONE

Exclusion zones will be established at the site for all sampling activities; unprotected onlookers should be located 50 feet upwind of sampling activities.

All personnel within the exclusion zone will be required to use the specified level of protection. No food, drink, or smoking will be allowed in the exclusion or decontamination zones. Contact lenses and cosmetics are not permitted on-site.

5.4.1.2 DECONTAMINATION ZONE

Should it be necessary to establish an exclusion zone, a decontamination zone will be utilized. This zone will be established between the exclusion zone and the support zone, and will include the personnel and equipment necessary for decontamination of equipment and personnel (discussed below). Personnel and equipment in the exclusion zone must pass through this zone before entering the support zone. This zone should always be located upwind of the exclusion zone.

5.4.1.3 SUPPORT ZONE

The support zone will include the remaining areas of the job site. Break areas, operational direction and support facilities (to include supplies, equipment storage and maintenance areas) will be located in this area. No equipment or personnel will be permitted to enter the support zone from the exclusion zone without passing through the personnel or equipment decontamination station. Eating, smoking, and drinking will be allowed only in this area.

5.4.2 DECONTAMINATION

Generally, any water used in decontamination procedures will be disposed of onsite due to the low level of contaminants expected at the site.

5.4.2.1 DECONTAMINATION OF PERSONNEL

Decontamination will not be necessary if only Level D protection is used. However, disposable gloves used during sampling activities should be removed and bagged; personnel should be encouraged to remove clothing and shower as soon as is practicable at the end of the day. All clothing should be machine-washed. All personnel will wash hands and face prior to eating and before and after using the restroom.

5.4.2.2 DECONTAMINATION OF FIELD EQUIPMENT

Field Equipment decontamination procedures are discussed in Section 2.3.4 of the Post Closure Monitoring and Maintenance Plan.

5.5 ACCIDENT PREVENTION CONTINGENCY PLAN

5.5.1 ACCIDENT PREVENTION

5.5.1.1 SITE-SPECIFIC TRAINING

All field personnel will receive health and safety training prior to the initiation of any site activities. On a day-to-day basis, individual personnel should be constantly alert for indicators of potentially hazardous situations and for signs and symptoms in themselves and others that warn of hazardous conditions and exposures. Rapid recognition of dangerous situations can avert an emergency. Before daily work assignments, regular meeting should be held. Discussion should include:

- Tasks to be performed.
- Time constraints (e.g., rest breaks, cartridge changes).
- Hazards that may be encountered, including their effects, how to recognize symptoms or monitor them, concentration limits, or other danger signals.
- Emergency procedures.

5.5.2 CONTINGENCY PLAN

5.5.2.1 EMERGENCY PROCEDURES

In the event that an emergency develops on site, the procedures delineated herein are to be immediately followed. Emergency conditions are considered to exist if:

1) Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on site.

2) A condition is discovered that suggests the existence of a situation more hazardous than anticipated.

General emergency procedures, and specific procedures for personal injury, chemical exposure and radiation exposure, are described below.

5.5.2.2 CHEMICAL EXPOSURE

If a member of the field crew demonstrates symptoms of chemical exposure the procedures outlined below should be followed:

- Another team member (buddy) should remove the individual from the immediate area of contamination. The buddy should communicate to the Field Team Leader (via voice and hand signals) of the chemical exposure. The Field Team Leader should contact the appropriate emergency response agency.

- Precautions should be taken to avoid exposure of other individuals to the chemical.

- If the chemical is on the individual's clothing, the chemical should be neutralized or removed if it is safe to do so.

- If the chemical has contacted the skin, the skin should be washed with copious amounts of water.

- In case of eye contact, an emergency eye wash should be used. Eyes should be washed for at least 15 minutes.

- All chemical exposure incidents must be reported in writing to the Office Health and Safety Representative. The Site Health and Safety Officer or Field Team Leader is responsible for completing the accident report.

5.5.2.3 PERSONAL INJURY

In case of personal injury at the site, the following procedures should be followed:

- Another team member (buddy) should signal the Field Team Leader that an injury has occurred.

- A field team member trained in first aid can administer treatment to an injured worker.

- The victim should then be transported to the nearest hospital or medical center. If necessary, an ambulance should be called to transport the victim.

- For less severe cases, the individual can be taken to the site dispensary.

- The Field Team Leader or Site Health and Safety Officer is responsible for making certain that an Accident Report Form is completed. This form is to be submitted to the Office Health and Safety Representative. Follow-up action should be taken to correct the situation that caused the accident.

5.5.2.4 EVACUATION PROCEDURES

The Field Team Leader will initiate evacuation procedure by signaling to leave the site.

All personnel in the work area should evacuate the area and meet in the common designated area.

All personnel suspected to be in or near the contract work area should be accounted for and the whereabouts of missing persons determined immediately.

Further instruction will then be given by the Field Team Leader.

5.5.2.5 PROCEDURES IMPLEMENTED IN THE EVENT OF A MAJOR FIRE, EXPLOSION, OR ON-SITE HEALTH EMERGENCY CRISIS

- Notify the paramedics and/or fire department, as necessary;
- Signal the evacuation procedure previously outlined and implement the entire procedure;
- Isolate the area;
- Stay upwind of any fire;
- Keep the area surrounding the problem source clear after the incident occurs;
- Complete accident report for and distribute to appropriate personnel.

A decision to notify local residents of emergency conditions at the site, will be made in consultation with local officials and the Fire Department.

APPENDIX A

SECTION 02670
MONITORING WELL INSTALLATION

1. GENERAL

1.1 Scope of Work

A. The **CONTRACTOR** shall furnish all labor, tools, materials, equipment, and incidentals to provide all work necessary to install and develop four (4) shallow overburden monitoring wells, as shown on the plans.

1.2 Submittals

A. The **CONTRACTOR** shall submit the monitoring well installation procedures as part of the Work Plan for the site.

2 PRODUCTS

2.1 Well Casing Materials

A. Each well casing shall consist of riser length and screen length as identified in Part 3 of this Section.

B. Solvents, glues, or other adhesives are prohibited for use on casing joints.

C. Shallow Well

1. Well casing and screen shall be four (4) inch inner diameter, threaded flush joint, Schedule 40 PVC. Casing and screen shall be steam cleaned prior to installation.
2. The screen shall be 0.010" slot Schedule 40 PVC. The bottom plus, on the screen shall be threaded, not slip on.

2.2 Sand Pack

A. The sand pack shall consist of #1 Morie sand (no substitutions).

2.3 Bollards

A. Bollards shall consist of a 6" diameter well casing filled with concrete. The bollard must extend a minimum of 36" above grade and a minimum of 24" below grade. Bollards are to be set in concrete.

3. EXECUTION

3.1 Drilling of Monitoring Wells

A. General

1. **CONTRACTOR** shall drill all monitoring well borings with a drill rig suitable for the work. Boreholes shall be advanced using hollow stem auger and roller bit/core drill equipment.
2. Prior to drilling at each location, the drill rig shall be leveled. Each well shall be installed plumb and true.
3. All equipment placed into the well borings must be properly decontaminated prior to the work, and between each well installation, by steam cleaning.
4. Use of drilling muds, air systems, and drilling lubricants is prohibited.

5. The **CONTRACTOR** shall place new locks on all wells, including existing wells. The locks shall be heavy duty, key locking padlocks, and must be approved by the **DEPARTMENT** prior to purchase. One key shall be able to open all well locks. Four keys for the locks must be given to the **DEPARTMENT** upon completion of the work.

B. Shallow Well

1. Overburden shallow well borings shall be installed with 61/4-inch ID hollow stem augers (HSA) drilled boreholes.
2. A 6-inch diameter temporary casing will be installed in the borehole.
3. A 10-foot well screen shall be placed in the well.

3.2 Well Construction

A. Shallow Well

1. The sand pack will be introduced gradually inside the 6-inch diameter temporary casing, and fill the annular space between the screen and borehole adjacent to the screen, extending one to two feet above the screen. The temporary casing will be withdrawn in increments so that the native formation materials are not allowed to collapse directly against the well casing or screen.
2. A one to two foot thick bentonite pellet seal above the sand pack will be provided by the **CONTRACTOR**. Bentonite will be allowed to hydrate for at least one hour. Cement/bentonite grout will installed above the bentonite seal to within three feet of ground surface. No organic polymer additives ire permitted. The grout will be mixed with a mud pump to a consistency acceptable to the **ENGINEER**.
3. Neat cement or concrete will be used from three feet to the ground surface.

B. An outer protective steel casing will be provided and cemented in place around the riser pipe. The top of the steel casing will extend approximately three feet above the finished grade and two inches above the top of the well casing,. Three feet of steel casing, will be below ground. The monitoring well will have a vented and locked cap. A drain hole shall be drilled at the base of the casing, and a vent hole shall be located at the top of the casing. The cement collar will be tapered away from the well to divert surface runoff from the well.

C. The monitoring wells will have a vented and locked cap. The **CONTRACTOR** shall remove the locks from the existing wells, and shall install heavy duty padlocks on all wells that are keyed the same.

D. All drilling equipment such as augers, casing, bits, and sampling equipment which may come in contact with subsurface materials shall be

steam cleaned before being brought onto the site. The drilling and sampling equipment will be steam cleaned before leaving the site. All PVC materials (screens and risers) will be steam cleaned prior to well installation.

E. Drilling fluids will be properly disposed off site in accordance to all applicable regulations, as approved by the **ENGINEER**.

F. The casing for Well #1 (as identified on contract drawings) will be protected from vehicular traffic by bollards. The **ENGINEER** may require bollards for the other casings if he determines that the well casing is at risk of damage due to vehicular traffic.

3.3 Well Development

A. All installed monitoring wells shall be developed as soon as possible following installation, but not before the well seal and grout have properly set. The entire saturated screened or openhole interval must be developed.

B. The wells shall be developed using either bailing , manual pumping using a Waterra or equal pump, or powered suction-lift pumping, as approved by the **ENGINEER**. Well development shall be initiated gently, and the degree of agitation then slowly increased to remove fines from the well bottom and sand pack. Water must not be introduced into the well during development.

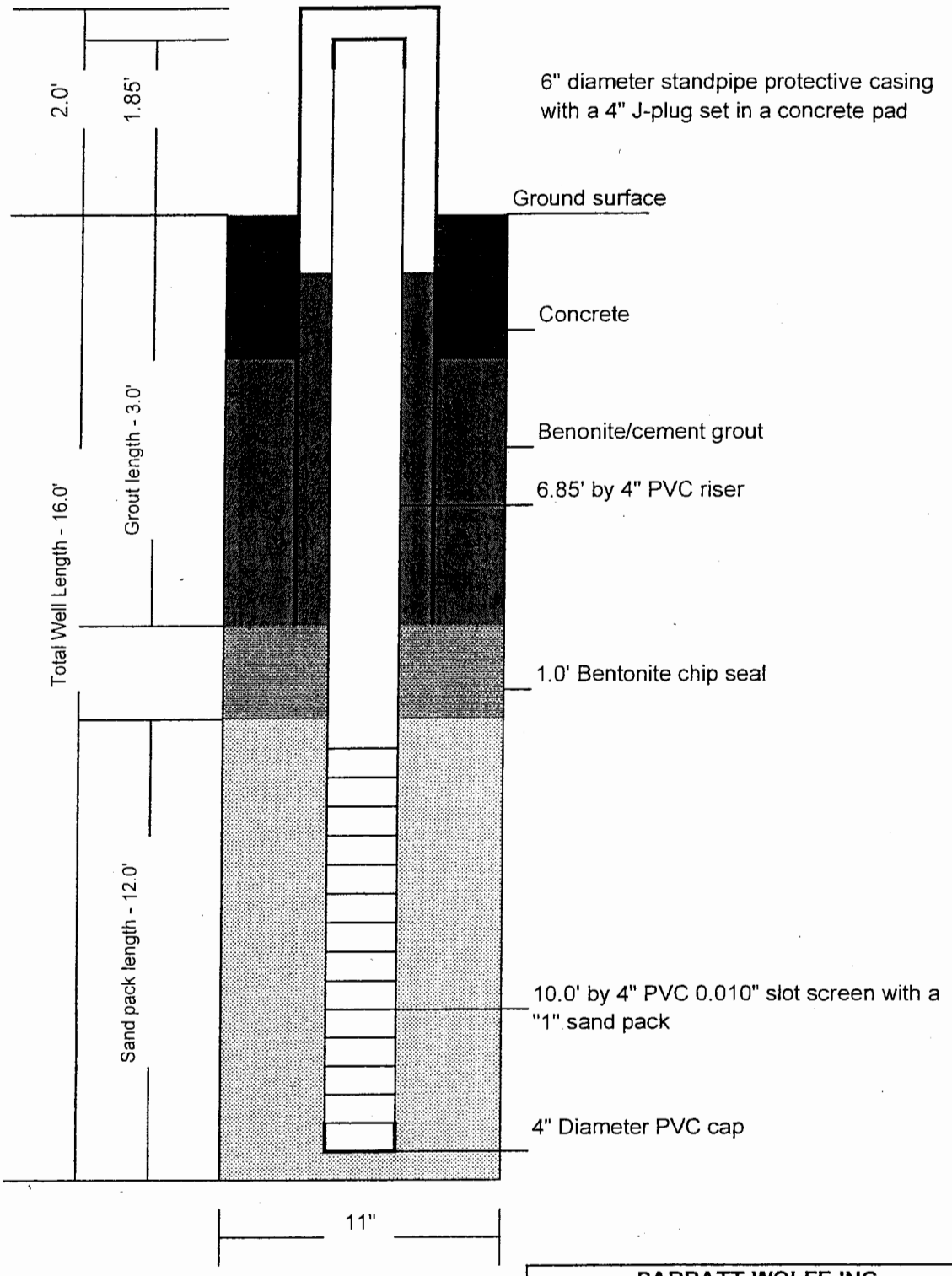
C. Development shall continue until the turbidity in the recovery water is less than 50 NTU'S. If the turbidity exceeds 50 NTU's after 500 gallons have been removed, development shall continue as determined by the **ENGINEER**.

D. **CONTRACTOR** will be responsible for testing and disposing of all development water in accordance to all applicable regulations, as approved by the **ENGINEER**.

3.4 Surveying

A. The locations and elevations of the installed monitoring wells shall be surveyed by a New York State licensed surveyor directly following installation, and located on a site drawing. Elevations are required for the ground surface, top of well casing, and top of protective casing. All elevations must be determined to the nearest 0.01 feet.

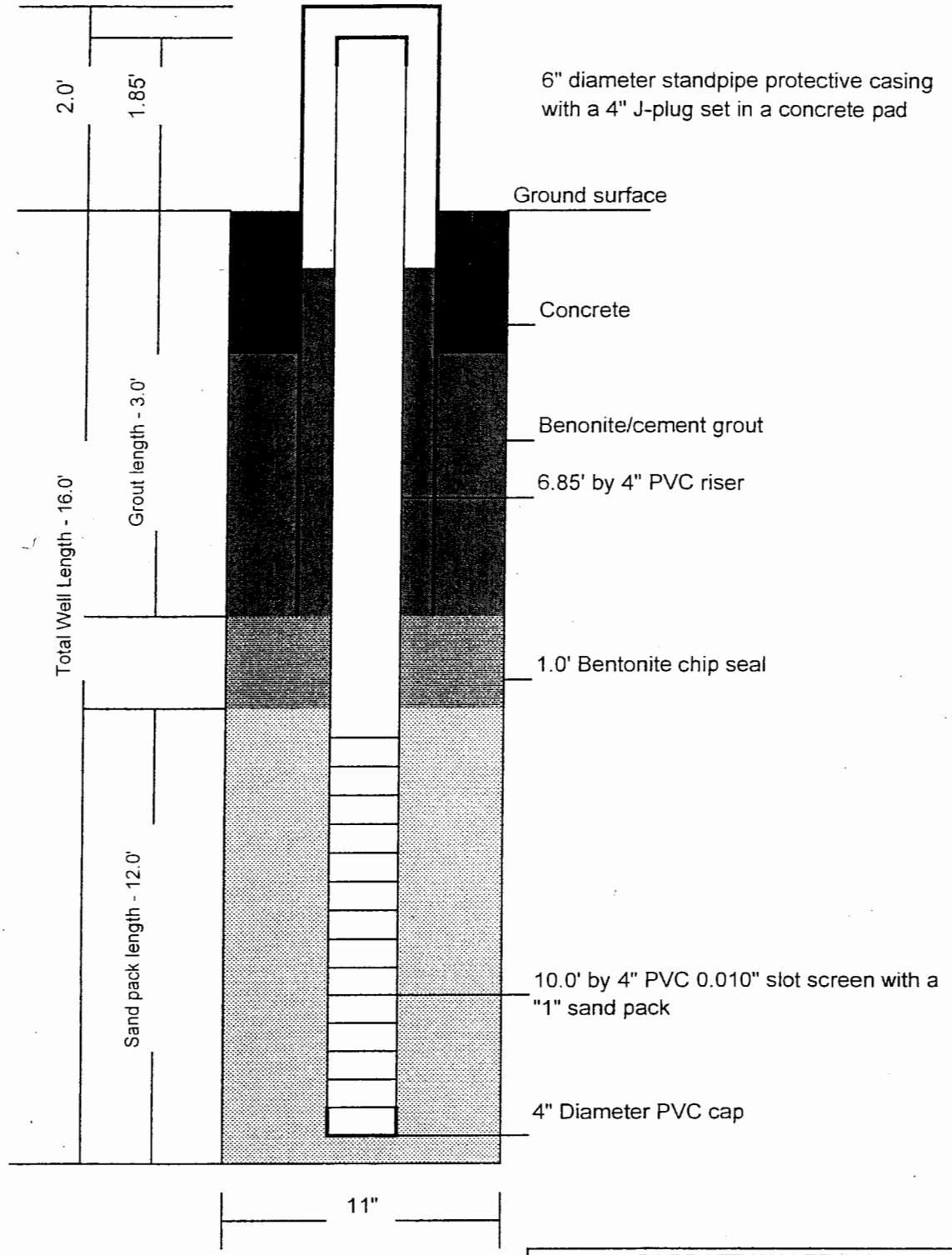
END OF SECTION



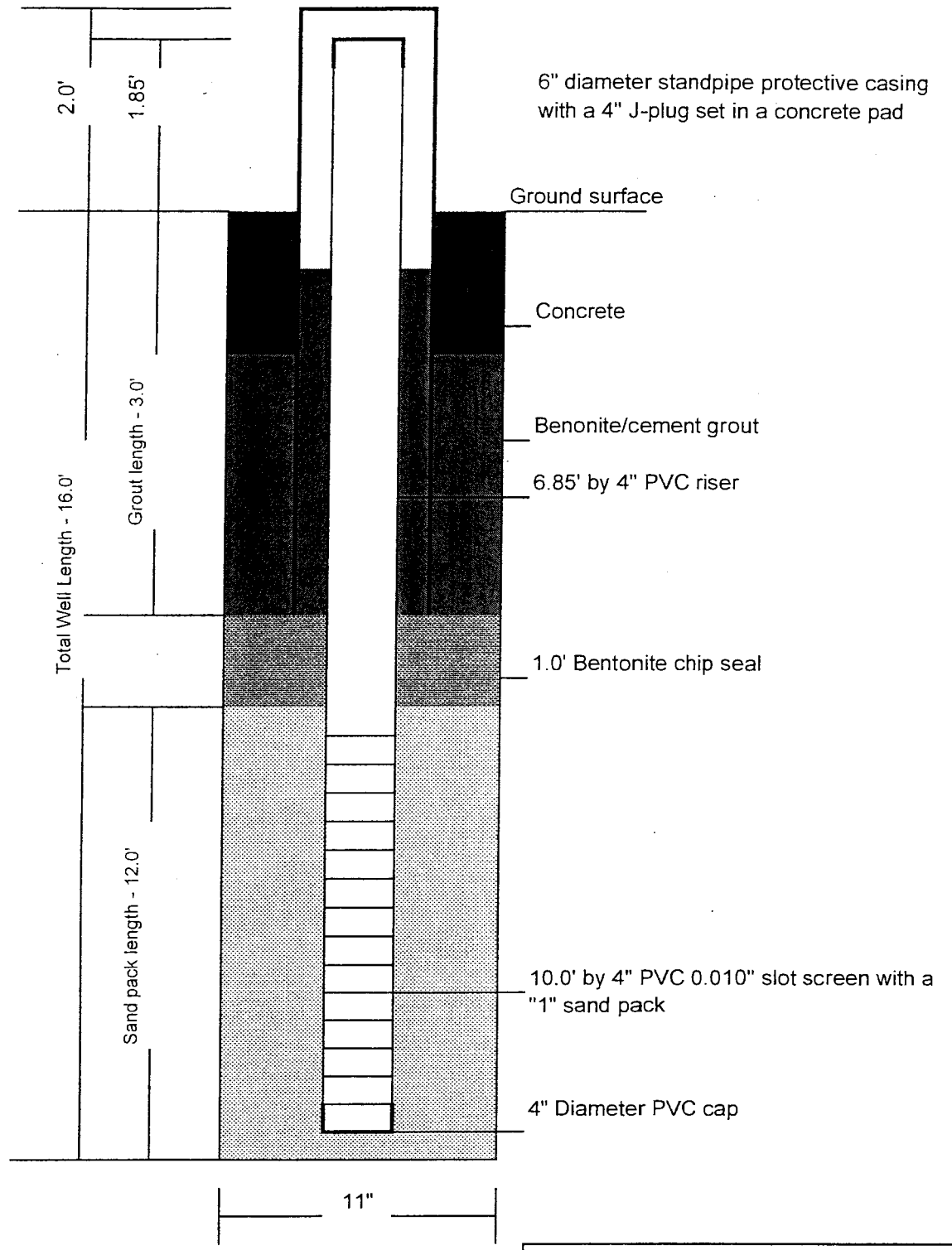
PARRATT-WOLFF INC.

MONITORING WELL MW-1
OSWEGO CASTINGS
OSWEGO, NEW YORK

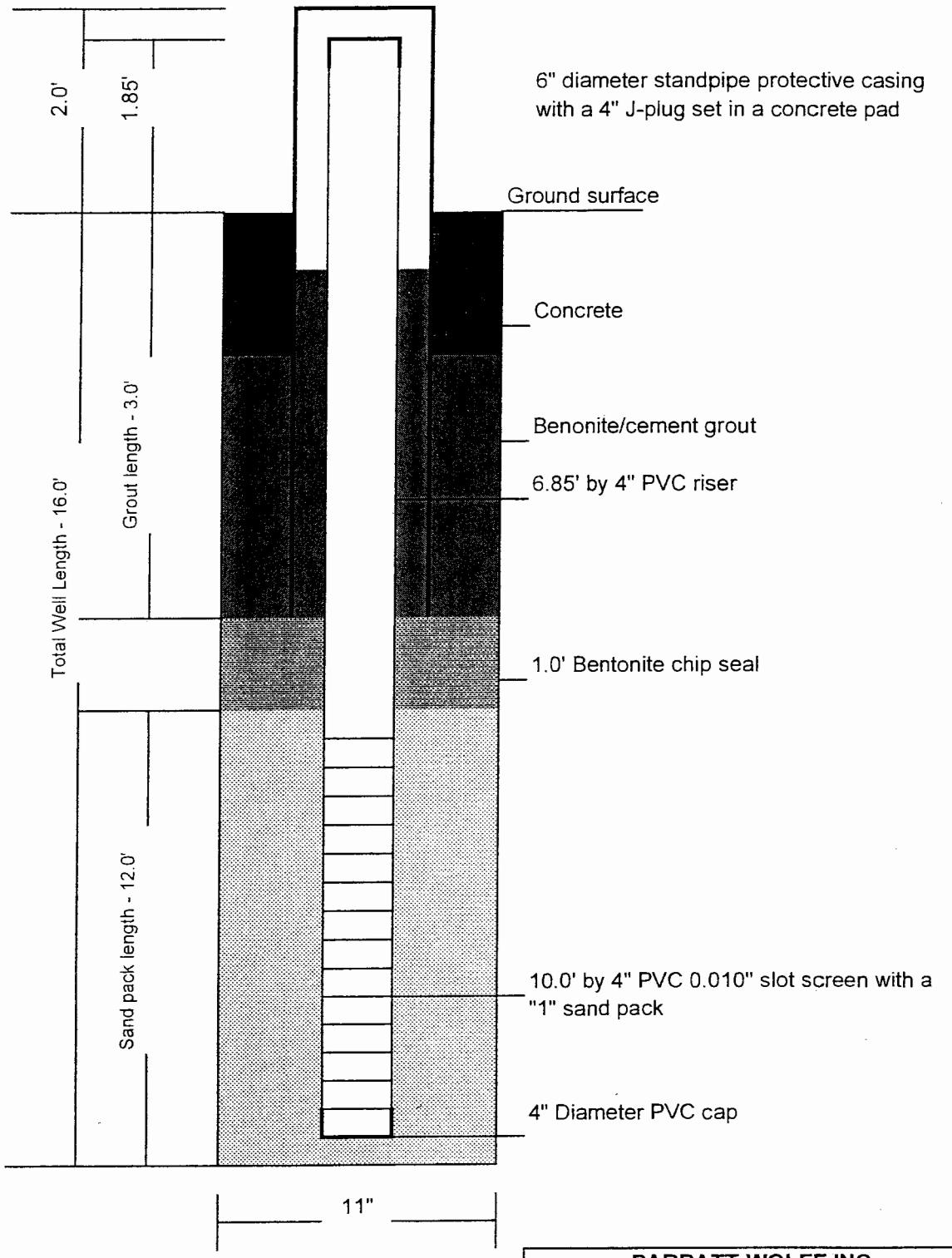
NOT TO SCALE AUGUST 2001



PARRATT-WOLFF INC.	
MONITORING WELL MW-2 OSWEGO CASTINGS OSWEGO, NEW YORK	
NOT TO SCALE	AUGUST 2001



PARRATT-WOLFF INC.	
MONITORING WELL MW-3 OSWEGO CASTINGS OSWEGO, NEW YORK	
NOT TO SCALE	AUGUST 2001



PARRATT-WOLFF INC.	
MONITORING WELL MW-4 OSWEGO CASTINGS OSWEGO, NEW YORK	
NOT TO SCALE	AUGUST 2001

APPENDIX B

NIOSH Pocket Guide to Chemical Hazards

Chlorodiphenyl (54% chlorine)	CAS 11097-69-1
$C_6H_3Cl_2C_6H_2Cl_3$ (approx)	RTECS TQ1360000
Synonyms & Trade Names Aroclor® 1254, PCB, Polychlorinated biphenyl	**DOT ID & Guide** 2315 171

Exposure Limits	NIOSH REL*: Ca TWA 0.001 mg/m^3 See Appendix A [*Note: The REL also applies to other PCBs.]
	OSHA PEL: TWA 0.5 mg/m^3 [skin]

IDLH Ca [5 mg/m^3] See: IDLH INDEX	**Conversion**

Physical Description
Colorless to pale-yellow, viscous liquid or solid (below 50°F) with a mild, hydrocarbon odor.

MW: 326 (approx)	BP: 689-734°F	FRZ: 50°F	Sol: Insoluble
VP: 0.00006 mmHg	IP: ?		Sp.Gr(77°F): 1.38
Fl.P: NA	UEL: NA	LEL: NA	

Nonflammable Liquid, but exposure in a fire results in the formation of a black soot containing PCBs, polychlorinated dibenzofurans, and chlorinated dibenzo-p-dioxins.

Incompatibilities & Reactivities
Strong oxidizers

Measurement Methods
NIOSH 5503
See: NMAM or OSHA Methods

Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet or contaminated Change: Daily Provide: Eyewash, Quick drench	**First Aid** (See procedures) Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having a high-efficiency particulate filter/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, chloracne; liver damage; reproductive effects; [potential occupational carcinogen]

Target Organs Skin, eyes, liver, reproductive system

Cancer Site [in animals: tumors of the pituitary gland & liver, leukemia]

See also: INTRODUCTION See ICSC CARD: 0939 See MEDICAL TESTS: 0176

NIOSH Pocket Guide to Chemical Hazards

Chlorodiphenyl (42% chlorine)	CAS 53469-21-9
$C_6H_4ClC_6H_3Cl_2$ (approx)	RTECS TQ1356000
Synonyms & Trade Names Aroclor® 1242, PCB, Polychlorinated biphenyl	**DOT ID & Guide** 2315 171

Exposure Limits	NIOSH REL*: Ca TWA 0.001 mg/m^3 See Appendix A [*Note: The REL also applies to other PCBs.]
	OSHA PEL: TWA 1 mg/m^3 [skin]

IDLH Ca [5 mg/m^3] See: 53469219	**Conversion**

Physical Description
Colorless to light-colored, viscous liquid with a mild, hydrocarbon odor.

MW: 258 (approx)	BP: 617-691°F	FRZ: -2°F	Sol: Insoluble
VP: 0.001 mmHg	IP: ?		Sp.Gr(77°F): 1.39
Fl.P: NA	UEL: NA	LEL: NA	

Nonflammable Liquid, but exposure in a fire results in the formation of a black soot containing PCBs, polychlorinated dibenzofurans & chlorinated dibenzo-p-dioxins.

Incompatibilities & Reactivities
Strong oxidizers

Measurement Methods
NIOSH 5503
See: NMAM or OSHA Methods

Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet or contaminated Change: Daily Provide: Eyewash, Quick drench	**First Aid** (See procedures) Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having a high-efficiency particulate filter/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

mptoms Irritation eyes; chloracne; liver damage; reproductive effects; [potential occupational carcinogen]
Target Organs Skin, eyes, liver, reproductive system **Cancer Site** [in animals: tumors of the pituitary gland & liver, leukemia]
See also: INTRODUCTION See MEDICAL TESTS: 0175

APPENDIX C

SECTION 02230

GEOTEXTILE

1. GENERAL

1.1 Scope of Work

A. The **CONTRACTOR** shall provide all labor, materials, equipment, and services necessary for the placement of geotextile stabilization fabric in the landfill cap and as shown on the drawings and specified.

1.2 Submittals

A. Shop Drawings:

1. Refer to Section 01011 for requirements relating to shop drawing submittals.

2. Submit manufacturer's data, specifications, installation instructions and dimensions.

3. Submit an affidavit certifying that the geotextile furnished complies with all requirements specified herein and is free of any broken needles.

4. No geotextile shall be shipped until the affidavit is submitted to the **ENGINEER**.

1.3 Quality Assurance

A. Manufacturer's Qualifications:

Geotextile manufacturer shall be a specialist in the manufacture of drainage control filter fabric, and must have produced and successfully installed a minimum of five million square feet.

1.4 Product Delivery, Storage and Handling

A. Each roll of geotextile delivered to the site shall be labeled by the manufacturer identifying the manufacturer's name, product identification, lot number, roll number and roll dimensions.

B. Geotextile shall be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions. Geotextile rolls shall be shipped and stored in relatively opaque and watertight wrappings.

C. **CONTRACTOR** shall provide all labor and equipment required to assist the **ENGINEER** in inspection of materials upon delivery to the site.

2. PRODUCTS

2.1 Geotextile

A. Geotextile shall be Mirafi 600X or equal, and shall conform to the following:

Fabric Property	Unit	Test Method	Typical Value
Grab Tensile Strength	lb.	ASTMD-1682	300
Grab Tensile Elongation	%	ASTMD-1682	35 (max.)
Modulus (at 10% Elongation)	lb.	ASTMD-1682	140
Trapezodal Tear Strength	lb.	ASTMD-1117	120
Mullen Burst Strength	psi	ASTMD-3786	600+
Puncture Strength	lb.	ASTMD-3787	130
Abrasion Resistance	lb.	ASTMD-3884	100
Coefficient. of Permeability, K	cm/sec	CFMC-GET-2	0.01
Water Flow Rate	gal/min/sf	CFMC-GET-2	50
EOS	US Std. Sieve	COE-CW-02215	20-45

Geotextile shall be woven from monofilaments of polypropylene which are nonbiodegradable and resistant to most soil chemicals, acids and alkalies within a pH range of 3 to 12. The fabric shall be stabilized against UV degradation.

3. EXECUTION

3.1 Installation - General

A. All geotextiles shall be weighted with sandbags when required. Such sandbags shall be installed during placement and shall remain until replaced with cover material.

B. Fabric shall be overlapped side-to-side and end-to-end 12 inches.

C. Geotextiles shall not be exposed to precipitation prior to being installed, and shall not be exposed to direct sunlight for more than 15 days.

D. Install according to manufacturer's recommendations.

3.2 Geotextile Repair

A. Any holes or tears in the fabric shall be repaired as follows:

1. On slopes: A fabric patch shall be sewn into place using a double sewn lock stitch (1/4 in. to 3/4 in. apart and no closer than I inch from any edge). Should any tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced.

2. Flat areas: A fabric patch shall be spot-seamed in place with a minimum of 24 inches of overlap in all directions.

B. Care shall be taken to remove any soil or other material which may have penetrated the torn geotextile.

3.3 Placement of Cover Materials

A. **CONTRACTOR** shall place all cover materials in such a manner to ensure the geotextile is not damaged; minimal slippage of the geotextile on underlying layers; and no excess tensile stresses in the geotextile.

*** END OF SECTION ***

SECTION 02224

BACKFILL AND CRUSHED STONE

1. GENERAL

1.1 Scope of Work

A. Due to the hazardous nature of the site, the **CONTRACTOR** shall confine all backfilling operations within the limits as specified by the **ENGINEER,** including limits of easement lines and right-of-way, and shall not enter any area outside these limits without prior written consent of the **ENGINEER**.

B. The **CONTRACTOR** shall furnish all labor, tools, materials, equipment and incidentals necessary to backfill and compact specified excavation areas and place and compact crushed stone over the backfilled landfill area as shown and specified..

C. The **CONTRACTOR** shall be responsible for placing suitable fill and following proper compaction methods to properly fill the specified excavation areas.

1.2 Related Sections

Section 01050 Surveys
Section 02220 Excavation
Section 02230 Geotextile
Section 02900 Restoration

1.3 Submittals

The **CONTRACTOR** shall submit:

A. The name and location of each proposed source of backfill and crushed stone.

B. Certification from suppliers that all fill materials to be supplied for use on this Project meet the requirements of this Specification section, and that the materials are clean (meet analytical criteria specified in Section 01425, Verification Sampling - provide one analytical sample per source of material to be used: the list of analytes must include each compound on the target compound list in the NYSDEC ASP). The **ENGINEER** shall use **DEPARTMENT** TAGM 4046 as the basis for acceptance of the fill materials. Certification must be received and approved by the **ENGINEER** prior to delivery of fill materials to the Site. The **ENGINEER** must be present during the acquisition of these samples from each source.

C. Samples of all fill and crushed stone.

D. A typical grain-size analysis, including hydrometer analysis of all proposed fill materials, except fine stone.

E. The liquid limit of the fill materials, except crushed stone.

F. The moisture density curve for the fill material.

G. Compaction testing results.

H. NYSDEC mining permits.

2. PRODUCTS

2.1 Common Fill

A. Common fill shall be well-graded granular material from fine to coarse, obtained from approved natural deposits and unprocessed except for the removal of unacceptable material and stones larger than the maximum size permitted. It shall be substantially free from loam and other organic matter, clay and other fine or harmful substances.

B. Common fill shall meet the following gradation:

Sieve	Percent by Weight Passing
2"	100
1½"	45-80
No. 40	20-50
No. 200	15-30

C. Any material containing vegetative or organic matter, such as peat, organic silt, sod, snow, or other deleterious material is not acceptable. Material that contains large voids when placed, which will allow migration of the overlying and surrounding materials and soil, is also not acceptable.

2.2 Crushed Stone

A. Crushed stone shall be well graded from coarse to fine and free from organic or other deleterious material.

B. Crushed stone shall be as per New York State Department of Transportation (NYSDOT) ***NYSDOT Standard Specifications, Construction and Materials***, January 2, 1990, Section 713-04 and meet the following gradation:

Sieve	Percent by Weight Passing
2"	100
½"	25-60
No. 40	5-40
No. 200	0-10

3. EXECUTION

3.1 General

A. The **ENGINEER** must approve all areas for backfill based on results of verification sampling prior to the start of backfilling.

B. Material shall be placed in uniform lifts not greater than six (6) inches in thickness, unless greater thicknesses are allowed by the **ENGINEER** upon demonstration by the **CONTRACTOR** that the materials and compaction efforts are adequate to obtain the required compaction.

C. Each lift shall be compacted using suitable mechanical compactors (10-ton minimum) such as a rubber tire roller or smooth wheel roller. Lifts shall be compacted a minimum of six passes of the compactor. At the approval of the **ENGINEER,** the fill shall be compacted at a moisture content within 2 percent of optimum at the time of placement. Improperly compacted fill material shall be replaced at the **CONTRACTOR's** expense. Compaction or consolidation achieved by traveling trucks, machines, or other equipment is not acceptable.

D. Backfill areas shall be free of debris, snow, and ice, and ground surfaces shall not be frozen during placement of backfill. Where required, the **CONTRACTOR** shall, at his own expense, add sufficient water during the compaction effort to assure proper density. If, due to the rain or other causes, the material exceeds the optimum moisture content acceptable range for satisfactory compaction, it shall be allowed to dry, assisted by dicing or harrowing, if necessary, before compaction or filling effort is resumed.

E. Erosion protection shall be provided to all areas not having topsoil and seed thereon and seeded areas where an adequate grass cover has not been established.

F. Common Fill Material Testing: Test material in accordance with ASTM C 136 for conformance to gradation limits; ASTM D 1140 for material finer than the No. 200 sieve; ASTM D 1557 for moisture density relations, as applicable. Provide testing for each 1,000 cubic yards of material to be used with a minimum of one sample per borrow source for each material.

3.2 Septic Tank Area

A. The septic tank excavation shall be backfilled with common fill and compacted to the pre-construction grades or as directed by the **ENGINEER.**

3.3 Landfill Excavation Area

A. The landfill excavation shall be backfilled with excavated pond sediments followed by backfilling with adjacent foundry wastes which contain PCB levels below 10 ppm (see Drawing 2). The area reshaped to achieve a subgrade for capping eighteen (18) inches below the original grade.

B. The original slopes shall be restored to direct storm water drainage towards the wetland area and away from the buildings. The foundry waste embankment adjacent to the wetland shall be cut back or extended, as necessary, to provide required backfill material or achieve proper drainage slopes.

C Cap:

1. Twelve (12) inches of common fill shall be placed over the landfill area landfill cover and compacted.

2. Geotextile stabilization fabric shall be placed over the common fill layer as specified in Section 02230.

3. Six (6) inches of crushed stone shall be placed over the geotextile and thoroughly compacted in place by means approved by **ENGINEER**.

*** END OF SECTION ***

APPENDIX D

NORTHERN READY MIX INC.
32 SILK ROAD
FULTON, NY 13069
(315)-598-2141

CONCRETE MIX DESIGN

MIX ID : 4316 [ ] **4000 PSI** 07/10/01

CONTRACTOR : ABSCOPE ENVIRONMENTAL
PROJECT : OSWEGO CASTING
SOURCE OF CONCRETE : NORTHERN READY MIX INC.

WEIGHTS PER CUBIC YARD (SATURATED, SURFACE-DRY)		YIELD, CU FT
LAFARGE CEMENT TYPE I/II, LB	611	3.11
HANSON AGGREGATES, LB	1294	7.68
CALLAHAN INDUSTRIES, LB	1758	10.47
WATER, LB (GAL-US)	284 (34.0)	4.55
TOTAL AIR, %	6.0 +/- 2.0	1.65
	TOTAL	27.46
POLYHEED 997 WATER REDUCER, OZ	48.88	
MBVR AIR ENTRAINING, OZ-US	6.1	
WATER/CEMENT RATIO, LBS/LB	0.46	
SLUMP, IN	5.00 +/-1	
CONCRETE UNIT WEIGHT, PCF	143.7	

AIR ENTRAINMENT TO BE ADJUSTED PER JOB CONDITIONS
PLEASE ORDER BY MIX # 4316

PREPARED BY :

NORTHEPN READY MIX INC.

P. 1

CME Associates, Inc.

Construction Materials Evaluation

MIX DESIGNATION: 4330

LABORATORY TRIAL BATCH

CLIENT:	Northern Aggregates, Inc.	DATE:	04/10/00
PRODUCER:	Northern Ready Mix	REPORT NO.:	4375C-03-0400

COMPONENT MATERIAL SOURCES

CEMENT:	Lafarge Cement Company. Type I/II
FINE AGGREGATE:	Hanson Aggregates, Jamesville, NY
COARSE AGGREGATE:	Callahan Industries
ADMIXTURE:	AEA: MBVR Master Builders WATER REDUCER: Polyheed 997

MIX PROPORTIONS PER CUBIC YARD

CEMENT:	611 lbs.	FINE AGG:	1294 lbs.	COARSE AGG # 1	1758 lbs.
WATER:	216.0 lbs.	W/C:	0.35 lb/lb		
AEA:	4.8 oz.	WATER REDUCER:	18.3 oz.		

PROPERTIES OF THE TRAIL BATCH

SLUMP:	3	INCHES	ASTM C-143
AIR CONTENT:	7.3	PERCENT	ASTM C-231
UNIT WEIGHT:	137.2	POUNDS/C.F.	ASTM C-138
YIELD:	38.3	CU.FT./CU.YD	ASTM C-138
TEMPERATURE:	60	DEGREE'S F	ASTM C-1064

6" X 12" CYLINDER COMPRESSIVE STRENGTH (ASTM C-39)

TEST AGE (DAYS)	DATE TESTED	TOTAL LOAD (POUNDS)	CROSS-SECTIONAL AREA (SQ. IN.)	UNIT STRESS (PSI)
7	04/26	120,160	28.26	4250
7	04/26	120,010	28.26	4280
7	04/26	119,400	28.26	4230
AVERAGE	-	-	-	**4250**
28	05/08	174,870	28.21	6200
28	05/08	175,310	28.21	6210
28	05/08	174,420	28.21	6180
28	05/08	175,030	28.21	6200
AVERAGE	-	-	-	**6200**

This Trial Batch was proportioned by the Client utilizing ACI 211 and was laboratory batched as specified in ASTM C-192.

LAFARGE CANADA INC.

CEMENT MILL TEST REPORT

Period Represented: March 2001
Plant: BATH
Cement Type: II

PHYSICAL DATA		CHEMICAL DATA	Percent
Specific Surface (Blaine) (sq.m./ kg.).....	370	Silicon Dioxide (SiO2).....	20.6
Percent Passing 325 Mesh....	96.7	Aluminum Oxide (Al2O3).....	4.5
Compressive Strength (psi)		Ferric Oxide (Fe2O3).....	3.1
		Calcium Oxide (CaO).....	63.6
Mortar Cubes		Magnesium Oxide (MgO).....	2.3
3 day...	4060	Sulphur Trioxide (SO3).....	2.8
7 day...	4930		
Previous 28 day...		*** Loss on Ignition.....	1.4
		Insoluble Residue.....	0.32
Vicat Time Of Set (min.)	105		
		Free Lime.....	0.7
Air Content (%).....	6.5	Tricalcium Silicate (C3S)...	59.5
Autoclave Expansion (%).....	0.03	Tricalcium Aluminate (C3A)..	6.7
		Total Alkali as Sodium Oxide	0.58

CERTIFIED BY: Lisa M Eisy
Quality Control Technician

We hereby certify that this cement complies with current standard ASTM C-150 specifications.This mill test represents a monthly average.

CEMENT GROUP / BATH PLANT
P.O. Box 160, Bath, Ontario K0H 1G0
Telephone: (613) 352-7711 Fax: (613) 352-5109

Hanson

Hanson Aggregates East
P.O. Box 513
Jamesville, NY 13078
Tel 1-315 469 5501
Fax + 315 469 3133

May 7, 2001

Roger Dunham
Northern Ready Mix, Inc.
32 Silk Road
Fulton, NY 13069

Dear Roger:

Re: Concrete Sand Poland

This is to certify that the fine aggregate produced at our Plant # 404, Poland NY location will meet the NYSDOT specification listed under 703, Aggregates. Plant #404 is a NYSDOT approved source # 2-18F holding a current Biennial Test number 99AF124. Below you will find the gradations of the product needed for your plant. These gradations are an average of one hundred stockpile tests taken throughout the 2000 production season.

Concrete Sand

3/8"	#4	#8	#16	#30	#50	#100	FM
100	95.1	91.6	80.0	53.8	15.6	2.4	2.62

Thank you for your interest in our products. Please let me know if I can be of any further assistance.

Sincerely,

Bridget Santa Maria

Bridget Santa Maria
Sales Representative
Hanson

Callanan Industries Inc.

South Bethlehem NY 12161 * (518) 767-2222 * Telefax (518) 767-2040

Location : Oxbow

Time : 9.10am

Material : WASHED 1S

Date : 5/7/01

Sample # 11

Sample Type : Stockpile

Tested By : DON FOSTER

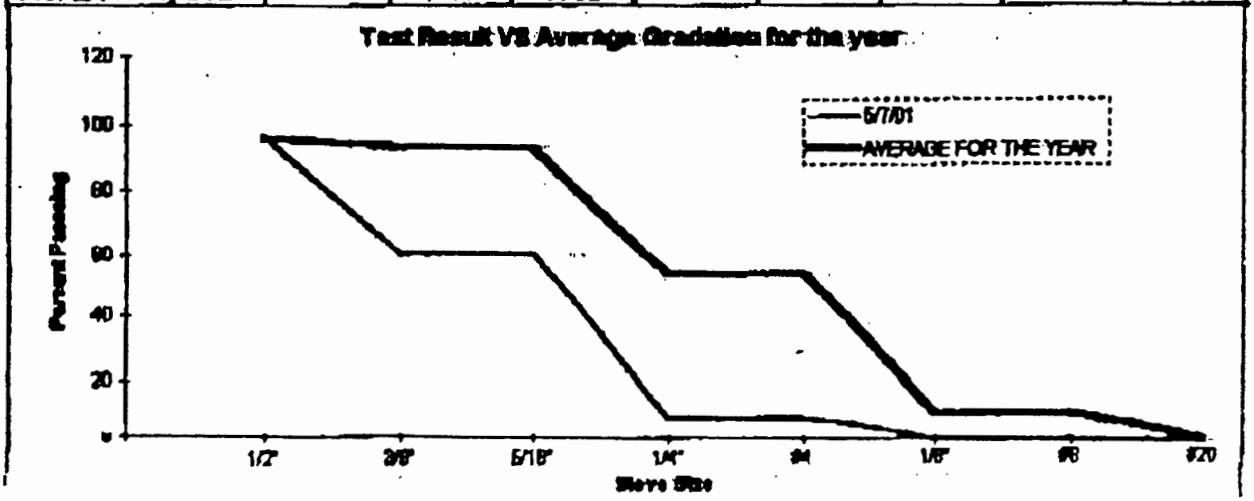
Washtest #200 : 0.40 %

Note: stockpile

Sieve Size	Weight	% Retainment	% Passing	NYSDOT Limits
1/2"	377.40	3.66	96.3	100
3/8"	3770.80	36.60	59.7	
5/16"	0.00	0.00	59.7	
1/4"	5287.10	51.31	8.4	0-15
#4	0.00	0.00	8.4	
1/8"	658.50	6.39	2.0	0
#8	0.00	0.00	2.0	
#20	60.40	0.59	1.5	
Pan	149.50	1.45		
Total	10303.70			

Material History . Number of samples = 12

	1/2"	3/8"	5/16"	1/4"	#4	1/8"	#8	#20
5/7/01	96.34	59.74	59.74	8.43	8.43	2.04	2.04	1.45
Target								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Std Dev. of last 5 tests	7.06	15.14	15.14	5.80	5.80	0.59	0.59	0.52
Std Dev. of last 10 tests	6.62	12.81	12.81	47.21	47.21	10.16	10.16	1.81
STD for the year	6.54	12.10	12.10	47.76	47.76	12.61	12.61	2.13
Over 2X Yearly STD		FAIL	FAIL					



Callanan Industries inc.

South Bethlehem NY 12161 • (518) 767-2222 • Telefax (518) 767-2040

Location : Oxbow

Time : 9.45

Material : WASHED 2S

Date : 5/8/01

Sample # 5

Sample Type : Stockpile

Tested By : DON FOSTER

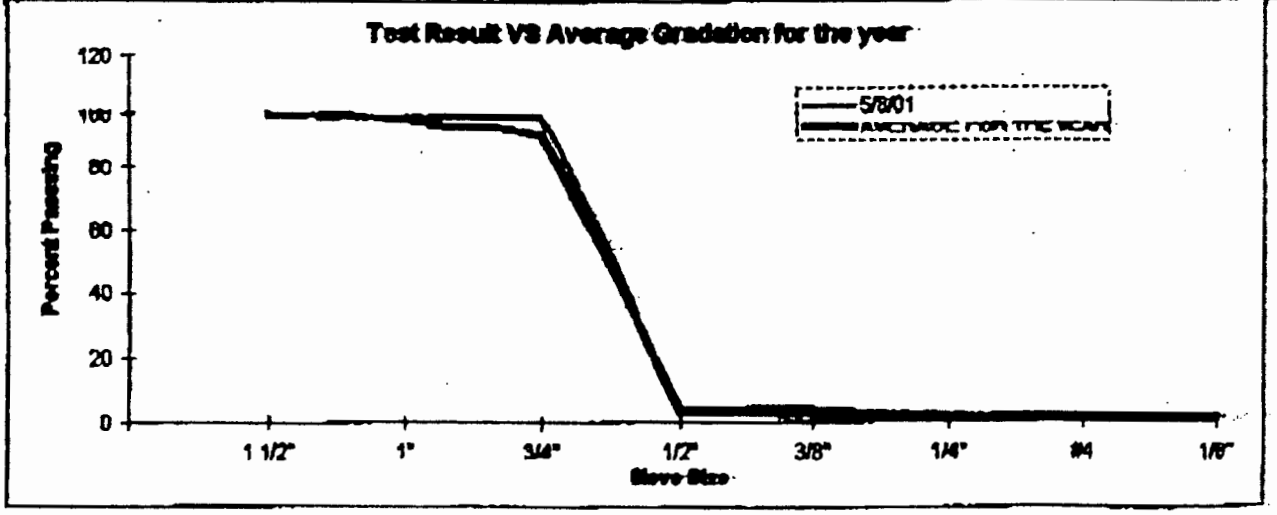
Washtest #200 : 0.85 %

Note: washed no2 stone

Sieve Size	Weight	% Retained	% Passing	NYSDOT Limits
1 1/2"	0.00	0.00	100.0	100
1"	205.40	1.44	98.6	90 - 100
1/2"	13689.50	96.15	2.4	0 - 15
1/4"	89.56	0.63	1.0	
1/8"	23.47	0.16	0.9	
Pan	125.20	0.88		
Total	14237.53			

Material History : Number of samples = 5

	1 1/2"	1"	3/4"	1/2"	3/8"	1/4"	#4	1/8"
5/8/01	100.00	98.56		2.41		1.04		0.88
Target								
AVERAGE FOR THE YEAR	100.00	98.25		3.93		1.47		1.33
Std Dev. of last 5 tests	0.00	0.58		2.28		0.86		0.91
Std Dev. of last 10 tests								
STD for the year	0.00	0.58		2.28		0.86		0.91
Over 2X Yearly STD								



Date Printed = 5/8/01

NEW YORK STATE
DEPARTMENT OF TRANSPORTATION
MATERIALS BUREAU

SOURCE # : 2- 11R TEST # 99AR 60
CALLANAN INDUSTRIES INC BR3a SERIAL # 144213
CLOCKVILLE,NY

On 12/06/99 material represented by sample 144213 was ACCEPTED FOR ITEMS 703-02 (coarse aggregate) NOT INCLUDING HIGH FRICTION AGGREGATE

YSDOT SIZES	NO.2	NO.1	NO.1A
10 Cycle MgSO4		2.7	2.5
25 Cycle freeze-thaw			
25 Cycle 3% freeze-thaw	10.3 based on 3/4" size only		
% Non-carbonate		5	
% Insoluble residue			
L.A. Abrasion Grading B		19.1	

Bulk Specific Gravity SSD	2.69	Gravity & absorption values represent
Bulk Specific Gravity	2.680	this sample only, use average values
Apparent Specific Gravity	2.714	from Aggregate Source Book in all
Absorption	0.5	calculations

OMPOSITION (size 2)	%
LIMESTONE	93
CHERT	5
LIMESTONE ARGILLACEOUS	2

MB VR®

Admixture for Entraining Air in Concrete

REQUIREMENTS/ADVANTAGES:

MB VR (Master Builders Neutralized VINSOL* Resin Solution) admixture for entraining air in concrete meets the requirements of ASTM C 260, AASHTO M 154, CRD-C 13 and other Federal and State specifications.

The entrainment of optimum air in concrete results in the following improvements in concrete quality:

- Increased resistance to damage from freezing and thawing[1]
- Increased resistance to scaling from deicing salts[1]
- Reduced permeability — Increased watertightness
- Reduced segregation and bleeding
- Improved plasticity and workability
- Improved properties of mixes used for making concrete block, concrete pipe and other precast products

[1]Concrete durability research has established that the best protection for concrete from the adverse effects of freeze/thaw cycles and deicing salts results from: • proper air content in the hardened concrete; • a suitable air-void system in terms of bubble size and spacing; and • adequate concrete strength, assuming the use of sound aggregates and proper mixing, placing, handling and curing techniques.

When unusually low or high amounts of an air-entraining admixture are required to achieve normal ranges of air content or if the required amount of air-entraining admixture necessary to achieve required levels of air content is observed to change significantly under given conditions, the reason should be investigated. In such cases, it is especially important to determine: (a) that a proper amount of air is contained in the fresh concrete at the point of placement; and (b) that a suitable air-void system (spacing factor) is being obtained in the hardened concrete.

FEATURES/BENEFITS:

Ready to Use — Solution is the proper concentration for rapid, accurate dispensing.
Compatible for Use — MB VR admixture is compatible with concrete containing other admixtures — water-reducers, high-range water-reducers, accelerators, retarders, and water repellents
The use of MB VR air-entraining admixture with Master Builders water-reducing, set-controlling admixtures forms a desirable combination for producing high-quality normal or lightweight concrete. Heavyweight concrete normally does not contain entrained air.

NOTE: As stated in ACI 212 and other publications, when two or more admixtures are used, each must be added to the mix separately (through dispensers or manually) and must not be mixed with each other prior to adding to the concrete mix.

For optimum, consistent performance, the air-entraining admixture should be dispensed on damp, fine aggregate or with the initial batch water. When using lightweight fine aggregate, field evaluations should be conducted to determine the best method to dispense the air-entraining admixture.

USAGE INFORMATION:

Add MB VR admixture to the concrete mix using a dispenser designed for air-entraining admixtures; or add manually using a suitable measuring device that ensures accuracy within plus or minus 3% of the required amount.
Measure the air content of the trial mix and either increase or decrease the quantity of MB VR admixture to obtain the desired air content in the production mix. Check the air content of the first batch and make further adjustments if needed.

Due to possible changes in the factors that affect the dosage rate of MB VR, frequent checks should be made during the course of the work. Adjustments to the dosage should be based on the amount of entrained air in the mix at the point of placement.

QUANTITY TO USE:

There is no standard dosage rate for MB VR admixture. The exact quantity of air-entraining admixture needed for a given air content of concrete is not predictable because of differences in concrete-making materials. Typical factors which might influence the amount of entrained air are: temperature, cement, sand grading, mix proportions, slump, means of conveying and placing, use of extra fine materials such as fly ash, etc.

The amount of MB VR admixture used will depend upon the amount of entrained air required under actual job conditions. In a trial mix, use 1/4 to 4 fl. oz/100 lbs. (16 to 260 ml/100 kg) of cement. In mixes containing water-reducing, set-controlling admixtures, the amount of MB VR needed may be somewhat less than the amount required in plain concrete. In mixes requiring a higher or lower dosage to obtain the desired air content, consult your local Master Builders representative.

Master Builders Technologies

AIR CONTENT DETERMINATION:

The total air content of normal weight concrete should be measured in strict accordance with ASTM C 231, "Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method" or ASTM C 173, "Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method." The air content of lightweight concrete should only be determined using the Volumetric Method.

The air content should be verified by calculating the gravimetric air content in accordance with ASTM C 138, "Unit Weight, Yield, and Air Content (Gravimetric) of Concrete." If the total air content, as measured by the Pressure Method or Volumetric Method and as verified by the Gravimetric Method, deviates by more than 1-1/2%, the cause should be determined and corrected through equipment calibration or by whatever process is deemed necessary.

TEMPERATURE PRECAUTION:

MB VR admixture should be stored and dispensed at 35°F (2°C) or higher. Although freezing does not harm this product, precautions should be taken to protect it from freezing. If it freezes, thaw and reconstitute by mild mechanical agitation. **Do not use pressurized air for agitation.**

PACKAGING:

MB VR admixture is supplied in 55 U.S. gallon (208 litre) drums and by bulk delivery.

CAUTION:

MB VR admixture is a CAUSTIC solution. Chemical goggles and gloves are recommended if transferring or handling large quantities of material. (See MSDS and/or product label for complete information.)

For additional information on MB VR air-entraining admixture, contact your local Master Builders representative.

Master Builders Technologies

Master Builders, Inc.
Admixture Division
23700 Chagrin Boulevard
Cleveland, Ohio 44122-5554
(216) 831-5500
Fax (216) 831-3470
Master Builders Technologies Ltd.
3637 Weston Road
Toronto, Ontario M9L 1W1
800-387-5862
Fax (416) 741-7925

Form P-64n
Printed in U.S.A. 992

POLYHEED® 997

DESCRIPTION:

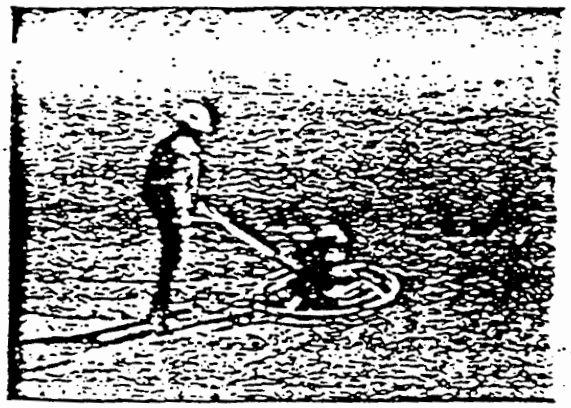
POLYHEED 997 is a ready-to-use liquid admixture for producing more uniform and predictable concrete. POLYHEED 997 admixture is statistically designed and formulated to produce: 1) superior workability and finishability, especially in concrete mixes using harsh aggregates or manufactured sands; 2) noticeably improved performance in all pumping applications, as well as low slump machine placements; and 3) cost effective mid-range slump performance (e.g. 6-8 in). It meets the requirements of ASTM C 494 Type A and F admixtures.

- INCREASED STRENGTH—compressive and flexural at all ages
- RELATIVE DURABILITY TO DAMAGE FROM FREEZING AND THAWING—well above industry standards
- REDUCED WATER CONTENT REQUIRED FOR A GIVEN WORKABILITY
- NORMAL SETTING TIME CHARACTERISTICS throughout the recommended dosage range

ADVANTAGES:

POLYHEED 997 admixture aids in the production of concrete by producing these special qualities:

- IMPROVED WORKABILITY AND PUMPABILITY
- REDUCED SEGREGATION
- SUPERIOR FINISHING CHARACTERISTICS for flatwork and formed surfaces
- EFFECTIVE AS A SINGULAR ADMIXTURE OR AS A COMPONENT IN A MASTER BUILDERS ADMIXTURE SYSTEM
- CONSISTENT PERFORMANCE AT ALL NORMAL RANGE SLUMPS, INCLUDING MID-RANGE (6-8 INCHES)



Mid-range slumps of 6 to 8 inches are economically achieved with POLYHEED 997 admixture when slump retention and normal set times are needed at more flowable consistencies. (Consideration of a Rheobuild admixture is suggested for higher slump concrete.)

At different dosages POLYHEED 997 meets ASTM standards for a Type A and a Type F water reducing and high range water reducing admixture.

PERFORMANCE CHARACTERISTICS

Type A Performance

Mix Data

470 lbs. (213 kg) of Type I cement per cubic yard (cubic meter). Slump 7 inches (17.8 cm). Concrete Temperature 72°F, Ambient Temperature 72°F.

Setting Time Performance[1]

Mix	Initial Set Hours:Minutes	Difference Hours:Minutes
Plain	4:10	X
POLYHEED 997 admixture @		
3 fl. oz./cwt (195 ml/100 kg)	3:50	−:20
5 fl. oz./cwt (325 ml/100 kg)	4:30	+:20
6 fl. oz./cwt (390 ml/100 kg)	4:30	+:20

Compressive Strength Performance

	7 Day			28 Day		
	PSI	MPA	%	PSI	MPA	%
Plain	4190	28.9	100	5650	39.0	100
POLYHEED 997 admixture @						
3 fl. oz./cwt (195 ml/100 kg)	4720	32.5	112	6300	43.4	111
5 fl. oz./cwt (325 ml/100 kg)	4960	34.2	118	6410	44.2	113
6 fl. oz./cwt (390 ml/100 kg)	5190	35.8	124	6710	46.3	119

Type F performance may be achieved at dosages of 8 oz. or greater.

Mix Data

518 lbs. (234 kg) of Type I cement per cubic yard (cubic meter). Slump 4 inches (10.2 cm). Concrete Temperature 72°F, Ambient Temperature 72°F.

Setting Time Performance[1]

Mix	Initial Set Hours:Minutes	Difference Hours:Minutes
Plain	4:55	X
POLYHEED 997 admixture @		
8 fl. oz./cwt. (520 ml/100 kg)	5:10	+:15

Compressive Strength Performance[1]

	1 Day			7 Day		
	PSI	MPA	%	PSI	MPA	%
Plain	1090	7.52	100	3950	27.2	100
POLYHEED 997 admixture @[2]						
8 fl. oz./cwt. (520 ml/100 kg)	2120	14.6	195	5410	37.3	137

[1]Note: The data shown is based on controlled laboratory tests. Reasonable variations from the results shown here may be experienced as a result of differences in concrete making materials and job site conditions.

[2]Note: A minimum of 12% water reduction is necessary vs plain to meet ASTM Type F performance requirements.

WHERE TO USE:

POLYHEED 997 admixture is recommended for use in all concrete where normal setting characteristics, superior workability and finishability qualities are desired.

POLYHEED 997 admixture is particularly useful in providing mid-range slumps in the area of 6-8 inches. Field data have consistently shown improved slump performance, cohesiveness, and pumpability versus traditional admixtures.

As a result of the advantages listed above, this admixture improves conventionally placed concretes containing a wide range of cements, granulated slags, Class C and F fly ashes and aggregates. It improves plain reinforced, precast, lightweight or standard weight concrete, pumped concrete and shotcrete (wet mix).

POLYHEED 997 admixture can be used with air-entraining cements and air-entraining admixtures approved under ASTM, AASHTO and CRD specifications when air-entrained concrete is desired.

Master Builders air-entraining admixtures are recommended for use with **POLYHEED 997** admixture when air-entrained concrete is specified or desired.

POLYHEED 997 admixture may be used in all colored and architectural concrete.

When used in conjunction with other admixtures, each admixture must be dispensed separately into the mix.

QUANTITY TO USE:

POLYHEED 997 admixture is recommended for use rate of 3 to 12 fl. oz. per 100 lbs. (195 to 780 ml per of cement for most concrete mixes using normal cor making materials.

POLYHEED 997 admixture will not initiate or promote c of reinforcing steel in concrete. This admixture does contain intentionally added calcium chloride or chlor based ingredients. The admixture, due to chlorides or from all the ingredients used in its manufacture, cont less than 0.00[illegible]% (1.1 ppm) chloride ions by weight cement when used at the rate of 1 fl. oz. per 100 lbs. per 100 kg) of cement.

NOTE: As the dosage rate of **POLYHEED 997** increas 12 fl. oz. per 100 lbs. (780 ml per 100 kg) of cement, r setting-time characteristics are maintained and early ultimate compressive strengths increase.

Master Builders does not advise employing dosage ra outside the recommended range without trial testing. your local Master Builders representative for assistar determining the dosage rate for optimum concrete perfo

PACKAGING:

POLYHEED 997 admixture is supplied in 55 U. S. gal (208 liter) drums and bulk delivery.

TEMPERATURE PRECAUTION:

If **POLYHEED 997** admixture has frozen, thaw at 35°F or above and completely reconstitute by mild mechar agitation. Do not use pressurized air for agitation.

For additional information on **POLYHEED-997** admixture or on its use in developing a concrete mixture with special performance characteristics, contact your local Master Builders representative.

Master Builders, Inc.
Admixture Division
23700 Chagrin Boulevard
Cleveland, Ohio 44122-5554
(216) 831-5500
Fax (216) 831-3470

Master Builders Technologies Ltd.
3637 Weston Road
Toronto, Ontario M9L 1W1
(416) 741-3331 Fax (416) 741-7525

Fibermesh® MD Product Bulletin

Making Good Concrete Better®

Description:

Fibermesh® MD micro-reinforcement system for concrete - 100 percent virgin homopolymer polypropylene fibrillated fibers containing no reprocessed olefin materials and specifically engineered and manufactured in an ISO 9002 certified facility, to an optimum gradation, with 25 individual unique fiber designs for use as concrete reinforcement at a minimum of 0.1% by volume. U.L. Classified. Complies with National Building Codes and ASTM C-1116, Type III 4.1.3, ASTM C-1116 Performance Level I and Residual Strength .

Function:

- Replaces welded wire fabric when used for secondary (crack control) reinforcing in concrete
- Inhibits and controls the formation of intrinsic cracking in concrete
- Reinforces against impact forces
- Reinforces against the effect of shattering forces
- Reinforces against material loss from abrading forces
- Reinforces against water migration
- Provides better durability
- Imparts toughness to hardened concrete
- Reduces plastic shrinkage and settlement cracking
- Provides Residual Strength

Advantages:

Accepted by National Codes as an alternate method of secondary reinforcing to welded wire fabric - Non-magnetic - Rustproof - Alkali proof - Requires no minimum amount of concrete cover - Is always positioned in compliance with codes - Safe and easy to use - Reduces construction time - Eliminates welded wire fabric hassle on the jobsite.

Uses:

Applicable to all types of concrete which demonstrate a need for toughness and resistance to intrinsic cracking and improved water tightness.

Examples:

Slab on Grade	Sidewalks	Driveways	Stucco
Curbs	Precast	Water Tanks	Overlays/Toppings
Tilt - Up Panels	Mortar	Composite Decks	Maintenance Jobs
Slope Paving	Walls	Thin Sections	Shotcrete

Chemical and Physical Properties:

Absorption	Nil	Specific Gravity	0.91
Fiber Length	Graded	Modulus (Young's)	0.5 (3.5 kN/mm ^{2})
Melt Point	324° F	Ignition Point	1,100° F
Thermal Conductivity	Low	Electrical Conductivity	Low
Acid & Salt Resistance	High	Alkali Resistance	Alkali Proof

Technical Services:

Trained Fibermesh fibrous concrete specialists are available worldwide to assist and advise in specifications and field service. Fibermesh representatives do not engage in the practice of engineering or supervision of projects and are available solely for service and support of Fibermesh customers.

Application Rate:
The standard application rate for Fibermesh fibers is 1.5 # per cubic yard (.9Kg per cubic meter). For specialty performance see your local Fibermesh representative for recommendations regarding increased application rates. COMPONET RATION TO BE ½LB OF FIBERS TO EACH CUBIC YARD OF CONCRETE PER SECTION 0300.

Mix Designs:
Fibermesh micro-reinforcing is a mechanical, not chemical, process. The addition of Fibermesh fiber does **not** require any additional water nor other mix design changes at normal rates.

Mixing Procedures:
Fibermesh fiber is added to the mixer before, during or after batching the other concrete materials. Mixing time and speed are specified in ASTM C-94.

Finishability:
Fibermesh micro-reinforced concrete can be finished by any finishing technique. Exposed aggregate, broomed and tined surfaces are no problem.

Compatibility:
Fibermesh is compatible with all concrete admixtures and performance enhancing chemicals, but requires no admixtures to work.

Guidelines:
Fibermesh fibers should not be used to replace structural, load bearing reinforcement. Fibermesh fibers should not be used as a means of using thinner concrete sections than original design. Fibermesh fibers should not be used to increase joint spacing past those dimensions suggested by PCA and ACI industry standard guidelines.

Packaging:
Fibermesh fibers are available in a variety of packaging options. The 1.5 pound bag (1 bag per cubic yard) is standard. Special packaging is available for full truckload addition. Bags are packed into cartons, shrink wrapped and palletized for protection during shipping. Both Fas-Pak® and convenience packages are available.

Mini-Specification:
Use only 100 percent virgin polypropylene fibers containing no reprocessed olefin materials and specifically manufactured with 25 individual unique fiber designs to an optimum gradation for use as concrete secondary reinforcement. Application per cubic yard shall equal a minimum of 0.1% (1.5 pounds) by volume (.9Kg per cubic meter) . Fibers are for the control of cracking due to drying shrinkage and thermal expansion/contraction, lowered permeability, increased impact capacity, shatter resistance, abrasion resistance and residual strength. Fiber manufacturer must document evidence of 5 year satisfactory performance history, ISO 9002 certification of manufacturing facility, compliance with applicable building codes and ASTM C-1116 Type III, 4.1.3, ASTM C-1116 (Ref: ASTM C-1018) Performance Level 1, I5 outlined in Section 21, Note 17 and an average minimum Residual Strength of 50 psi, of 4 beams from a single batch. Fibrous concrete reinforcement shall be manufactured by Fibermesh, 4019 Industry Drive, Chattanooga, Tennessee, USA, 37416. Phone: (423) 892-7243 • Fax: (423) 499-0753 • E-Mail: fibermesh@aol.com • http://www.fibermesh.com
NOTE: Complete CSI Manu-Spec format specification is available both as hardcopy and IBM diskette from your Fibermesh representative.

Fibermesh® Division Offices

SOUTHERN UNITED STATES DIVISION	(512) 261-4600	FAX: (512) 261-4994
NORTHERN UNITED STATES DIVISION	(303) 670- 0447	FAX: (303) 674-9642
INTERNATIONAL DIVISION	(423) 892-8080	FAX: (423) 892-3506

Fibermesh Worldwide Headquarters, 4019 Industry Drive, Chattanooga, TN 37416 (423) 892-7243 FAX: (423) 499-0753
Fibermesh Europe Ltd., Smeckley Wood Close, Sheepbridge, Chesterfield S41 9PZ England, Phone: (+44) 1246 453102

FM-FM - 121 F:\AMIPRO\DOCS\PROBULL\FM-121.SAM dlr 06/10/97
Printed in USA
5M 06-97

Sonneborn

Concrete
Restoration
Systems

KURE-N-SEAL 25

Transparent solvent-based acrylic curing, sealing, and dustproofing compound

Features

- Cures...
- Semi-gloss appearance...
- Seals and dustproofs...
- Abrasion resistant...
- Compatible with a variety of adhesives...

Benefits

- Minimizes shrinkage cracking
- Surfaces look newer and brighter
- Surfaces easier to clean and maintain
- Extended wear
- Can be tiled or carpeted over

Where to Use Kure-N-Seal 25

- Freshly placed and finished concrete
- Aged concrete floors
- Exposed aggregate
- Brick floors, terrazzo
- Interior and exterior
- Floors and walls

How to Apply Kure-N-Seal 25

Surface Preparation

Newly placed concrete: Surface must be sound and properly finished. Surface is application ready when damp, but not wet, and can no longer be marred by foot traffic.

Newly cured bare concrete: Level any gouged-out spots. Remove all dirt, dust, oil, grease, asphalt, and foreign matter. Cleanse with caustics and detergents as required. Citrus Degreaser is excellent for removing oil stains and many curing compounds (see Form No. SC-256). Rinse thoroughly and allow to dry. Kure-N-Seal 25 may be applied to damp, but not wet surfaces.

Aged concrete: Restore surface to soundness by patching, grouting, filling cracks and holes. Surface must also be free of any dust, dirt, and other foreign matter. Use power tools or strippers to remove any incompatible sealers or coatings. Clean as required, following procedure under "Newly cured bare concrete."

Application

Stir Kure-N-Seal 25 thoroughly before using.

Apply a continuous, uniform film by low-pressure spray only, short-nap roller, or lamb's wool applicator. Canister sprayers are recommended for best results.

For curing, apply first coat evenly and uniformly as soon as possible after final finishing. Apply second coat when all construction is completed and structure is ready for occupancy.

To seal and dustproof, 2 coats must be applied. For sealing new and aged concrete, both coats are applied full strength.

Clean Up

Clean tools and equipment with Reducer 990 immediately after use and while Kure-N-Seal 25 is still wet.

Drying Time

At 65° to 85°F (18° to 29°C) light foot traffic or between coats—3 hours; normal traffic—overnight; maximum hardness—7 days. High humidity will increase drying times.

Maintenance

For maximum life of coating, routinely sweep and wash with conventional cleaners and detergents. Remove all abrasive grit and wipe up corrosive spills as soon as possible. Inspect membrane periodically for wear or breaks and gouges in the surface. If required, areas can be renovated by reapplying Kure-N-Seal 25 to regain original gloss and protection.

For Best Performance

- Do not apply Kure-N-Seal 25 to the interfacing of channels to be caulked with elastomeric sealants, avoid sealant adhesion problems by masking.
- Do not use on surfaces to receive concrete overlays or additional toppings or coatings.
- Not recommended as a release agent or where other sealers or treatments are to be later applied.
- Mechanical methods are recommended for removing Kure-N-Seal 25.
- Kure-N-Seal 25 should not be used in areas requiring resistance to solvents such as gasoline, diesel fuel or paint thinners.
- Avoid excess moisture until material is fully cured.
- Apply at recommended coverage rates for best results (see Coverage section).
- Although Kure-N-Seal 25 is compatible with a variety of tile, carpet and floor covering adhesives, a test application is always recommended.
- May rubber burn when subjected to forklift or other wheeled traffic.
- Do not thin.
- Kure-N-Seal 25 may settle and must be stirred thoroughly before and during application.
- Kure-N-Seal 25 can be applied to colored concrete or dry shake hardeners, but mottling may occur.
- Kure-N-Seal 25 will highlight imperfections and may darken the final appearance of the concrete surface.
- Application not recommended when surface temperature exceeds 120°F (49°C).
- For professional use only; not for sale to or use by the general public.
- **Keep away from heat and open flame.**
- If Kure-N-Seal 25 is to be applied in or near areas containing foodstuffs, they should be removed before application; do not return foodstuffs until Kure-N-Seal 25 has fully dried and all solvent vapors have dissipated.
- Heating, ventilation and Conditioning (HVAC) units may draw solvent vapors into occupied buildings/locations. Solvent vapors can be irritating. Do not apply Kure-N-Seal 25 in or around buildings occupied by nonconstruction personnel without consulting building management, and taking appropriate precautions. Use only with adequate ventilation and with a minimum of 6 air changes per hour.
- Make certain the most current version of the data guide is being used; call Customer Service (1-800-433-9517) to verify the most current version.
- Proper application is the responsibility of the user. Field visits by ChemRex Inc. personnel are for the purpose of making technical recommendations only, and are not to supervise or provide quality control on the job site.

Technical Data

Compliances

- ☐ Kure-N-Seal 25 is recommended for use on Class 1, 2, 3, and 4 concrete floors as classified in Table 1.1, ACI Standard 302-77
- ☐ ASTM C 309, Type I, Class A
- ☐ ASTM C 1315-96, Type I, Class B
- ☐ Corps of Engineers CRD-C504-36, Type I (for ID), Class A or B
- ☐ AASHTO M-148
- ☐ USDA approval for use in meat and poultry areas, when fully cured

Test Data

Moisture Retention Test ASTM C 156

Kure-N-Seal 25	kg/m²
(when applied at 300 sq. ft. per gallon)	.38
Test requirement	< .4

Test results are averages obtained under laboratory conditions. Reasonable variations can be expected.

Properties

Property	Result	Test
Drying time, hrs	< 4	ASTM C 1315
Solids, %	25	ASTM C 1644
Flashpoint, °F (°C)	> 108°F (40°C)	ASTM D 56
Acid & alkali resistance	no effect observed at 1 & 16 hours	ASTM D 1308
UV light resistance	membrane lighter than Gardner color 3	ASTM C 65
Adhesion of tile cement, psi	> 150	ASTM C 1315

Order Information

Packaging

Kure-N-Seal 25

- ☐ 1 gallon cans (3.7 L)
- ☐ 5 gallon pails (18.9 L)
- ☐ 55 gallon drums (208 L)

Shelf life is 1 year when stored in unopened containers under normal conditions. Keep Kure-N-Seal 25 from freezing in the container; do not store below 35°F (2°C).

Color

Amber, dries clear.

Coverage

Coverage rates listed are approximations. Coverage varies with texture and porosity of surface; actual surface profile will determine exact coverage rate.

	Sq. Ft. per Gallon per Coat (M²/L)
Curing only	200 - 400 (4.9 - 9.8)
Dustproofing and sealing	
1st coat	200 - 400 (4.9 - 9.8)
2nd coat	400 - 800 (9.8 - 14.6)
Renovating, dustproofing, and sealing	200 - 300 (4.9 - 7.3)
Under mastic floor adhesives	400 - 600 (9.8 - 14.6)

Caution

Kure-N-Seal™ 25 contains naphtha-light aromatic, 1,2,4 trimethyl benzene xylene, cumene

Risks

Combustible liquid and vapor. May cause skin and eye irritation. May cause dermatitis and allergic responses. Inhalation of vapors may cause irritation and intoxication with headaches, dizziness and nausea. Ingestion may cause irritation. May be absorbed through skin. Repeated or prolonged exposure increases the risk of absorption. Reports associate repeated or prolonged occupational overexposure to solvents with permanent brain, nervous system, liver and kidney damage.

INTENTIONAL MISUSE BY DELIBERATELY INHALING THE CONTENTS MAY BE HARMFUL OR FATAL

Precautions

READ MSDS AND TECHNICAL DATA GUIDE BEFORE USING. DO NOT USE UNTIL ALL BYSTANDERS HAVE BEEN WARNED OF PRODUCT HAZARDS. KEEP OUT OF THE REACH OF CHILDREN. KEEP AWAY FROM HEAT, FLAME AND SOURCES OF IGNITION. Vapors are heavier than air. DO NOT cut or weld on or near empty container. Empty container may contain explosive vapors or hazardous residues. Keep container closed. Use only with adequate ventilation. Prevent contact with eyes, skin and clothing. Wash thoroughly after handling. DO NOT breathe vapors. Use impervious gloves, eye protection and if the TLV is exceeded or product is used in a poorly ventilated area, use NIOSH/MSHA approved respiratory protection in accordance with applicable federal, state and local regulations. All label warnings must be observed until container is commercially cleaned or reconditioned.

First Aid

In case of eye contact, flush thoroughly with water for at least 15 minutes. SEEK IMMEDIATE MEDICAL ATTENTION. In case of skin contact, wash affected areas with soap and water. If irritation persists, SEEK MEDICAL ATTENTION. Remove and wash contaminated clothing. If inhalation causes physical discomfort, remove to fresh air. If discomfort persists or any breathing difficulty occurs, or if swallowed, SEEK IMMEDIATE MEDICAL ATTENTION.

Refer to Material Safety Data Sheet (MSDS) for further information.

Proposition 65

This product does not knowingly contain materials listed by the state of California as known to cause cancer and birth defects or other reproductive harm.

VOC Content

646 g/L or 5.4 lbs. per gallon less water and exempt solvents.

For medical emergencies only, call Chemtrec 1-800/424-9300

Limited Warranty Notice

Every reasonable effort is made to apply Chemrex Inc. exacting standards both in the manufacture of our products and in the information which we issue concerning these products and their use. We warrant our products to be of good quality and will replace or, at our election, refund the purchase price of any products proved defective. Satisfactory results depend not only upon quality products, but also upon many factors beyond our control. Therefore, except for such replacement or refund, CHEMREX INC. MAKES NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY, RESPECTING ITS PRODUCTS, and CHEMREX INC. shall have no other liability with respect thereto. Any claim regarding product defect must be received in writing within one (1) year from the date of shipment. No claim will be considered without such written notice or after the specified time interval. User shall determine the suitability of the products for the intended use and assume all risks and liability in connection therewith. Any authorized change in the printed recommendations concerning the use of our products must bear the signature of the Chemrex Inc. Technical Manager.

Chemrex Inc.
380 Vardon Park Drive, Shakopee, MN 55379

Manufacturing Plants: Newark, CA; Denver, CO; Centerville, IN; Fort Wayne, IN; Mattawan, MI; Bloomington, MN; Bristol, PA.

Regional Warehouses: Hayward, CA; Ontario, CA; Atlanta, GA; Clinton Heights, [illegible]; Brampton, ONT/Canada; Grand Prairie, TX

TECHNICAL DATA SHEET

HORNBOARD

Asphalt Impregnated Fiber Expansion Joint Filler

1. **DESCRIPTION:** HORNBOARD Asphalt Impregnated Fiber Expansion Filler is composed of tough, resilient, cellulose fibers securely bonded together with a uniform impregnation of bituminous binder and performed into strips or sheets. The material is strong but lightweight; cuts and handles easily; resists breakage. It will not extrude from the joint under normal compression and service temperatures, and does not embrittle in cold weather. Installation is easy. HORNBOARD will not twist, break or deform with ordinary handling. It cuts cleanly, places readily, stays strong and sound through many years of repeated expansion/contraction cycles.

2. **USES:** HORNBOARD is a general, multi-purpose filler for expansion joints in all types of heavy concrete construction. It is specifically engineered for commercial, industrial and public works applications.

3. **COMPOSITION AND MATERIALS:** HORNBOARD is manufactured to provide an expansion joint filler that will conform to the current and future specifications as needed.
Designed to comply with:
AASHTO Spec. M213-81
ASTM Spec. D 1751-83
Fed. Spec. H H-F-341f, Type I
Corps of Engineers Spec. CRD C508-72
FAA Spec. P 501-2.4 & P610-2.7 (1968)

Values presented are typical and not necessarily referenced to create specifications.

4. **SIZES:** HORNBOARD Joint is available in the following sizes:
Thickness: 1/4", 3/8", 1/2", 3/4", 1"
Widths: 3" to 48" and 48" slabs
Length: 5 ft. & 10 ft.

5. **CAUTIONS:** HORNBOARD should not be used in conjunction with polysulfide, acrylic or other polymer-base joint sealants.

6. **ENVIRONMENTAL AND SAFETY PRECAUTIONS:** **Industrial Use Only.** Wash hands thoroughly with soap and clean water after handling or before smoking or eating or rubbing eyes. **KEEP OUT OF REACH OF CHILDREN AND ANIMALS.** Consult Material Safety Data Sheet before using this product. EMERGENCY RESPONSE PHONE NUMBER: (800) 862-2667 TAMMS or (800) 424-9300 CHEMTREC.

7. **TECHNICAL SERVICE:** For application procedures or surface conditions not specified above, please contact:

TAMMS INDUSTRIES
3835 State Route 72, Kirkland, IL 60146
800-862-2667 FAX: 815-522-2323
www.tamms.com

WARRANTIES: Seller warrants that the Products do not infringe upon any copyright, patent, or trademark or trade secret, nor violate the proprietary information rights of any third party. Seller warrants that its Products will conform to and perform in accordance with the Products' specifications. **THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THOSE CONCERNING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. LIMITATION ON LIABILITIES:** Because of the difficulty of ascertaining and measuring damages hereunder, it is agreed that, except for claims for bodily injury, Seller's liability to the Buyer or any third party, for any losses or damages, whether direct or otherwise, arising out of the purchase of Product from Seller by Buyer shall not exceed the total amount billed and billable to the Buyer for the Product hereunder. **IN NO EVENT WILL SELLER BE LIABLE FOR ANY LOSS OF PROFITS OR OTHER SPECIAL OR CONSEQUENTIAL DAMAGES, EVEN IF SELLER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.**

TAMMS INDUSTRIES
JANUARY 2000 (Replaces 5/99)

TAMMS INDUSTRIES
JANUARY 2000 (Replaces 5/99)
CONCRETE ACCESSORIES CONCRETE
03150

#12+13

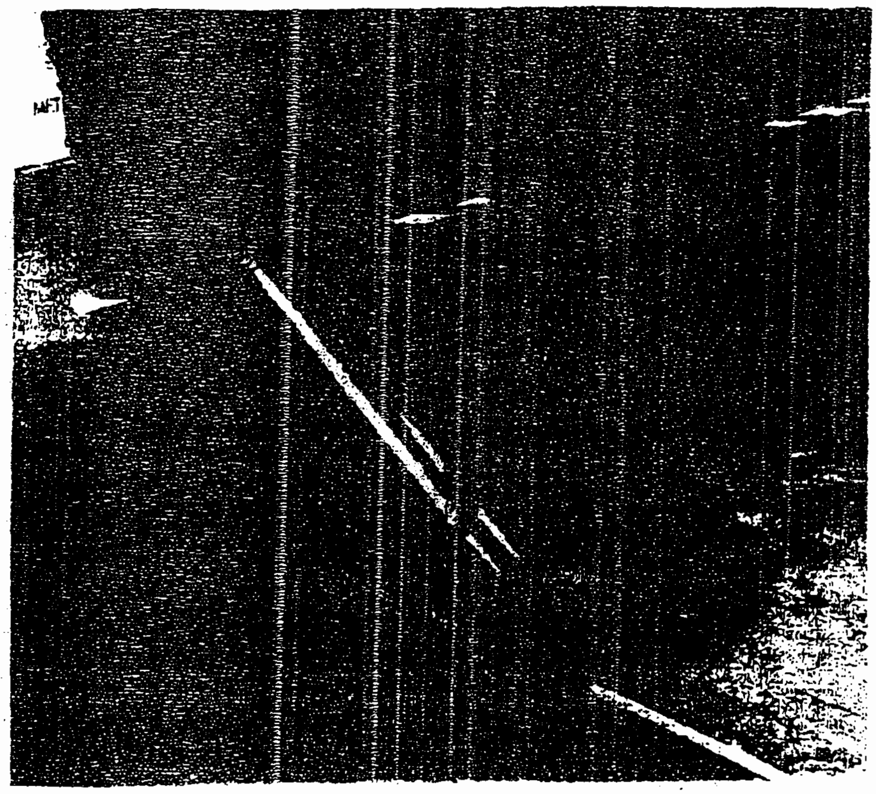
Sonneborn

Sealant · Systems

SONOLASTIC®

SL 2™

Self-leveling and slope-grade elastomeric polyurethane sealant for horizontal joints



Where to Use SL 2™

- Concrete expansion joints
- Metal expansion joints
- Interior or exterior
- Sidewalks
- Pavements
- Decks
- Parking ramps
- Precast double T's
- Cantilever decks
- Warehouses
- Balconies
- Industrial applications

Features

- Movement capability ±25% ...
- Abrasion resistant...
- Resists penetration...
- Resilient ...
- Service range from -40°F to 180°F (-40°C to 82°C) ...
- Resistant to weathering and aging
- Available in custom colors
- Self-leveling and slope grade...

Benefits

- Expands and contracts with joint movement
- Handles pedestrian and vehicular traffic
- Withstands pressure from pointed objects
- Resists permanent deformation
- Suitable for all climates
- Long performance
- Can be color matched to any substrate
- Versatility in applications

JUL-18-2001 11:27 DRISCOLL MASONRY P.02/05

How to Apply SL 2™

Joint Preparation

1. The number of joints and the joint width should be designed for a maximum of ±25% movement.

2. The depth of the sealant should be 1/2 the width of the joint. The maximum depth is 1/2" (13 mm) and the minimum is 1/4" (6 mm).

3. In deep joints, the sealant depth must be controlled by Closed Cell Backer-Rod or Soft Backer-Rod. (Refer to Form Nos. SJ-403 and SJ-405.) Where the joint depth does not permit the use of backer-rod, a bondbreaker (polyethylene strip) must be used to prevent three-point bonding.

4. To maintain the recommended sealant depth, install backer-rod by compressing and rolling it into the joint channel without stretching it lengthwise. Closed-Cell Backer Rod should be about 1/8" (3 mm) larger in diameter than the width of the joint to allow for compression. Soft Backer Rod should be approximately 25% larger in diameter than the joint width. The sealant does not adhere to it, and no separate bondbreaker is required. Do not prime or puncture the backer-rod.

Surface Preparation

1. It is essential that joints be clean and dry. Joint surfaces must be structurally sound, fully cured, and free of all loose aggregate, paint, oil, grease, asphalt, wax, mastic compounds, waterproofing compounds, form release materials, curing compounds or any other contaminants.

2. **New concrete:** Remove all loose material from joints by wire brushing, sandblast surfaces in contact with form release agents. Fresh concrete must be fully cured. Laitance must be removed by abrading.

3. **Old concrete:** For previously sealed joints, remove all old material by mechanical means. If joint surfaces have absorbed oils, remove sufficient concrete to ensure a clean surface.

Priming

1. Joint surfaces must be primed with Primer 733 (see Form No. SJ-481) before sealing. If the surfaces are other than masonry or concrete, test first to determine adhesion. Technical assistance is available from ChemRex Inc.

2. Apply primer in a thin, uniform film. Avoid buildup of film.

3. Allow approximately 15 - 30 minutes drying time before applying sealant. (Primer should be tack free.) Sealant must be applied same day as primer.

4. To minimize contamination of adjacent surfaces, apply masking tape and remove before sealant has begun to thicken and set.

Mixing

1. SL 2™ is a three component system and must be thoroughly mixed before use. The oversize base container allows for the addition and mixing of Part B and color pigment into Part A.

2. **1-1/2 gallon (5.67 L) unit:** (1) Transfer Part B to Part A container using a spatula or knife. It is imperative that the entire contents of Part B be combined with Part A. (2) With a slow-speed drill and a sealant mixing paddle, thoroughly mix 2 - 3 minutes. The paddle blade must be kept below the surface of the sealant to avoid whipping in air. (3) Transfer the contents of the pigment can into the mixed Part A and B. Use a spatula or knife, removing the entire contents to ensure consistent color. (4) Continue mixing with a slow-speed drill and sealant paddle until color is uniform. During the process, scrape the sides and bottom of the Part A container can and the paddle itself several times.

3. **3 gallon (11.37 L) unit:** Use 2 Part B and 2 pigment containers for each Part A container. Mix as instructed under 1-1/2 gallon (5.7 L) unit.

4. Pot life of the sealant is dependent upon temperature. See Table 1 for specific data.

Table 1 — **Working Times**

	Standard Conditions 73°F (23°C)	Colder Temperatures 40°F (4°C)
No accelerator	1-1/2 to 2 hours	4-1/2 to 5-1/2 hours
1 accelerator	30 minutes to 45 minutes	1-1/2 to 2 hours
2 accelerator	30 minutes to 45 minutes	1-1/2 to 2 hours
3 accelerator	—	45 minutes to 1 hour

Application

1. All caulking and sealing should be performed when temperatures are above 40°F (4°C); any moisture or frost on surfaces will adversely affect adhesion.

2. Fill joints from the bottom; avoid bridging of the joint, which may form air voids.

3. For large joints, the self-leveling grade may be poured directly from the can.

4. For smaller joints and for all slope-grade applications, fill the joint by flowing the sealant from a bulk-loading gun.

5. Light tooling of the slope-grade sealant is recommended to smooth out ripples. On sloped surfaces, tool from the lowest point to the highest. Do not use soap or solvent.

Clean Up

1. Immediately after use and before sealant has cured, clean equipment with Reducer 990 or xylene.

2. The cured sealant may be removed by cutting with a sharp-edged tool, thin films by abrading.

Curing

Cure time will vary with humidity and temperature. Initial cure is within 24 hours and complete cure takes approximately 7 days. Cure rates are dependent on temperature and humidity.

Protect joint from dirt and traffic until cured.

For Best Performance

- Do not allow SL 2™ sealants to come into contact with alcohol based materials or solvents.
- Do not apply polyurethane sealants in the vicinity of uncured silicone sealants.
- SL 2™ is not intended for continuous immersion in water. Contact Technical Service for recommendation.
- For slopes up to 12% use SL 2™ Slope Grade. For
- Backer-rods, joint fillers, or bondbreakers must be tight to the sides of the joint to prevent loss of sealant through the bottom.
- For joints subject to puncture by high heels or umbrella points, a stiffer or higher density backup material is required. Cork or rigid resin-impregnated cane-fiber joint fillers are suitable. Separate materials from the sealant by a
- Do not use other caulks or sand as a bottom bed in a joint.
- Do not install when rain is expected before the sealant reaches initial cure (about 12 hours).
- Units of SL 2™ are premeasured; do not use partial units.
- SL 2™ may yellow in the presence of unvented artificial heat; this is a surface phenomenon that does not
- Use only color packs intended for use with SL 2™.
- Make certain the most current version of this data guide is being used; call Customer Service (1-800-433-9517) to verify the most current version.
- Proper application is the responsibility of the user. Field visits by ChemRex Inc. personnel are for the purpose of making technical recommendations only and are not to supervise or pro-

Technical Data

Compliances

- Federal Specification TT-S-00227E, Type I, Class A
- Corps of Engineers CRD C 506, Type I, Class A
- ASTM C 920, Type M, Grade P, Class 25, Use T and M
- Canadian Specification CAN/CGSB-19.24-M90, Classification MCG 1 40-B-L, No. 81051
- Canadian approval for use in establishments that handle food
- USDA approval for use in areas that handle meat and poultry

Typical Properties of Cured Sealant

Table 2

Property	SL 2 Value	SL 2 Slope Grade Value	Test Method
Tensile strength, psi (MPa)	125 (0.9)	145 (1.0)	ASTM D 412
Elongation, %	240	225	ASTM D 412
Shrinkage	Nil	Nil	
Low temperature flexibility, -15°F (-26°C)	Passes	Passes	ASTM C 793
Service temperature range, -40 to 180°F (-40 to 82°C)	Passes	Passes	
Stain and color change (no visible stain)	None	None	ASTM C 510
Extrusion rate and application life	Passes	Passes	ASTM C 603
Rheological (flow) at 40°F (4°C)	Self-leveling	–	ASTM C 639
Hardness at standard conditions, Shore A	30	30	ASTM C 661
Hardness after heat aging (Maximum Shore A 50)	40	20	ASTM C 661
Tack-free time, hours, (Maximum 72 hours)	<24	<24	ASTM C 679
Movement capability, %	± 25	± 25	ASTM C 719
Bond durability on concrete	Passes	Passes	ASTM C 719
Weight loss after heat aging, %	5	5	ASTM C 792
Cracking & chalking after heat aging	None	None	ASTM C 792
Artificial weathering Xenon arc, 250 hours	Passes	Passes	ASTM C 793
Artificial weathering Xenon arc, 2,000 hours	No surface cracking	No surface cracking	ASTM G 26
Adhesion in peel, on concrete	Passes	Passes	ASTM C 794

Test results are averages obtained under laboratory conditions. Reasonable variations can be expected.

Order Information

Packaging

SL 2™

- 1.5 gallon units (5.67 L) containing Part A and Part B
- 3 gallon units (11.34 L) containing Part A and Part B
- For slope grade SL 2™ Fast-Cure see Form No. SN-330

Primer 755

- 1 pint (473 mL) cans, 12 pints per carton

Coverage rate of primer is approximately 450 linear feet (137 m) per pint for a ½" (13 mm) deep joint.

Shelf life of both products is 12 months when stored in unopened containers under normal conditions.

Colors

40 standard, stocked colors are available. Refer to the Rainbow of Colors® popular palette, Form No. SP-041.

455 standard (non-stocked) colors are also available, and custom matching can be done upon request. Refer to the Rainbow of Colors® book.

Available in pretinted colors: Precast gray, Limestone

- 1.5 gallon (5.7 L) units
- 4.5 gallon (17 L) units

Minimum order is 100 pails in 4.5 gallon units.

Coverage

Table 3

Joint Depth (inches)	Linear Feet per Gallon Joint Width (inches) 1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"
1/4	308	205	154	122			
3/8				82	68	58	51
1/2					51	44	38

Joint Depth (mm)	Linear Meters per Liter Joint Width (mm) 6	10	13	16	19	22	25
6	24.8	16.5	12.4	9.8			
10				6.6	5.5	4.7	4.1
13					4.1	3.5	3.0

Warning

SL 2™ Part A contains calcium carbonate, light aromatic naphtha, 1,2,4-trimethyl benzene, toluene diisocyanate, silicon dioxide, titanium dioxide, mineral spirits (Stoddard type)

Risks

Combustible liquid and vapor. May cause skin and eye irritation. May cause dermatitis and allergic responses. Potential skin and/or respiratory sensitizer. Inhalation of vapors may cause irritation and intoxication with headaches, dizziness and nausea. Ingestion may cause irritation. Reports associate repeated or prolonged occupational overexposure to solvents with permanent brain, nervous system, liver and kidney damage. INTENTIONAL MISUSE BY DELIBERATELY INHALING THE CONTENTS MAY BE HARMFUL OR FATAL.

Precautions

KEEP OUT OF THE REACH OF CHILDREN. KEEP AWAY FROM HEAT, FLAME AND SOURCES OF IGNITION. Keep container closed when not in use. Use only with adequate ventilation. Avoid contact with skin, eyes and clothing. Wash thoroughly after handling. Avoid breathing vapors. DO NOT take internally. Use impervious gloves, eye protection and if the TLV is exceeded or product is used in a poorly ventilated area, use NIOSH/ MSHA approved respiratory protection in accordance with applicable federal, state and local regulations. Empty containers may contain explosive vapors or hazardous residues. All label warnings must be observed until container is commercially cleaned or reconditioned.

First Aid

In case of eye contact, flush thoroughly with water for at least 15 minutes. SEEK IMMEDIATE MEDICAL ATTENTION. In case of skin contact, wash affected areas with soap and water. If irritation persists, SEEK MEDICAL ATTENTION. Remove and wash contaminated clothing. If inhalation causes physical discomfort, remove to fresh air. If discomfort persists or any breathing difficulty occurs, or if swallowed, SEEK IMMEDIATE MEDICAL ATTENTION.

Refer to Material Safety Data Sheet (MSDS) for further information.

Proposition 65

This product contains material listed by the state of California as known to cause cancer, birth defects or other reproductive harm.

VOC Content

When mixed, product contains less than 84.6 - 93 g/L or 0.54 - 0.77 lbs./gal. less water and exempt solvents.

Warning

SL 2™ Part B contains toluene diisocyanate

Risks

May cause eye, skin or respiratory irritation. May cause dermatitis and allergic reactions. Potential skin and/or respiratory sensitizer.

Precautions

Prevent contact with skin, eyes or clothing. Wash thoroughly after handling. DO NOT take internally. Ingestion may cause irritation. Use only with adequate ventilation. Keep container closed. Inhalation may cause irritation. Use impervious gloves, eye protection and if the TLV is exceeded or used in a poorly ventilated area, use NIOSH/MSHA approved respiratory protection in accordance with applicable federal, state and local regulations. All label warnings must be observed until container is commercially cleaned or reconditioned.

First Aid

In case of eye contact, flush thoroughly with water for at least 15 minutes. In case of skin contact, wash affected areas with soap and water. If irritation persists, SEEK MEDICAL ATTENTION. Remove and wash contaminated clothing. If inhalation causes physical discomfort, remove to fresh air. If discomfort persists or any breathing difficulty occurs, SEEK IMMEDIATE MEDICAL ATTENTION. If swallowed, SEEK IMMEDIATE MEDICAL ATTENTION.

Refer to Material Safety Data Sheet (MSDS) for further information.

Proposition 65

This product contains materials listed by the state of California as known to cause cancer, birth defects, or other reproductive harm.

VOC Content

8.09 g/L or 0.07 lbs/gal less water and exempt solvents

Warning

SL 2™ Accelerator contains toluene diisocyanate mix

Risks

May cause skin, eye or respiratory irritation. May be absorbed through skin. May cause dermatitis and allergic reactions. Ingestion may cause irritation. Repeated or prolonged exposition may affect kidneys.

Precautions

KEEP OUT OF THE REACH OF CHILDREN. Prevent contact with skin, eyes and clothing. Wash thoroughly after handling. DO NOT take internally. Ingestion may cause irritation. Use only with adequate ventilation. Inhalation may cause irritation. Keep container closed. Use impervious gloves, eye protection and if the TLV is exceeded or used in a poorly ventilated area, use NIOSH/MSHA approved respiratory protection in accordance with applicable federal, state and local regulations.

First Aid

In case of eye contact, flush thoroughly with water for at least 15 minutes. In case of skin contact, wash affected areas with soap and water. If irritation persists, SEEK MEDICAL ATTENTION. Remove and wash contaminated clothing. If inhalation causes physical discomfort, remove to fresh air. If discomfort persists or any breathing difficulty occurs or if swallowed, SEEK IMMEDIATE MEDICAL ATTENTION.

Refer to Material Safety Data Sheet (MSDS) for further information.

Proposition 65

This product contains materials which are known to the state of California to cause cancer, birth defects, or other reproductive harm.

VOC Content

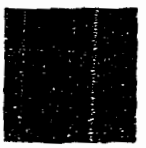
0 g/L or 0 lbs. per gallon less water and exempt solvents

For medical emergencies only, call ChemTrec (1/800/424-9300)

Customer Service: 1/800/433 9517
Technical Service: 1/800/ChemRex (1/800/243 6739)
Web Site: www.chemrex.com

Limited Warranty Notice

Every reasonable effort is made to apply ChemRex Inc. exacting standards both in the manufacture of our products and in the information which we issue concerning these products and their use. We warrant our products to be of good quality and will replace or, at our election, refund the purchase price of any products proved defective. Satisfactory results depend not only upon quality products, but also upon many factors beyond our control. Therefore, except for such replacement or refund, CHEMREX INC. MAKES NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY, RESPECTING ITS PRODUCTS, and CHEMREX INC. shall have no other liability with respect thereto. Any claim regarding product defect must be received in writing within one (1) year from the date of shipment. No claim will be considered without such written notice or after the specified time interval. User shall determine the suitability of the products for the intended use and assume all risks and liability in connection therewith. Any authorized change in the printed recommendations concerning the use of our products must bear the signature of the ChemRex Inc. Technical Manager.



Sonneborn

ChemRex Inc.

889 Valley Park Drive, Shakopee, MN 55379

Manufacturing Plants: Allentown, PA; Bloomington, MN; Bristol, PA; Caguas, PR; Centerville, IN; Delaware, OH; Forest Hill, TX; Fort Wayne, IN; Gurnee, IL; Houston, TX; Lancaster, TX; Marietta, GA; Matawan, MI; Newark, DE; Rancho Cucamonga, CA; Reynolds, GA; Scarbe, WA; Streetsboro, OH; Troy City, OH; Toronto (Canada); Montreal (Canada); Edmonton (Canada)

Regional Warehouses: Atlanta, GA; Aurora, CO; Brampton, Ontario (Canada); Chicago, IL; Dallas, TX; Fairfield, NJ; Hayward, CA; Ontario, CA

(1) ATTN — BOND BREAKER

PRODUCT INFORMATION

Tectyl RUST PREVENTIVES

A PRODUCT OF VALVOLINE OIL COMPANY DIVISION OF ASHLAND PETROLEUM COMPANY

TECTYL 506

Description

TECTYL 506 is a solvent cutback, wax base, corrosion preventive compound. The dry film is firm, amber, waxy and translucent. TECTYL 506 is excellent for long term protection of metallic surfaces against corrosion in either indoor or outdoor exposure and during domestic and international shipments.

Laboratory Data

	Typical Properties English	Metric
Flash, PMCC, Minimum	100°F	37.8°C
Specific Gravity @ 60°F (15.6°C)	0.88	0.88
Recommended Dry Film Thickness	1.3 Mils	32.5 Microns
Theoretical Coverage	650 sq. ft./ U.S. Gallon	16 sq. meters/ liter
Non Volatile % by Weight	53-57	—
Approximate Air Dry Time @ 77°F (25°C)	1 hour	1 hour
High Temperature Flow Point	300°F	148.5°C
Low Temperature Flexibility, (90° bend-No flaking or cracking)	-10°F	-22.5°C
Volatile Organic Content V.O.C.	3.24 lbs./ U.S. Gallon	400 grams/ Liter
Accelerated Corrosion Tests:		
5% Salt Spray (Hours)		
(A) *ASTM B-117 @ 1.3 mils, (2x4x1/8 in. Polished Steel Panels)	2000	—
(B) **DIN 50021 @ 32.5 microns (125x200 mm. DIN 1623 Panels)	—	168

*ASTM (American Society for Testing and Materials)
**DIN (Deutsche Industrie Normen)

Benefits

Easy Application
TECTYL 506 is formulated for easy application by spray, dip or brush.

Low-Cost Protection
TECTYL 506 is a one coat rust preventive. The thin film provides high coverage and low cost protection.

7015

Printed in U.S.A.

MATERIAL SAFETY DATA SHEET

The Valvoline Company

Date Prepared: 08/21/98
Date Printed: 10/17/98
MSDS No: 506.00014S8-012.001

TECTYL 506

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Material Identity
Product Name: TECTYL 506
Product Code: 50010145
General or Generic ID: SOLVENT-BASED RUST PREVENTATIVE

Company
The Valvoline Company
P.O. Box 14000
Lexington, KY 40512

Telephone Numbers
Emergency: 1-800-274-5263
Information: 1-606-357-7547

2. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient(s)	CAS Number	% (by weight)
CALCIUM SALT OF OXIDIZED PETROLATUM	68425-34-3	74.0- 84.0
ALIPHATIC HYDROCARBONS (STODDARD TYPE)	8052-41-3	16.0- 26.0

3. HAZARDS IDENTIFICATION

Potential Health Effects

Eye
Can cause eye irritation. Symptoms include stinging, tearing, redness, and swelling of eyes.

Skin
May cause mild skin irritation. Prolonged or repeated contact may dry the skin. Symptoms may include redness, buring, drying and cracking of skin, and skin burns

Swallowing
Swallowing small amounts of this material during normal handling is not likely to cause harmful effects. Swallowing large amounts may be harmful. This material can enter the lungs during swallowing or vomiting and cause lung inflammation and/or damage.

Inhalation
Breathing of vapor or mist is possible. Breathing small amounts of this material during normal handling is not likely to cause harmful effects. Breathing large amounts may be harmful.

Symptoms of Exposure
stomach or intestinal upset (nausea, vomiting, diarrhea), irritation (nose, throat, airways), central nervous system depression (dizziness, drowsiness, weakness, fatigue, nausea, headache, unconsciousness).

Target Organ Effects
Overexposure to this material (or its components) has been suggested as a cause of the following effects in humans, and may aggravate pre-existing disorders of these organs: central nervous system effects.

Continued On Next Page

MATERIAL SAFETY DATA SHEET

The Valvoline Company

Page 002
Date Prepared: 08/21/98
Date Printed: 10/17/98
MSDS No: 305.0001453-012.001

TECTYL 308

Developmental Information
No data

Cancer Information
No data

Other Health Effects
No data

Primary Route(s) of Entry
Inhalation, Skin contact.

---

4. FIRST AID MEASURES

Eyes
If symptoms develop, immediately move individual away from exposure and into fresh air. Flush eyes gently with water for at least 15 minutes while holding eyelids apart; seek immediate medical attention.

Skin
Remove contaminated clothing. Wash exposed area with soap and water. If symptoms persist, seek medical attention. Launder clothing before reuse.

Swallowing
Do not induce vomiting. This material is an aspiration hazard. If individual is drowsy or unconscious, place on left side with the head down. Seek medical attention. If possible, do not leave individual unattended.

Inhalation
If symptoms develop, immediately move individual away from exposure and into fresh air. Seek immediate medical attention; keep person warm and quiet. If person is not breathing, begin artificial respiration. If breathing is difficult, administer oxygen.

Note to Physicians
No data

---

5. FIRE FIGHTING MEASURES

Flash Point
106.0 F (41.1 C) PMCC

Explosive Limit
(for component) Lower 1.0 Upper 6.0 %

Autoignition Temperature
No data

Hazardous Products of Combustion
May form: carbon dioxide and carbon monoxide, sulfur compounds, various hydrocarbons.

Continued On Next Page

MATERIAL SAFETY DATA SHEET

The Valvoline Company

Page 003
Date Prepared: 08/21/98
Date Printed: 10/17/98
MSDS No: 506.0001-58-012.001

TECTYL 506

Fire and Explosion Hazards
Vapors are heavier than air and may travel along the ground or be moved by ventilation and ignited by heat, pilot lights, other flames and ignition sources at locations distant from material handling point. Never use welding or cutting torch on or near drum (even empty) because product (even just residue) can ignite explosively.

Extinguishing Media
regular foam, carbon dioxide, dry chemical.

Fire Fighting Instructions
Water may be used to extinguish fire by cooling, and diluting liquid with water. Wear a self-contained breathing apparatus with a full facepiece operated in the positive pressure demand mode with appropriate turn-out gear and chemical resistant personal protective equipment. Refer to the personal protective equipment section of this MSDS.

NFPA Rating
Health - 1, Flammability - 2, Reactivity - 0

---

6. ACCIDENTAL RELEASE MEASURES

Small Spill
Eliminate all sources of ignition such as flares, flames (including pilot lights), and electrical sparks. Absorb liquid on vermiculite, floor absorbent or other absorbent material.

Large Spill
Eliminate all ignition sources (flares, flames including pilot lights, electrical sparks). Persons not wearing protective equipment should be excluded from area of spill until clean-up has been completed. Stop spill at source. Prevent from entering drains, sewers, streams or other bodies of water. Prevent from spreading. If runoff occurs, notify authorities as required. Pump or vacuum transfer spilled product to clean containers for recovery. Absorb unrecoverable product. Transfer contaminated absorbent, soil and other materials to containers for disposal.

---

7. HANDLING AND STORAGE

Handling
Containers of this material may be hazardous when emptied. Since emptied containers retain product residues (vapor, liquid, and/or solid), all hazard precautions given in the data sheet must be observed. All five gallon pails and larger metal containers including tank cars and tank trucks should be grounded and/or bonded when material is transferred.

Storage
Not applicable

---

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye Protection
Chemical splash goggles in compliance with OSHA regulations are advised; however, OSHA regulations also permit other type safety glasses. Consult your safety representative.

Continued On Next Page

MATERIAL SAFETY DATA SHEET

The Valvoline Company

TECTYL 506

Skin Protection
Wear resistant gloves such as: neoprene, To prevent repeated or prolonged skin contact, wear impervious clothing and boots..

Respiratory Protections
If workplace exposure limit(s) of product or any component is exceeded (See Exposure Guidelines), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (consult your industrial hygienist). Engineering or administrative controls should be implemented to reduce exposure.

Engineering Controls
Provide sufficient mechanical (general and/or local exhaust) ventilation to maintain exposure below TLV(s).

Exposure Guidelines
Component

CALCIUM SALT OF OXIDIZED PETROLATUM (68425-34-3)
No exposure limits established

ALIPHATIC HYDROCARBONS (STODDARD TYPE) (8052-41-3)
OSHA VPEL 100.000 ppm - TWA
ACGIH TLV 100.000 ppm - TWA

PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point
(for component) 315.0 F (157.2 C)

Vapor Pressure
(for component) 2.000 mmHg

Specific Vapor Density
> 1.000 @ AIR=1

Specific Gravity
.890 @ 77.00 F

Liquid Density
7.310 lbs/gal @ 77.00 F
.890 kg/l @ 25.00 C

Percent Volatiles (Including Water)
50.0 - 54.0 %

Volitile Organic Compounds (VOC) (Maximum)
3.480 lbs/gal

Evaporation Rate
SLOWER THAN ETHYL ETHER

Continued On Next Page

MATERIAL SAFETY DATA SHEET

The Valvoline Company

Page 005
Date Prepared: 08/21/98
Date Printed: 10/17/98
MSDS No: 306.0001458-012.001

TECTYL 506

Appearance
TRANSLUCENT

State
LIQUID

Physical Form
No data

Color
AMBER

Odor
No data

pH
Not applicable

---

10. STABILITY AND REACTIVITY

Hazardous Polymerization
Product will not undergo hazardous polymerization.

Hazardous Decomposition
May form: carbon dioxide and carbon monoxide, sulfur compounds, various hydrocarbons.

Chemical Stability
Stable.

Incompatibility
Avoid contact with: strong oxidizing agents.

---

11. TOXICOLOGICAL INFORMATION

No data

---

12. ECOLOGICAL INFORMATION

No data

---

13. DISPOSAL CONSIDERATION

Waste Management Information
Dispose of in accordance with all applicable local, state and federal regulations.

Continued On Next Page

MATERIAL SAFETY DATA SHEET

The Valvoline Company

Date Prepared: 08/21/98
Date Printed: 10/17/98
MSDS No: 506.0001458-012.001

TECTYL 506

14. TRANSPORT INFORMATION

DOT Information - 49 CFR 172.101
DOT Description:
COMBUSTIBLE LIQUID, N.O.S.,NA 1993,III

Container/Mode:
DRUMS/SURFACE - NO EXEMPTIONS

NOS Component:
ALIPHATIC HYDROCARBONS (STODDARD TYPE)

RQ (Reportable Quantity) - 49 CFR 172.101
Not applicable

15. REGULATORY INFORMATION

US Federal Regulations
TSCA (Toxic Substances Control Act) Status
TSCA (UNITED STATES) The intentional ingredients of this product are listed.

CERCLA RQ - 40 CFR 302.4
None

SARA 302 Components - 40 CFR 355 Appendix A
None

Section 311/312 Hazard Class - 40 CFR 370.2
Immediate(X) Delayed( ) Fire(X) Reactive( ) Sudden Release of Pressure( )

SARA 313 Components - 40 CFR 372.65
None

International Regulations
Inventory Status
Not determined

State and Local Regulations
California Proposition 65
None

New Jersey RTK Label Information
STODDARD SOLVENT 8052-41-3

Pennsylvania RTK Label Information
STODDARD SOLVENT 8052-41-3

16. OTHER INFORMATION

The information accumulated herein is believed to be accurate but is not warranted to be whether originating with the company or not. Recipients are advised to confirm in advance of need that the information is current, applicable, and suitable to their circumstances.

Last Page

(2)

CO·STEEL SAYREVILLE

NORTH CROSSMAN RD
P.O. Box 249
SAYREVILLE, NJ, USA
08871-0249

FAX: (732)721-6674 TEL: (732)721-6600

TESTING LABORATORY REPORT
COMPTE RENDU DU LABORATOIRE D'ESSAI

- PHYSICAL PROPERTIES - PROPRIETES PHYSIQUES
- METALLURGICAL PROPERTIES - PROPRIETES METALLURGICAL
- CHEMICAL ANALYSIS - ANALYSE CHIMIQUE

BILL OF LADING NO DE CONN. 218302

THE CHEMISTRY ANALYSIS WAS DETERMINED IN ACCORDANCE WITH TEST METHODS ASTM E 415 AND/OR ASTM E 1019.

SHIP TO / EXPEDIER A:
MEADOW BURKE PRODUCTS
565 OAK RIDGE ROAD
HAZLETON, PA, USA
18201
Attn:JOHN WOITKO

Julius J. Bergonich
Plant Metallurgical Engineer

CO·STEEL SAYREVILLE CERTIFIES THAT THE RESULTS BELOW ARE A TRUE AND CORRECT COPY OF THE RECORDS PREPARED AND MAINTAINED BY THE AFOREMENTIONED COMPANY, IN COMPLIANCE WITH THE REQUIREMENTS OF THE SPECIFICATIONS CITED BELOW.

THIS PRODUCT HAS BEEN MELTED AND MANUFACTURED IN U.S.A.

MATERIAL TESTED / MATERIAU EPROUVE	GRADE / NUANCE	CONTROL NO. / NO. DE CONTROLE	CUSTOMER P.O. NO. / NO DE COMM DU CLIENT
EPOXY ROUNDS 1 1/8" ROUNDS EPOXY(33 FT 5 IN)	ASTM A615 GR60	61167202	000155

TEST RESULTS FOR HEAT N10071 HEAT SEQ 1

SAMPLE	C	MN	P	S	SI
1	.42000	.79000	.00500	.05800	.20000

MECHANICAL TESTS SAMPLE NUMBER 1 YIELD: 71025.0 PSI, TENSILE: 105229.0 PSI %ELONGATION: 16.0 - BEND TEST PASSED

EPOXY ROUNDS 1 1/4 ROUNDS EPOXY(20 FT)	ASTM A615 GR60	62520901	010898

TEST RESULTS FOR HEAT N12308 HEAT SEQ 1

SAMPLE	C	MN	P	S	SI
1	.42000	.81000	.00600	.04700	.18000

MECHANICAL TESTS SAMPLE NUMBER 1 YIELD: 67878.0 PSI, TENSILE: 95368.0 PSI %ELONGATION: 13.0 - BEND TEST PASSED

EPOXY ROUNDS 1 1/4 ROUNDS EPOXY(20 FT)	ASTM A615 GR60	62520901	010898

TEST RESULTS FOR HEAT N12310 HEAT SEQ 1

SAMPLE	C	MN	P	S	SI
1	.43000	.87000	.01200	.04800	.18000

MECHANICAL TESTS SAMPLE NUMBER 1 YIELD: 66509.0 PSI, TENSILE: 107899.0 PSI %ELONGATION: 12.0 - BEND TEST PASSED

EPOXY ROUNDS 1" RDS EPOXY(20 FT)	C.S.A. G40.21-98 44W	62971001	000155

TEST RESULTS FOR HEAT N14072 HEAT SEQ 1

SAMPLE	C	MN	P	S	SI	CU	NI	CR	MO	SN	V
1	.17000	.75200	.02300	.05700	.18200	.45700	.14600	.10400	.03500	.02400	.00000

MECHANICAL TESTS SAMPLE NUMBER 1 YIELD: 53731.0 PSI, TENSILE: 75885.0 PSI %ELONGATION: 25.0

EPOXY ROUNDS 1 1/8" ROUNDS EPOXY(20 FT)	ASTM A615 GR60	62971002	000155

TEST RESULTS FOR HEAT N12332 HEAT SEQ 1

SAMPLE	C	MN	P	S	SI
1	.43000	.87000	.01700	.04300	.22000

MECHANICAL TESTS SAMPLE NUMBER 1 YIELD: 80280.0 PSI, TENSILE: 114283.0 PSI %ELONGATION: 13.0 - BEND TEST PASSED

(3)

Lilly Industries, Inc. (r))

CERTIFICATION of COMPLIANCE
C of C 3-95-PC

Date: 04-7-00

Customer: Co-Steel

Address: N. Croaman Road

City: Dayesville State/Zip: NJ-08871

Factory Order Number: na

Specification: ASTM A775, ASHTO M284, ASHTO M254

Lilly Product Code: 720AC09 GREENBAR FUSION BOND EPOXY POWDER COATING

Batch Number: 0030192

Production Date: 04-06-00

Batch Size: 26,620 lbs est.

I hereby certify that the above lot of material was manufactured to formulation, meeting all the requirements of the above specification and that this material is chemically the same material that was tested by Valley Forge Laboratories of Devon, PA.

Shawn Mullendore
Process control

1136 Fayette
North Kansas City, MO 64116
(816) 421-7400
Fax: (816) 421-4563

CO-STEEL SAYREVILLE
NORTH CROSSMAN RD
SAYREVILLE, New Jersey, USA, 08871-0249
TEL: (732) 721-6600 FAX: (732) 721-6674

EPOXY COATING DIVISION
EPOXY TESTING LABORATORY REPORT

Bill of Lading No: 218302
Load No: 235146

Ship To Customer
MEADOW BURKE PRODUCTS
Attention: JOHN WOITKO
565 OAK RIDGE ROAD
HAZLETON, , PA, USA ,18201

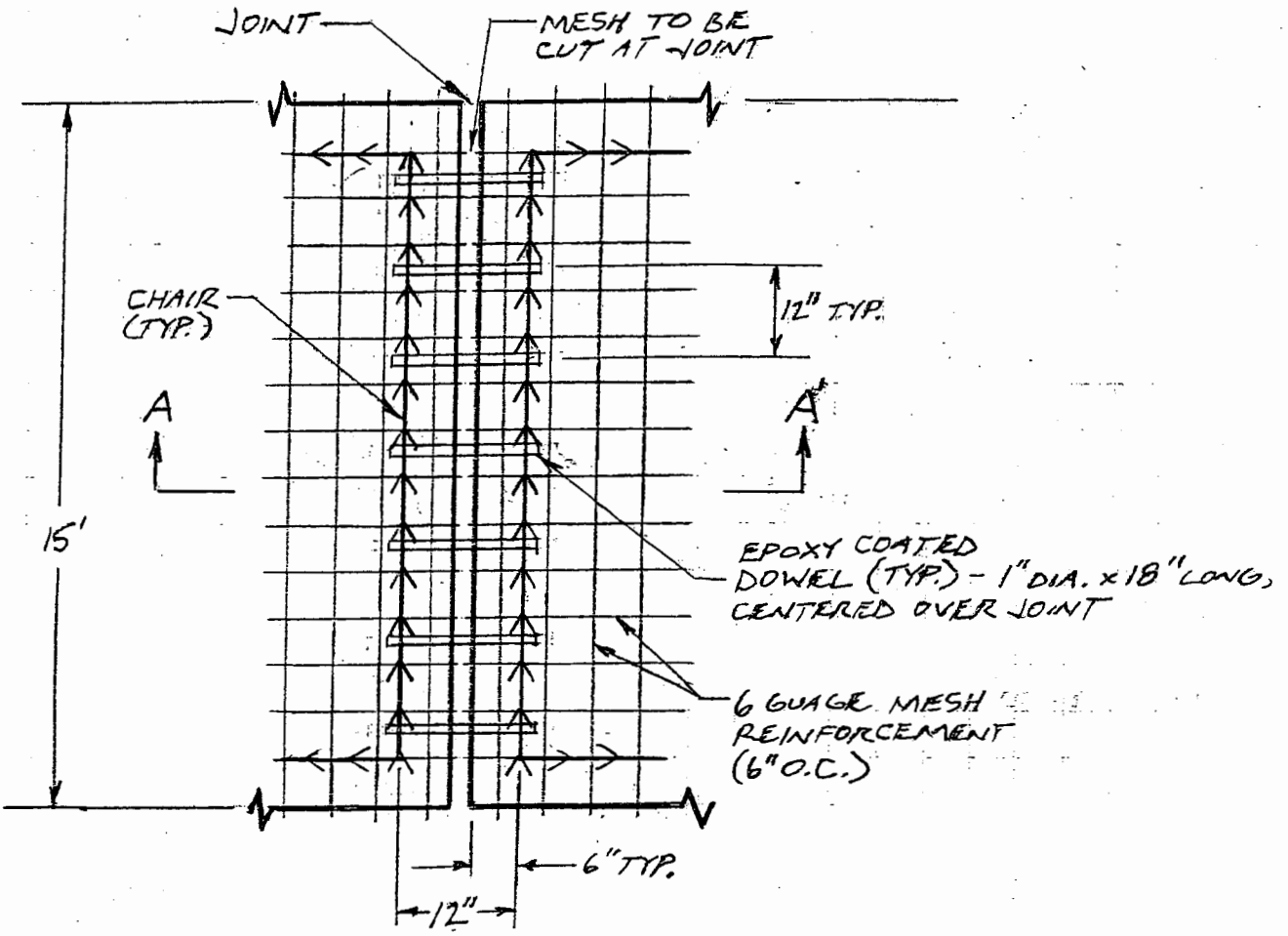
3868 1

QA Manager

This is to certify that the steel reinforcement bars listed below have been epoxy coated in accordance with the epoxy powder manufactures product data recommendations and complies with those parmeters set forth in the current editions of ASTM. ASTM specifications A775 and AASHTO specification M284. This product has been melted and manufactured in USA.

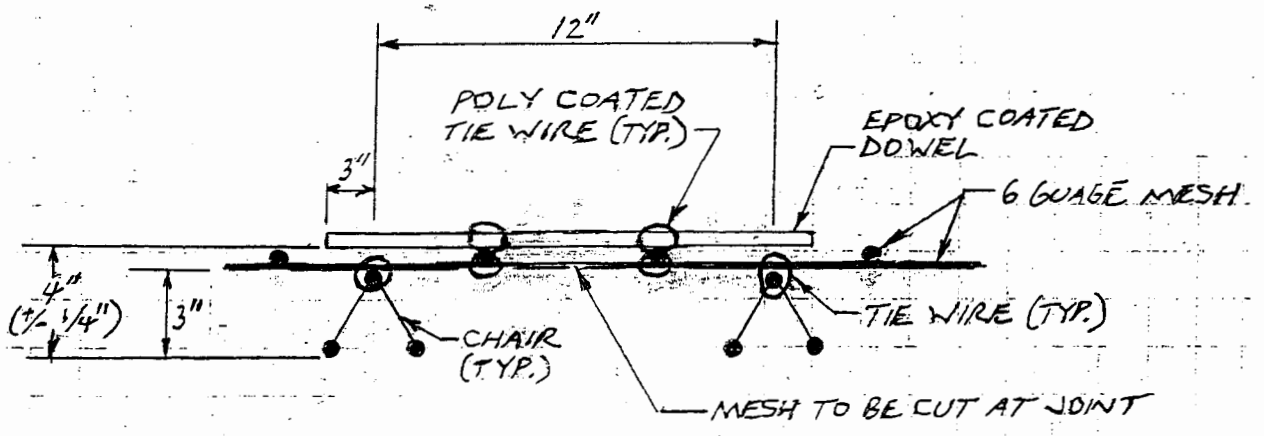
Epoxy Tag	Mill Tag	Heat No	Product	Grade	PCS	Length	Powder MFG	Powder Type	Powder Bat No	Coat Temp	Cure Time	Tolerance	Bend Test	Holiday Test	Order No
717703	1272282	N 10071	1 1/8" ROUNDS EPOXY	R60	54 -	33 FT 5 IN	MORTON	10	291201170	440 F	30 SEC	10 +8, 12	PASS	PASS	000155
724289	1272456	N 12310	1 1/4 ROUNDS EPOXY	R60	75 -	20 FT	LILLY	720	40123	440 F	30 SEC	10 +8, 12	PASS	PASS	010898
724270	1272452	N 12310	1 1/4 ROUNDS EPOXY	R60	75 -	20 FT				440 F	30 SEC	10 +8, 12	PASS	PASS	
725513	1272240	N 12332	1 1/8" ROUNDS EPOXY	R60	90 -	20 FT	morton	10	2003044446	440 F	30 SEC	10 +8, 12	PASS	PASS	000155
725542	1326353	N 14072	1" RDS EPOXY	44W	96 -	20 FT	lly	720	40122	440 F	30 SEC	10 +8, 12	PASS	PASS	000155
725606	1272497	N 12308	1 1/4 ROUNDS EPOXY	R60	75 -	20 FT	MORTON	10	20030-4449	440 F	30 SEC	10 +8, 12	PASS	PASS	010898

OSWEGO CASTINGS



CONTROL JOINT PLAN

(NOT TO SCALE)



SECTION A-A' (TYP. AT CONTROL JOINT)

NOT TO SCALE

APPENDIX E

How to reseal pavement joints

Proper joint preparation and sealant installation help extend pavement life by keeping out water and incompressible materials

Over time, all pavement joint sealants suffer accumulated distress. Sealants can lose bond with joint reservoir sidewalls or lose internal bond and split open. They can also lose their flexibility through natural aging and long-term exposure to oxygen, ozone, and sunlight.

Distressed sealants allow water to seep through joints, which can soften and erode the subbase or subgrade. This degradation can result in loss of structural support and pavement settlement and faulting. Incompressible materials can also enter joints and obstruct pavement expansion, which can cause spalling of the joint faces.

To extend pavement life, joint sealants must be replaced periodically. Correct sealant application and maintenance minimize infiltration of surface water and incompressible materials.

In concrete pavement restoration (CPR), which often includes full- and partial-depth repair and diamond grinding, resealing joints is the last technique in the sequence. Successful resealing consists of five steps:

1. Removing old sealant
2. Shaping the reservoir
3. Cleaning the reservoir
4. Installing the backer rod
5. Installing the sealant

Removing old sealant

Simply pouring new sealant over an existing sealant will not restore pavement joints. Removing the old sealant and cleaning the joint faces are essential steps. These processes provide a surface to which the new sealant can bond. It is imperative that methods for removing old sealant do not damage the joint reservoir. The following methods provide acceptable results:

Manual removal. Typically, compression seals can be easily removed by hand. This simple method provides a quick result whenever feasible and does not leave much material on the reservoir sidewalls.

Sawing. The most common and efficient removal method is sawing with diamond blades (Figure 1). This method is efficient because sawing also shapes the reservoir for the new material. However, it may not be effective on sticky sealing materials such as PVC coal tar. Sticky materials can clog diamond blades.

Plowing. Plowing can be very effective for removing most of the old sealant. A small plow pulled through the reservoir dislodges the material. Be careful, however, when selecting the plow design. Avoid V-shaped plows because they tend to scour the reservoir corners and can easily spall the surrounding concrete. Very little damage occurs with a rectangular plow.

Cutting. Cutting requires a worker to run a knife blade along the faces of the joint. Afterward, the sealant easily pulls free by hand.

All photos by American Concrete Pavement Association

Reservoir preparation is the most important step of a joint resealing project. Above, a worker sandblasts the top of a joint face to provide a clean bonding surface for the sealant.

Shaping the reservoir

Saws can be used to widen the sealant reservoir after the sealant is removed. Saws with dry or wet diamond blades are acceptable. The blades remove any remaining old sealant and provide the proper dimensions for the new sealant.

In certain instances, this step may not be required. Shaping is unnecessary if the sealant was removed by hand and the existing reservoir provides adequate dimensions. Sawing out the old sealant typically provides an adequate reservoir and should not require this step either.

Some minor spalling along the joint face will not inhibit performance of

most sealants. However, some patching may be needed for larger spalls. The specifications should detail areas requiring patching so that these areas can be repaired before cleaning the reservoir and installing the sealant.

Resealing pavements containing plastic or metal joint inserts requires first removing the insert. Afterward, sawing provides smooth vertical faces for the new sealant.

Cleaning the reservoir

Cleaning is the most important aspect of joint sealing. For every liquid sealant, manufacturers require essentially the same cleaning procedures. Likewise, the performance claims of any liquid sealant product are predicated on those cleaning procedures.

Reservoir faces require a thorough cleaning to ensure good sealant adhesion and long-term performance. No dust, dirt, or visible traces of old sealant should remain on the joint faces after cleaning. The ability to attain this condition may depend on the reservoir width. Most contractors report that it is easier to consistently clean joints if they are at least ⅜ inch wide. Cleaning ⅛-inch or even ¼-inch joints is very difficult.

Do not use chemical solvents to wash the joint reservoir. Solvents can carry contaminants into pores and surface voids on the reservoir faces. These contaminants will inhibit bonding of the new sealant.

Proper cleaning requires mechanical action and pure water flushing to remove any contaminants. Use the following procedures:

1. Immediately after sawing, wash away the slurry from the sawing operation. Perform this operation in one direction to minimize contamination of surrounding areas.
2. After the joint has dried sufficiently, sandblast the joint to remove any remaining residue. Do not sandblast straight into the joint. Hold the sandblast nozzle close to the surface at an angle to clean the top inch of the joint face. One pass along each reservoir face provides excellent results. This not only cleans the joint faces, it provides texture to improve sealant adhesion.
3. To ensure that the sealant enters a clean reservoir, airblast the joint and pavement surface to remove sand, dirt, and dust just before pumping the sealant. Make sure the air compressor does not introduce oil into the lines because this will contaminate the joint faces. The compressor should deliver air at a minimum of 120 cubic feet per minute and develop at least 90 psi nozzle pressure. Consider using a vacuum sweeper and hand brooms to keep the surrounding pavement clean.

Compression seals do not require steps two or three.

Installing backer rods

Install backer rods after cleaning the joint but before installing the liquid sealant. The backer rod must be compatible with the liquid sealant and have a diameter about 25% greater than the reservoir width. Backer rods can be placed easily with a double-wheeled, steel roller or any smooth, blunt tool that will force it into the joint uniformly to the desired depth (Figure 2). A steel roller allows exchange of the center insertion wheel to create different depths and provides the most consistent results. Slightly faulted joints may require a single-wheel roller. Ensuring that the backer rod is at the proper depth cannot be overemphasized. Good practice is to roll the insertion wheel over the backer rod twice.

Installing the sealant

Before installing the sealant, wipe the reservoir sidewalls with your finger to check for dirt and dust (Figure 3). If you find any traces of contamination, reclean the joint.

Installation requirements are slightly different for each sealant type. For most liquid sealants, manufacturers recommend some curing time before opening the pavement to traffic. Some liquid sealant manufacturers also place limits on the ambient and pavement temperatures required for installation. Compression seal manufactur-

Figure 1. **Diamond sawing is an effective way to remove old sealant and to widen joints to provide the proper shape factor.**

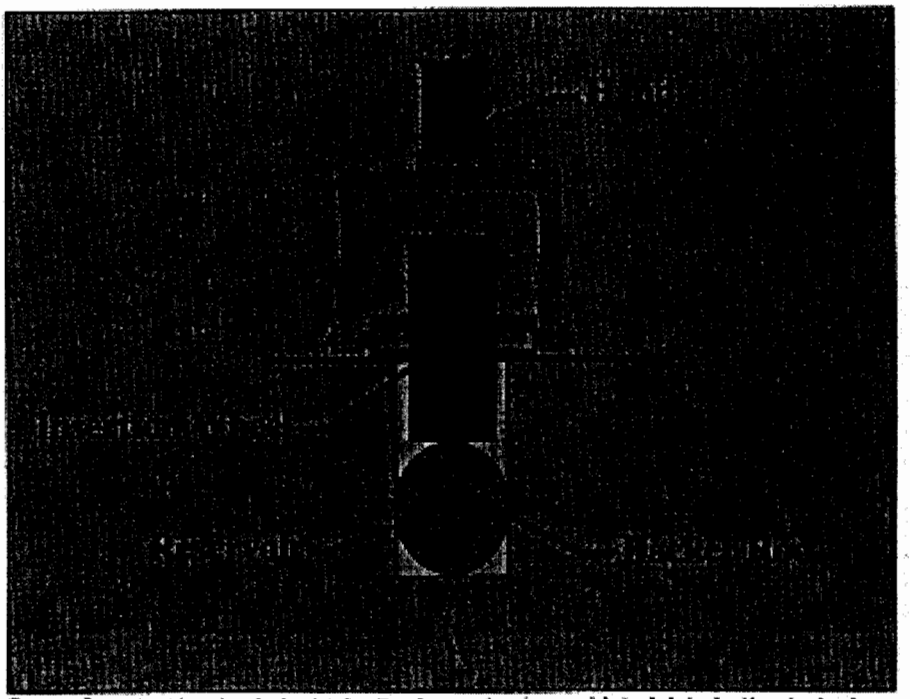


Figure 2. **A double-wheeled, steel roller forces backer rod into joints to the desired depth.**

ers specify desirable limits on sealant stretch and lubrication. Always consult the sealant manufacturer for particular product recommendations.

Liquid sealants. Pay special attention to the temperature of hot-pour liquid sealants before installing them. No sealant should be installed before it reaches proper installation temperature. Approximately one gallon of material is unusable because cooled sealant and flushing oil remains in the pumping unit hoses and nozzle. Discard this material and begin pumping only after fresh sealant is ejected from the nozzle at an acceptable temperature.

All liquid sealants require uniform installation. Pump the sealant through a nozzle sized for the width of the joint reservoir. The nozzle should fit into the reservoir to allow pumping to the bottom. Filling the reservoir from the bottom up reduces the chances of trapping air pockets in the sealant. Drawing the nozzle toward you rather than pushing it results in fewer voids and a more uniform sealant cross section. Do not fill the reservoir all the way to the top. Recess the sealant at least ¼ to ⅜ inch below the surface of the pavement.

Low-modulus silicone sealants that are not self-leveling require tooling to provide the desired results. After pumping the sealant, draw a tool or backer rod strip over the fresh sealant. This forces the sealant into contact with the sidewalls at the top of the reservoir and produces the desired shape (Figure 4). Tool the sealant within 10 minutes of installation, because, after this time, the sealant will begin to cure and form a "skin."

The reservoir walls *must be dry* before installing a liquid sealant. Water will boil when placed in contact with hot-pour materials, forming steam that will bubble the sealant. Water will also inhibit silicone sealant adherence. Most silicone manufacturers require a surface-dry condition before installation. This includes drying the reservoir walls after water flushing or rainfall. Follow the manufacturer's guidelines for optimum seal adherence. Moisture removal is not as critical for compression sealants.

When transverse joints are sealed with silicone and longitudinal joints are sealed with hot-pour material, seal the transverse reservoirs first. Some contamination of the longitudinal reservoirs will occur while placing the silicone; however, silicone is somewhat more viscous than hot-pour sealants and the longitudinal joint contamination will be tolerable.

It is important to examine all sealants after installation. A knife blade pushed down along the joint face provides an excellent tool for checking sealant adhesion (Figure 5). A loose, effortless penetration indicates adhesion loss, while good adhesion provides resistance.

Testing of silicone sealant curing can only be completed after 14 to 21 days. For a quick check, remove a small 2-inch-long sample of sealant, and stretch the segment about 50% for about 10 seconds before releasing it. A fairly fast and uniform relaxation of the sample indicates adequate curing. Slow rebound and curling of the sample indicates differential curing. The curl results from the upper (cured) seal retracting faster than the lower (less cured) portion. It is important to repair the 2-inch gap in the sealant where the sample was extracted. Use the same brand of sealant to take advantage of the good adherence the material has to itself.

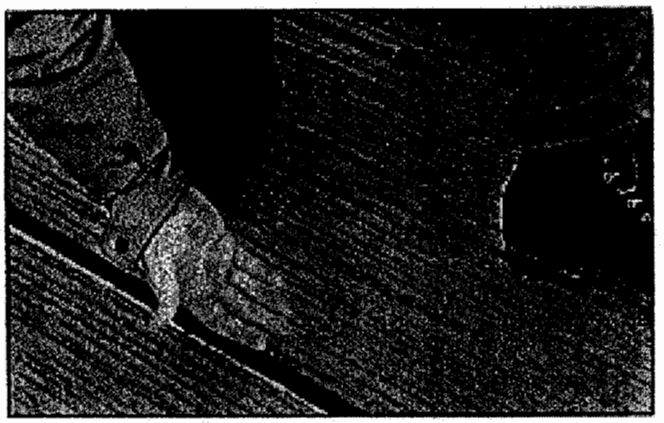


Figure 3. Dirt and dust on the reservoir sidewalls will inhibit bonding of the sealant. If you find any traces of contamination, reclean the joint.

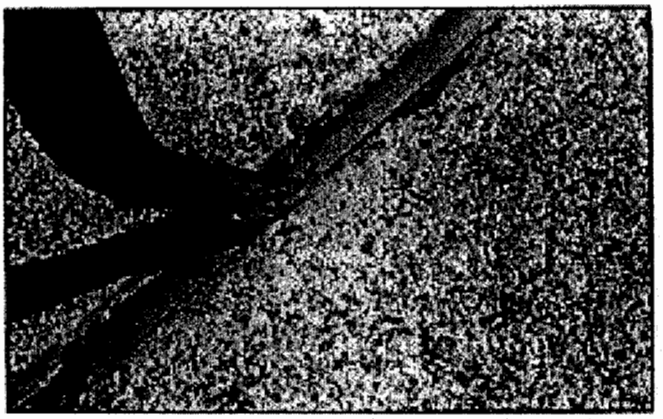


Figure 4. Low-modulus silicone sealants that are not self-leveling require tooling. This forces the sealant into contact with the sidewalls at the top of the reservoir and produces the desired shape factor.

Compression seals. A compression sealing operation requires application of a lubricant/adhesive to the sealant edges and/or reservoir sidewalls. The compression seal is then mechanically compressed and inserted into the reservoir. The lubricant/adhesive material eases sealant insertion and forms a weak adhesive to help hold the seal in place.

Inspect the joint walls before sealant installation to find any suspect areas. Raveling, spalling, or other irregularities in the joint walls pose potential problems. These areas could reduce the seal's lateral pressure and allow the seal to extrude or pop from the joint. The engineer and contractor should agree on potential problem areas before the contract is complete and seal damage occurs.

Sealant stretch of 3% or less is desirable. Some neoprene seals are capable of stretching as much as 50%. Stretching reduces the cross section and compression recovery of the sealant. More than 5% stretch is excessive and could be detrimental. Some sealants can later break into pieces if stretched excessively during installation. Pay special attention during installation to avoid twisting, nicking, or stretching the sealant.

To monitor sealant stretch, lay a length of sealant parallel to the joint and cut the seal to the exact length. After installing the seal, measure the length of any protruding seal, and divide this number by the original seal length to determine stretch percentage.

Figure 5. A knife blade pushed down along the joint face provides an excellent tool for checking sealant adhesion. A loose, effortless penetration indicates adhesion loss, while good adhesion provides resistance.

Most compression seal manufacturers make equipment for accurate seal installation. The most common are compress-eject machines. The machines compress and insert a seal to a desired depth in a continuous motion. The most advanced equipment automatically applies lubricant/adhesive along the sealant edges. Compress-eject machines remove most stretching and twisting problems that accompany hand installation. The machines are usually self-propelled with a guide that keeps them on course over the joint.

Burrs along the sawed joints may make seal installation difficult. Dragging a blunt, pointed tool along sawed joints removes sharp edges. A mechanized wire brush will also remove burrs and provide consistent results. While this simple step eases seal installation, it may contaminate clean joints and should be done only when needed and before cleaning the reservoir.

Whenever possible, avoid splicing compression seals. Splices are discontinuities prone to moisture infiltration and dislodging by traffic. Use only one length of compression seal for transverse joints less than 25 feet long. For transverse joints on wider pavements, one splice is acceptable. For longitudinal joints, cut the compression seal at the transverse joint crossings.

Acknowledgment

This article is based on information from *Joint and Crack Sealing and Repair for Concrete Pavements*, American Concrete Pavement Association, 1993. For more information, contact ACPA, 3800 N. Wilke Rd., Suite 490, Arlington Heights, IL 60004 (708-966-2272).

AMERICAN CONCRETE PAVEMENT ASSOCIATION

3800 N. Wilke Road, Suite 490
Arlington Heights, Illinois 60004
(708) 966-2272

RP336P

Dowel retrofit restores pavement load transfer

When combined with diamond grinding, it provides a long-lasting solution to faulted joints and cracks

By James W. Mack, P.E.

High-production slot cutting has been the driving force behind the renewed interest in dowel bar retrofit.

Concrete pavements have been serving the United States well for more than 100 years. The first, built in Bellefontaine, Ohio, in 1893, carried traffic until its 100th anniversary in 1993. Throughout this century of service, concrete pavements have had one primary location of weakness—the joints.

Because concrete shrinks as it gains strength and hardens, joints are placed at certain intervals to control the location and pattern of the cracking. Today, modern pavement jointing details include dowels, proper joint reservoir design, and durable sealants. Proper details, along with regular maintenance programs, have made possible the construction of durable, high-quality joints that help concrete pavements perform for many years.

Unfortunately, many roads built in the past do not contain joints with the proper design features. Pavement designers often placed the joints too far apart and did not use dowels because of underpredicted traffic volumes. Some of these pavements have carried up to three times more traffic than their design. Consequently, they have lost their load transfer capability, which consisted mainly of aggregate interlock. Load transfer is a slab's ability to transfer part of its load to its neighboring slab. The higher the load transfer, the better the pavement performs. Pavements with poor load transfer often suffer from joint faulting.

Until very recently, the two most common practices roadway agencies used to fix roughness and faulting were asphalt overlays and diamond grinding. The problem with these methods is that they cover up or remove the faulting, but do not address the problem of poor load transfer at the joints and cracks. Reflection cracks quickly deteriorate asphalt overlays, and faulting often returns to diamond-ground surfaces. Either way, the life of the improvement rarely exceeds 8 to 10 years.

However, recent improvements in concrete pavement restoration techniques have provided a better solution to the problem of poor load transfer. Dowel bar retrofit is an operation in which slots are cut into the concrete across the joints and cracks, and dowels are placed in the slots to restore the

and prevents them from locking up or tying the pavement together. Slots are cut between 1¼ and 2½ inches wide and slightly deeper than half the slab depth. This puts the dowel at the slab mid-depth after placement (Figure 2).

The most effective slot pattern appears to be three slots per wheel path. The outside wheel path dowels should start 12 to 18 inches in from the pavement edge and be separated by 12 to 15 inches. The inside wheel path dowels should start 18 to 24 inches in from the center line and be separated by 12 to 15 inches (Figure 3).

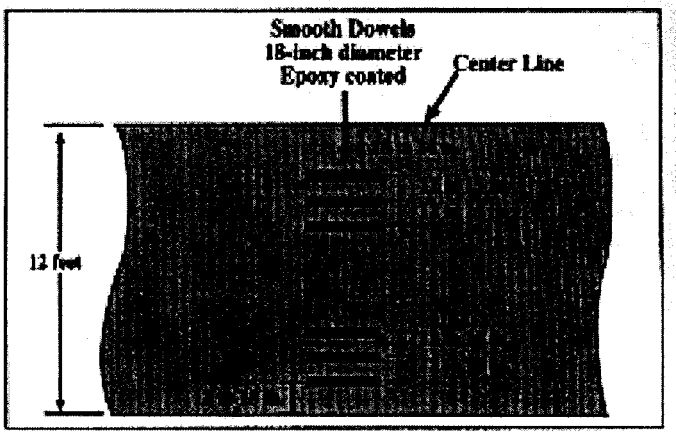


Figure 3. **Three slots per wheel path is a typical slot pattern.**

Preparing the slots

If the slots are sawed, slot preparation consists of removing the fins, flattening the bottom of the slots, cleaning the slots, and caulking the joints or cracks. If a milling machine is used, slot preparation consists of cleaning the slots and caulking the joints or cracks.

To remove the fins after sawing, use a hand-held jackhammer no heavier than 30 pounds to chip out the concrete. Larger jackhammers may break through the concrete, which will then require a full-depth repair. One technique to remove the fins is to place the jackhammer at the end of the fin and jackhammer down and along the bottom of the sawcuts (Figure 4). Another is to place the jackhammer along the side of the slot and break off the fin. Either way, with some practice, most workers can remove a fin in two or three large pieces.

After removing the fins, flatten the bottom with a small hammerhead bit mounted on the jackhammer. This removes rocks and stubble from the slot bottom. Rocks and stubble can prevent proper dowel alignment by keeping the dowel from sitting level. They can also prevent the patching material from completely encasing the dowel. Improper dowel alignment and incomplete encasement can result in pavement lockup or dowel socketing. Pavement lockup is the inability of the joint or crack to open and close with temperature changes. Dowel socketing is the widening of the dowel hole, which leads to loss of load transfer.

The slot must be clean when placing the dowel and patching material. Otherwise, the patch material may not bond to the slot sides. To clean the slot, sandblast the sides and bottom, then airblast them. To determine if the slot is clean, wipe your hand along the slot sides and bottom. If there is laitance or dust on your hand, the slot is not clean and will need to be recleaned.

The final step in slot preparation is caulking the joint or crack on the bottom and sides of the slot. This keeps the patching material from entering the joint or crack. If the patching material gets into the joint, point bearing stresses can develop when the joint closes, causing spalling and possibly failing the repair.

Placing the dowels

The dowels used for retrofitting are the same as those used for new concrete pavement construction, with a few modifications. Their minimum length is 14 inches. They must be long enough to have at least 6 inches on each side of the joint or crack being repaired when placed in the slot. However, due to construction and field variability, most agencies have used 18-inch-long dowels in their major repair projects. The minimum dowel diameter is either 1¼ or 1½ inches, depending on the slab thickness. Finally, the dowels should be epoxy-coated over the entire bar, including the ends, to prevent the corrosion that can cause the pavement to lock up.

Before placing it into the slot, fit the dowel with a ¼-inch nonmetallic expansion cap, a plastic foam or filler-board joint reformer, and nonmetallic chairs (Figure 5). Placed on one end or both ends of the dowel, expansion caps allow the joint to open and close after installation. Placed at the dowel midpoint, the plastic foam joint reformer also allows slab movement by keeping patching material out of the joint. Nonmetallic chairs are placed at each end of the dowel to lift the dowel ½ inch off the slot bottom and ¼ inch away from the saw kerf ends. A ½-inch clearance at the bottom and sides of the dowel ensures that the patch material will be able to completely encapsulate the dowel. It is important to use nonmetallic chairs and endcaps on the dowels. Otherwise, the dowel may corrode and cause pavement lockup.

Before placing the dowel in the

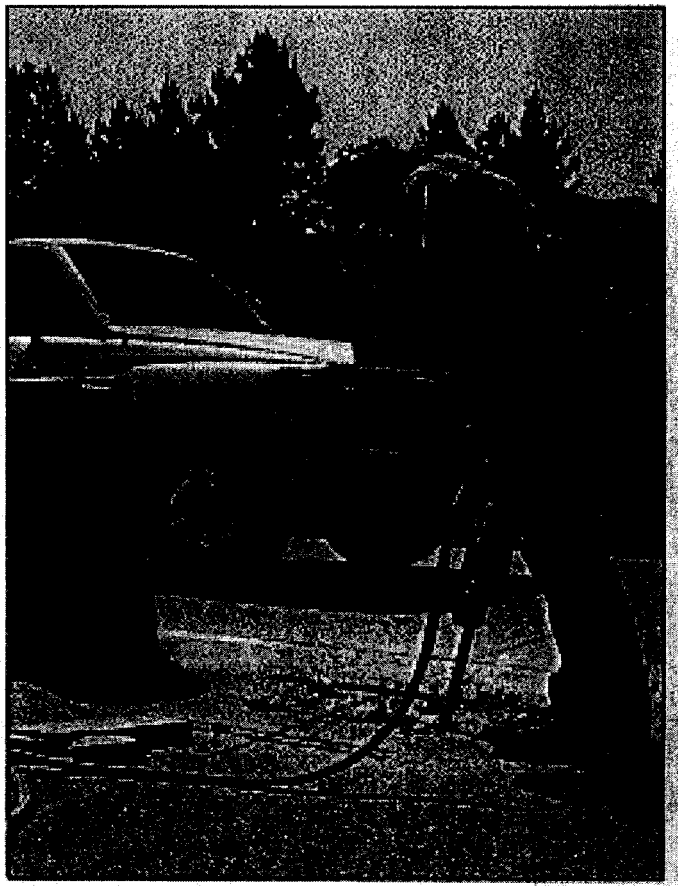


Figure 4. **One technique to remove the fins is to place the jackhammer at the end of the fin and jackhammer down and along the bottom of the sawcuts. With some practice, most workers can remove a fin in two or three large pieces.**

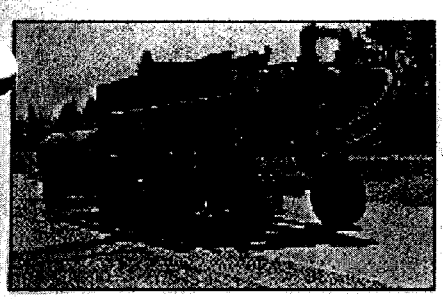


Figure 1. **The machine above saws the edges of all six dowel slots at one time. The machine below saws three slots at a time. After sawing, traffic can be returned to the pavement until the fins between the sawcuts are removed.**

load transfer. When combined with diamond grinding, dowel retrofit increases the load transfer capabilities and structural capacity of the pavement and removes its roughness.

Dowel bar retrofit is a relatively simple procedure that consists of five main operations:

1. Cutting the slots
2. Preparing the slots
3. Placing the dowel bars
4. Backfilling the slots
5. Opening the pavement to traffic

Cutting the slots

Advancements in slot-cutting equipment have been the driving force behind the renewed interest in dowel bar retrofit. Manufacturers have developed two types of equipment that are capable of cutting slots quickly and efficiently: the diamond-saw slot cutter and the modified milling machine. Of the two, the diamond-saw slot cutter is the most reliable and proven method, while the modified milling machine has been used only experimentally.

Diamond-saw slot cutting. In diamond-saw slot cutting, multiple sawcuts are made that form the edges of the slots. The cutting operation leaves fins in between the sawcuts that must be removed. Currently, there are machines that are capable of cutting either three slots (one wheel path) or six slots (two wheel paths) in one pass (Figure 1).

To cut the slots, the saw head is placed before the joint or crack, then plunged into the concrete and advanced across the joint or crack. Typically, the saw operator must make more than one plunge to cut the slot to its required depth. The plunging and moving back and forth across the repair area creates a flat bottom along the slot that is used to keep the dowel in proper alignment. The slot must be long enough to allow the dowel to sit at the bottom of the slot without its ends hitting the curves of the sawcuts. Typically, this requires the surface length of the sawcut to be 3 feet for an 18-inch-long dowel bar. After sawing, traffic can be returned to the pavement until the fins are removed.

Modified milling machine. When milling the slots, the modified milling machine is placed before the joint or crack, then plunged into the concrete and moved across the repair area. The advantage of milling is that it creates the slot in one pass and does not leave concrete fins that need to be broken out. However, because the milling operation creates open slots, you can't allow traffic on the pavement; you must complete the entire dowel retrofit operation in one stage.

Some agencies have raised concerns about the milling process causing microcracking at the slot edges and fractures at the crack or joint faces. They suspect that the microcracks and fractures may decrease the long-term durability of the dowel retrofit. Presently, the Indiana Department of Transportation is investigating the possible detrimental side effects of milling the slots.

When creating the slots, it is essential that they are cut parallel to the center line of the pavement. This keeps the dowels in proper alignment

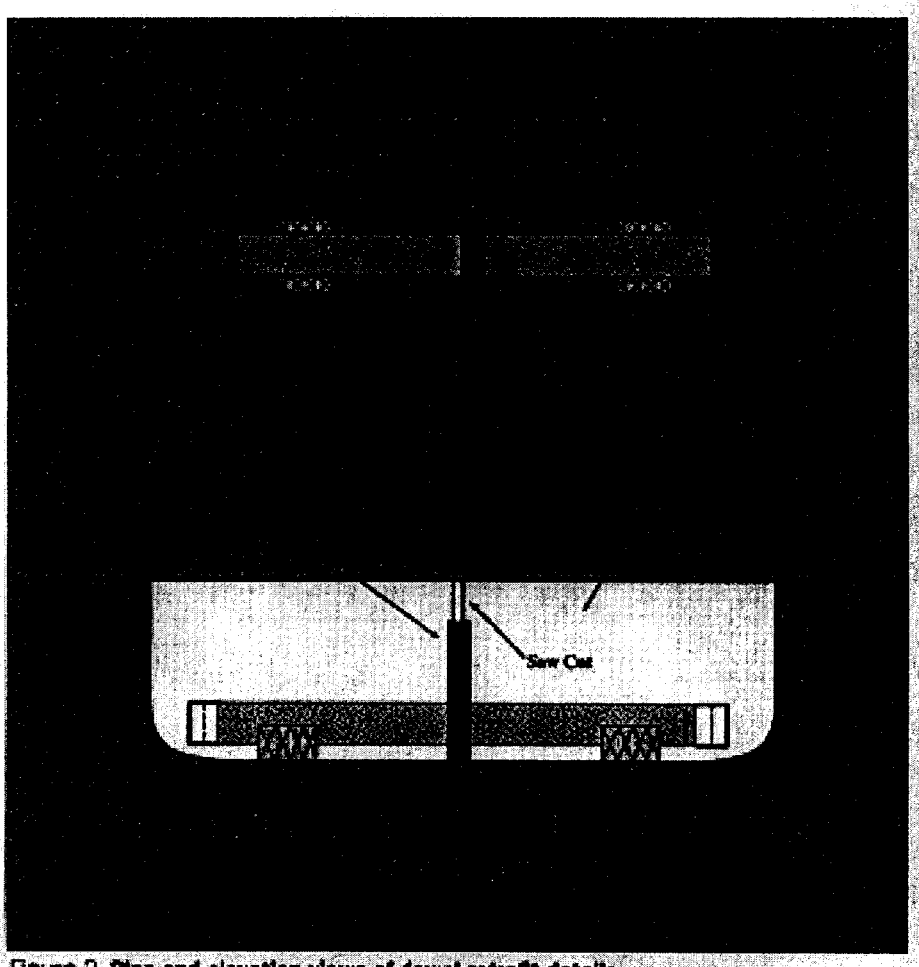


Figure 2. **Plan and elevation views of dowel retrofit details.**

slot, cover it with a debonding agent such as form oil or grease so that it can move within the patch after it has hardened. However, make sure that no oil or grease falls onto any of the slot surfaces. Oil or grease will keep the patch material from bonding to the slot, which could cause the patch to fail. Some agencies have tried placing a sleeve over the dowel, but this is not recommended. Sleeves build an inherent looseness into the slot that could cause the dowel to socket and fail.

To insert the dowel properly, place it so that the chair legs are in the saw-cut kerfs at the bottom of the slot. This maintains proper dowel alignment by keeping the dowel horizontal and parallel to the pavement center line and surface. The joint reformer should be over the joint or crack with half of the dowel on each side of the joint. The legs and sides of the chairs should also be snug against the slot wall. This keeps the dowel from moving and becoming misaligned during placement of the patch material.

Backfilling the slots

Generally, any material that works for a partial-depth repair should work as a patch material for a dowel retrofit. The patch material should have thermal properties similar to concrete and have little or no shrinkage. It should also set and develop strength quickly so the repair can support traffic as soon as possible.

Several state agencies have used both fast-track concrete mixes and proprietary mixes successfully. The fast-track concrete mixes usually contain Type III cement, accelerators, and aluminum powder. Accelerators shorten the concrete set time and aluminum powder reduces its shrinkage. However, be careful when using chloride accelerators. Too much chloride accelerator may cause the dowel bar to corrode. For proprietary mixes to perform well, you need to follow the manufacturer's recommendations closely. For both the fast-track concrete and proprietary mixes, use a maximum aggregate size of ⅜ inch. This helps ensure that the dowel bar is completely encased by the patch material.

Figure 5. **Before placing it into the slot, fit the dowel with ¾-inch nonmetallic expansion caps, a plastic foam or filler-board joint reformer, and nonmetallic chairs.**

To place the patch material, shovel the concrete into the slot and consolidate it in the slot and around the dowel bar with a spud vibrator. Be careful not to hit the dowel bar with the vibrator when placing the patch material. This may knock the dowel out of alignment. After consolidating the concrete, you may want to put a curing compound on the patch, depending on the weather conditions. Although hot and windy conditions will probably require a curing compound, cool, calm conditions will not. The finish of the patch usually is not crucial since the entire pavement surface is usually diamond ground shortly after the dowel retrofit is complete.

Opening to traffic

You can allow traffic back onto the dowel retrofit when the patch material has gained adequate strength. Recent fast-track studies have shown that the minimum compressive strength required to open a repair to traffic is about 2000 psi for a slab that is 8 inches thick or greater. Most fast-track concrete mixes and proprietary mixes can gain this strength within two to six hours after placement. A recent dowel retrofit job in Washington state used a patch material that reached 4000 psi compressive strength in about two hours. Once the dowel retrofit is complete and open to traffic, the entire pavement should be diamond ground. This will remove the joint faulting and imperfections left after the patching procedure and restore the rideability of the roadway.

For more information on dowel retrofitting concrete pavements, contact:

ACPA-IGGA
5156 Cainsville Rd.
Lebanon, TN 37090
(615) 449-8026

ACPA
5420 Old Orchard Rd.
Suite A100
Skokie, IL 60077
(847) 966-2272

Jim Mack is Director of Engineering and Rehabilitation for the American Concrete Pavement Association.

RP335P

5420 Old Orchard Road, Suite A100, Skokie, IL 60077
(847) 966-2272

Reprinted from Concrete Repair Digest

The Aberdeen Group

Fast full-depth pavement repair

To open a pavement to traffic quickly, it takes more than just fast-setting concrete

By Gerald F. Voigt

The methods used to remove old concrete, install dowels, and place and cure the repair concrete can greatly affect total repair time.

Full-depth pavement repair entails removing and replacing at least a portion of a slab to the bottom of the concrete, in order to restore areas of deterioration. Full-depth repairs can improve pavement rideability and structural integrity and can extend pavement service life. A major factor when installing full-depth repairs is opening them to traffic quickly. Several key factors that will help reduce the time necessary to install a full-depth repair in a concrete pavement include:

- Choice of repair size
- Method of old concrete removal
- Dowel installation equipment
- Patching material selection
- Placing and curing provisions
- Opening-to-traffic criteria

Repair size

The size and geometry of a repair can affect the speed of completion. Accurately defining repair boundaries is essential to completing a project quickly. Deterioration that is found outside of original repair boundaries after work has begun requires additional time-consuming sawcuts and concrete removal.

Except for on low-traffic roadways, all full-depth repairs should extend the full width of one lane. Under heavy traffic, full-width patches are large enough to avoid rocking, a problem often seen in smaller patches. Full-width patches also provide adequate room in the removal area for time-saving dowel-hole drill rigs and compaction equipment.

To simplify concrete removal, remove the concrete in rectangular sections. Don't make notches or diagonal cuts in the pavement. Doing so may reduce material costs, but it complicates sawcutting and concrete removal operations.

A time-consuming and costly step in the pavement patching process is preparing the transverse joints, which includes sawing the perimeter, drilling and grouting dowel holes, placing the dowels, and sealing the joint. It's often cheaper and faster to combine two adjacent patches into one large patch, because this reduces the number of transverse joints you have to prepare. Table 1 provides an estimate of the distance between patches when the cost of additional patching and curing is equivalent to the cost of preparing two patch joints (one from each patch). When two patches are closer than the distances shown in the table, it is probably more cost-effective to combine them into one large patch.

Removing old concrete

Before removing deteriorated concrete, isolate the area from adjacent concrete and shoulder materials using full-depth sawcuts. The full-depth cuts separate the segment of deteriorated concrete and allow room for its removal with minimal damage to surrounding material. To expedite the repair, make the sawcuts well in advance of concrete removal and placing operations, so that removal and placing operations will never be held up while waiting for sawing. Traffic can continue over sawcut sections that are waiting to be removed, but avoid keeping the area open longer than about two days. This will reduce the chance of traffic punching the patches into the subgrade.

Whenever possible, lift deteriorated concrete out of place rather than breaking it. Lifting the old concrete imparts no damage to the subbase and usually is faster and requires less labor than breaking the concrete before removal. The most common liftout method uses a steel chain connected to lift pins (Figure 1). Other time-saving lift equipment includes forklift devices, vertical bridges, and torque claw attachments for front-end loaders.

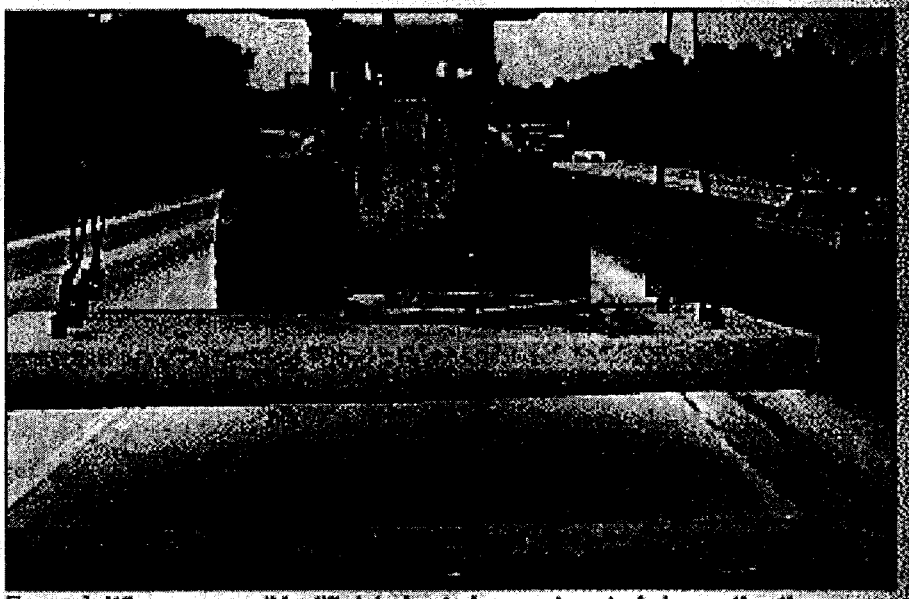


Figure 1. **Whenever possible, lift deteriorated concrete out of place rather than breaking it. Lifting the old concrete imparts no damage to the subbase and usually is faster and requires less labor than breaking the concrete before removal.**

Installing dowels

For most full-depth repairs of jointed pavements (except light-traffic plain pavements less than 7 inches thick), doweled transverse joints are essential for load transfer. Generally, 1¼-inch-diameter dowel bars provide effective load transfer for full-depth repairs in airport, interstate highway, or industrial pavements. For light-traffic highways and pavements less than 10 inches thick, 1¼-inch-diameter dowels are acceptable.

Dowel bars slip into holes drilled into the edge of the existing slab. Automatic dowel drilling rigs produce straight, consistent holes faster than single, hand-held drills (Figure 2). Modern dowel drilling rigs mount on a boom or on a frame with wheels and are maneuverable on a jobsite. However, single, frame-mounted, or hand-held drills are necessary where there is not enough room for the multiple-drill rigs.

Both standard pneumatic or hydraulic percussion drills are acceptable for drilling dowel holes. Both drill a typical dowel hole in about 30 seconds. Avoid electric-pneumatic rotary drills where speed and production are essential because they take three to four times longer to drill each hole.

After drilling, clean out the dowel holes. Insert an air nozzle into the hole to force out all dust and debris. Dust and dirt prevent the epoxy or non-shrink grout from bonding to the concrete around the hole perimeter. Oil also prevents good bonding. Therefore, always check the air for oil and moisture contamination from the compressor by blowing some air into a piece of dry cloth.

Place the anchoring material using a long nozzle that feeds the material to the back of the hole. This ensures that the anchoring material will flow forward along the entire dowel embedment length during insertion and decreases the likelihood of leaving voids between the dowel and the concrete. Prefabricated epoxy cartridges are available that supply enough material for one or two holes, but a faster and cheaper system for large projects is to use a pressurized injection system from bulk epoxy containers.

Patches in continuously reinforced pavements require splicing to the existing steel embedded in the old concrete. Splicing the old steel requires careful hand chipping with light jackhammers, which slows production. To reduce patching time, some agencies avoid splicing to the

Table 1. Criteria for Combining Adjacent Patches

Minimum cost-effective distance in feet between two patches

Slab Thickness (inches)	Patch (Lane) Width			
	9 Feet	10 Feet	11 Feet	12 Feet
7.0	17	15	14	13
8.0	15	13	12	11
9.0	13	12	11	10
10.0	12	11	10	9
11.0	11	10	9	8
12.0	10	9	8	8
15.0	8	8	7	6

It's often cheaper and faster to combine two adjacent patches into one large patch because this reduces the number of transverse joints that need to be prepared. If two patches are closer than the distances shown above, it is probably more cost-effective to combine them into one large patch.

old steel by drilling holes and anchoring all new reinforcing bars into the old concrete. This procedure makes the repair faster because it does not require hand chipping to expose the lap length of existing reinforcing bars. Hole cleaning and grouting steps should conform to those for dowel bars in jointed pavements.

Selecting a repair material

Patch mixes for full-depth repairs often use ASTM C 150 Types I, II, or III portland cement. The target slump ranges from about 2 to 4 inches to provide adequate finishibility. Most patch mixes require 4.5% to 7.5% entrained air, but this may vary by climate and the maximum size of the coarse aggregate. Laboratory testing of each patching mix is necessary to ensure that it meets the field requirements.

Mix proportions will depend on the pavement opening requirements. Mixes containing Type III cement or calcium chloride accelerators are common for the early strength gain necessary for quick opening. Proprietary cements also are available that gain strength very quickly. Using insulating blankets (or boards) during the first few hours after placement also improves the strength development of any mix by holding in the heat from cement hydration. Table 2 provides the approximate time necessary for different mixes to reach 2000 psi, a strength often required before opening the pavement to traffic.

Mixes using Type III cement may require slightly more mix water than a similar mix with Type I portland cement. However, too much extra water can cause the concrete to suffer from high shrinkage during curing. Consider using a water-reducing admixture to disperse cement particles and reduce the extra water necessary for thorough mixing.

Precautions are necessary when using a calcium chloride accelerator. Initial set may occur within 30 minutes on warm days, so use only 1% calcium chloride by weight of cement when air temperature exceeds 80° F. Up to 2% is acceptable in lower temperatures. For on-site mixing, add calcium chloride in liquid form to the mixer before adding other admixtures.

Placing and curing

Place concrete into the repair area from ready mix trucks or other mobile batch vehicles. The chute operator should distribute the concrete evenly to avoid the need for excessive shoveling. Attaining good concrete consolidation around dowel bars and along the patch perimeter is important to achieve long-term performance. Vertical penetrations of a standard spud vibrator will adequately mobilize the patching concrete. Do not drag the vibrator through the mix because this may cause segregation and loss of entrained air.

Figure 2. Automatic dowel drilling rigs produce straight, consistent holes faster than single, hand-held drills.

For high-early-strength patch mixes, the first few hours after placing the concrete are the most critical. Proper curing is essential to maintain a satisfactory moisture and temperature condition in the concrete after placement. As soon as possible, apply a liquid-membrane-forming curing compound at a rate of about 200 square feet per gallon and cover the patches with insulating mats. Place polyethylene sheeting between the mats and fresh concrete to avoid marring the patch surface.

Opening to traffic

Table 3 provides minimum concrete compressive strengths necessary to open the full-depth repairs to traffic. Most patch mixes fall into one of three categories depending on the time it usually takes them to reach these minimum compressive strengths: 4- to 6-hour mixes, 12- to 24-hour mixes, and 24- to 72-hour mixes. For the 4- to 6-hour and 12-

Table 2. Compressive Strength Development of Repair Concretes

For Mixes Containing:	Typical Time to Opening Strength (Approx. 2000 psi)
Certain blended cements	2-4 hours
Sulfo-aluminate cements	2-4 hours
Type III cement with nonchloride accelerating admixture	4-6 hours
Type III cement with calcium chloride accelerator	4-6 hours
Type I cement with calcium chloride accelerator	6-8 hours
Type III cement with Type A water-reducing admixture	12-24 hours
Type I cement (air-entrained paving mix without fly ash)	24-72 hours

to 24-hour mixes, the concrete strength should be measured to determine if it is ready to accept traffic. Small variations in air temperature can have a great effect on the strength development of these mixes. Portable beam or cylinder test devices, maturity meters, or pulse-velocity devices can be used.

The 12- to 24-hour mixes are conventional mixes and are often used when fast turnaround is not critical. Paying close attention to the strength development of these mixes is often not necessary—specifying a minimum time after placement is sensible in these situations.

Table 3. Minimum Opening Strength Needed for Full-depth Repairs

Slab Thickness (inches)	Compressive Strength for Opening to Traffic (psi)	
	Repair Length < 10 Feet	Total Slab Replacement
6	3000	3600
7	2400	2700
8	2150	2150
9	2000	2000
10 or more	2000	2000

Acknowledgment

This article is based on the newly revised American Concrete Pavement Association technical publication TB002P *Guidelines for Full-Depth Repair*. For more information, contact: ACPA, 5420 Old Orchard Rd., Suite A100, Skokie, IL 60077 (847-966-2272).

Gerald F. Voigt, P.E., is Director of Technical Services for the American Concrete Pavement Association, Skokie, Ill.

AMERICAN CONCRETE ★ PAVEMENT ASSOCIATION ★ acpa

5420 Old Orchard Road, Suite A100
Skokie, IL 60077
(847) 966-2272

APPENDIX F

APPENDIX G

M. Cruden

New York State Department of Environmental Conservation
Division of Environmental Remediation
Bureau of Construction Services, 12th Floor
625 Broadway, Albany, New York 12233-7013
Phone: (518) 402-9814 • **FAX:** (518) 402-9819
Website: www.dec.state.ny.us

Erin M. Crotty
Commissioner

NOV 15 2001

Mr. Gary Canfield
Great Lakes Veneer Corporation
375 Mitchell Street
Oswego, NY 13126

Dear Mr. Canfield:

Re: Site No. 7-38-033
Oswego Castings

The purpose of this letter is to resolve issues related to the maintenance of the concrete slab installed at your facility. In response to assertions you made in the first part of your letter of December 14, 2000 (enclosed), I note that the Department has evaluated your business activities and has attempted to design the slab accordingly. It is not our intention that you restrict the normal course of your business, but rather simply be cognizant of the existence of the cap, its intended purpose and take reasonable care to avoid damage to its integrity. I believe your staff have a certain amount of discretion in the course of normal operations to minimize excessive loading and impacts to the constructed slab.

Although the Department is unwilling to agree to an annual fixed dollar commitment per your request, we would be willing to agree that Great Lakes Veneer and its successor owners of the site be responsible for routine and periodic maintenance and failure of the slab caused by the fault of Great Lakes Veneer. Failure of the slab itself would not be the responsibility of the site occupant (unless the site occupant caused such failure) provided that Great Lakes Veneer agrees to take reasonable care in the normal course of business and there are no significant changes in use with regards to activities which take place on the slab. Routine and periodic maintenance and any repairs to failures of the slab caused by the fault of Great Lakes Veneer would be at Great Lakes Veneer's own cost and expense.

Routine and periodic maintenance would be defined to include:

- Routine care of the slab surface, including sweeping and washing with conventional cleaners and detergents. All abrasive grit should be removed and corrosive spills wiped up as soon as possible.

- Waterproof sealants should be applied to any hairline cracks to retard slab deterioration in the specific area of the crack.

- Particular close attention should be paid to all joints and joint sealants. Note that correct sealant application and maintenance minimizes infiltration of surface water and incompressible materials. Sealants can lose bond with joint reservoir sidewalls or lose internal bond and split open, along with loss of flexibility through natural aging and long-term exposure to oxygen, ozone and sunlight. To extend pavement life, joint sealants must be replaced periodically and, therefore, the condition of joints and joint sealants should be monitored. It's anticipated that a portion of the joints will need to be resealed from time to time to maintain the integrity of the slab.

- Inspect periodically for wear and breaks or gouges in the surface. Conditions of spalling, scaling or cracking should be noted and the Department notified in writing. Routine maintenance of such areas should be performed promptly by Great Lakes Veneer.

- NYS registered professional engineering annual inspection report. Any failures of the slab must be evaluated with respect to cause and recommendations for repair provided in the report. Your engineer's evaluation should address any long- term or recurring maintenance concerns.

- It may be necessary to isolate a portion of the slab to restrict activities and prevent further damage to the slab until adequate repairs are completed.

I would also point out that the geotextile and stone covers over the former cooling water pond and landfill areas must remain undisturbed. Also, in accordance with the wishes of Gary Barnett of Great Lakes Veneer, the cover over the cooling water pond was reduced to one foot. Originally, two foot of cover was specified to account for any future settlement. Mr. Barnett agreed to place any additional material required to address future settlement.

Your December 14, 2000 letter also raised some concerns with the proposed language of the deed restriction transmitted to you on October 17, 2000. The deed restrictions have been redrafted (enclosed) to address your concerns. The Department requests that these restrictions be recorded at your earliest convenience and the appropriate documentation be forwarded to my attention.

Two (2) copies of this letter are included. If Great Lakes Veneer is in agreement with this proposal, please sign and have notarized below, return one copy to my attention and this will constitute the maintenance agreement for the site. In any event, this letter outlines the technical maintenance requirements for the slab and Great Lakes Veneer should take reasonable care of it as of the date you occupy it.

If you have any questions, please call me at (518) 402-9812.

Sincerely,

Michael J. Cruden, P.E.
Project Manager
Western Field Services Section
Bureau of Construction Services
Division of Environmental Remediation

Enclosure

_____
Accepted By

STATE OF)
) SS:
COUNTY OF)

On the ___ day of _____, 20__ , before me personally came _____, to me known, who being duly sworn, did depose and say that (s)he resides in _____, New York; that (s)he is _____ of _____, the corporation described in and which executed the above instrument; that (s)he knows the seal of said corporation; that the seal affixed to said instrument is such corporate seal; that it was so affixed by authority of the Board of Directors of said corporation and that (s)he signed his/her name thereto by the same authority.

_____
Notary Public

Enclosures
MJC:mm
bcc: G. Harris
M. Cruden
M. Ryan
J. May
D. Desnoyers
Dayfile
e:oswego.maintenance.wpd

GREAT LAKES VENEER, CORP.

[illegible] Mitchell Street • Oswego, New York 13126
Office: 315-342-9178 • Fax: 315-342-9179

December 14, 2000

Mr. William S. Ottaway, P.E.
Project Engineer
NYS Department of Environmental Conservation
Bureau of Western Remedial Action, Room 348
50 Wolf Road
Albany, New York 12230-7010

Dear Mr. Ottaway:

I am in receipt of your letter dated November 17, 2000 in which you request response from Great Lakes Veneer, Corp. concerning design and maintenance of your proposed concrete slab.

As we have stated in the past, the use of the area that you are proposing to cap with concrete is subject to daily heavy equipment operation. We are in the hardwood lumber manufacturing business. The subject area is used to debark and stockpile hardwood sawlogs measuring up to twenty feet in length and 40" in diameter. It is common for as many as 40 to 50 logs to be placed in a pile in this area. They regularly role and fall from the pile as they are moved by loaders to the production area. It is not uncommon for logs to be dropped by the loaders from as high as 12 feet. This area also receives fully loaded tractor trailers weighing as much as 60,000 pounds. It is not unusual for logs to drop to the ground as they are unloaded from the trailers. Logs are also delivered to this area by trucks equipped with dump beds. As many as 25 logs can hit the ground at the same time within a small area as they are off-loaded.

I have attempted to describe the abusive activity that occurs in this area in the normal course of our business. You have asked us to evaluate the design of the slab you have proposed to accommodate a fail safe cover. We are not qualified to pass judgement on the engineering of the slab, nor do we think it is our responsibility to do so. We have described the use of the area. It is harsh and aggressive. We propose a cap that will survive such treatment, without fail.

The proposed deed restriction alludes to identifying slab damage as being caused by use or design flaw. Our intended use is abusive. We know it, we intend to continue it, and we have, and are, telling you that up front. If the slab is damaged by our using it the way we have described then the damage can not be from misuse. Any resulting damage, by default, must result from design deficiencies.

The objective of the slab is to contain the contamination that lies beneath. The DEC is proposing the method of containment based on the DEC's knowledge and experience in PCB migration. If at any time after slab installation the DEC determines that containment is less than satisfactory, we contend that the original design was insufficient or that the theories of adequate containment employed by the DEC have changed. Any additional remedial action would be the DEC's responsibility.

We acknowledge that over time even properly designed and installed concrete will develop a small number of hairline cracks. We do however contend that the discovery of numerous hairline cracks and those that develop into larger surface separations suggests an improper and insufficient concrete application. Our understanding from previous conversations with the DEC is that minor surface separations do not necessarily indicate that the required integrity of the slab has been destroyed. We understand that if left untreated these cracks may develop into larger fissures that may render the slab ineffective as a containment device.

We propose that Great Lakes Veneer, Corp. and successor owners of the site be responsible for the application of waterproof sealants to the reasonably occurring hairline cracks designed to retard slab deterioration in the specific area of the crack. Site owners should not be held responsible for the repair or replacement of the slab or slab sections that have develop excessive hairline cracks or larger surface separations.

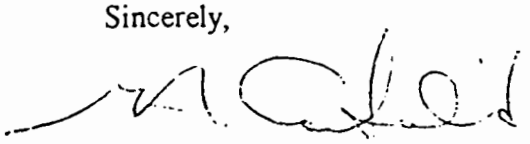
I have introduced the nebulous terms, "reasonably occurring" and "excessive" when referring to the physical condition of the slab. In an effort to avoid a debate to define these terms I suggest that "reasonable" and "excessive" lie on either side of an annual fixed dollar commitment. I propose that Great Lakes Veneer, Corp. be responsible annually for the first $2,500 of required slab maintenance cost, specifically including hairline crack treatment and NYS registered professional engineering annual inspection reports. Annual expenditures beyond $2,500 will be deemed necessitated by a required repair as determined by the DEC.

Before closing I would like to address two areas in the proposed deed restriction that need modification. First, I would like to see some clarity to the last sentence on paragraph 2. As written it is very open-ended pertaining to the handling and disposal of encountered PCB contaminated soil. I presume it is intended to refer to any contaminated soil uncovered or brought to the surface resulting from a DEC approved slab penetration requested by the Owner. I have no problem with an Owner being accountable for this specific responsibility. I would request that if my interpretation is correct a few words of limitation be added the last sentence.

Second, I am also concerned with the apparent open-ended nature of paragraph 4. It appears that this paragraph would hold an Owner hostage for any and all, existing and future institutional and engineering controls required by the DEC. This is far too encompassing. What are all the institutional and engineering controls? What could they become? Why should an Owner be responsible for something that doesn't currently exist? Certainly you can be more specific so we could evaluate our potential exposure. As written, paragraph 4 is a problem.

I trust I have addressed the unresolved issues as presented in your letter. Please review what I have written and get back to us with the next step in the process necessary to move forward. Thank you.

Sincerely,



Gary A. Canfield

Cc: Patrick Jones
Gary Barnett
Edward A. Mervine

Deed Restriction

A. The Owner shall, within 30 days of Owner's receipt of the Department's request to file a deed restriction, record an instrument with the Oswego County Clerk, to run with the land, that:

1. Shall prohibit the Site from ever being used for purposes other than for the current use as an industrial/commercial facility (excluding day care/child care facilities, health care facilities and eating establishments), if such other use requires the penetration of the foundation slab or excavation below the foundation slab without the express written waiver of such prohibition by the Department, or if at such time the Department shall no longer exist, any New York State department, bureau, or other entity replacing the Department;

2. Shall require Owner and Owner's successors and assigns to provide 30 days notice to the Department prior to penetrating or otherwise disturbing the floor slab and the cap in the yard area and to obtain the Department's approval, or if at such time the Department shall no longer exist, any New York State department, bureau, or other entity replacing the Department, of a remediation plan as part of any proposal to penetrate the floor slab and remove PCB contaminated soil. The handling and disposal of any PCB contaminated soil encountered as a result of a slab penetration shall be the responsibility of the Owner and Owner's successors and assigns.

3. Shall require Owner and Owner's successors and assigns to provide an annual inspection report, prepared by a NYS registered professional engineer, certifying that the foundation slab is intact and that there has been no penetration of the slab or excavation of soil from below the slab;

4. Shall require Owner and Owner's successors and assigns to continue in full force and effect any and all institutional and engineering controls (floor slab and cap in the yard area, geotextile and stone covers over the former cooling water pond and landfill areas, deed restriction and the monitoring wells) required by the Department unless a written waiver from such controls is obtained from the Department; and

5. Shall provide that Owner, on behalf of itself and its successors and assigns, hereby consents to the enforcement by Department, or if at such time the Department shall no longer exist, any New York State department, bureau, or other entity replacing the Department, of the prohibitions and restrictions that this Paragraph requires to be recorded, and hereby covenants not to contest such enforcement.

B. Within 30 days of the filing of the deed restriction, Owner shall provide the Department with a copy of the instrument reflecting the deed restriction certified by the Oswego County Clerk to be a true and faithful copy of the instrument as recorded in the Office of the Oswego County Clerk.