Report
Concrete Joint Removal
North Boeing Field
Seattle, Washington

November 9, 2010

Prepared for

The Boeing Company

LANDAU ASSOCIATES
130 2nd Avenue South
Edmonds, WA 98020
(425) 778-0907

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1.0 INTRODUCTION

This report documents Concrete Joint Removal activities performed at North Boeing Field (NBF) in Seattle, Washington. NBF is located east of East Marginal Way South, adjacent to the King County Airport and the City of Seattle Georgetown Steam Plant (GTSP) (Figure 1). Concrete Joint Removal activities were conducted by The Boeing Company (Boeing). Activities described in this report began in July 2010 and were completed in October 2010. The objective of the Concrete Joint Removal activities was to remove all concrete joint material (CJM) in areas of the Propulsion Engineering Labs (PEL) area of NBF where concrete was installed prior to 1980 and where samples of suspended storm drain solids have historically had elevated concentrations of polychlorinated biphenyls (PCBs). CJM removal activities were performed in general accordance with the *Concrete Joint Removal Work Plan, North Boeing Field, Seattle, Washington* (Work Plan, Landau Associates 2010a), which was submitted to the US Environmental Protection Agency (EPA) in accordance with the Toxic Substances Control Act (TSCA) requirements for self-implementing cleanup and disposal of PCB remediation waste and the Washington Department of Ecology (Ecology). Approximately 3,900 linear ft of CJM was removed. CJM removal areas are shown on Figure 2.

Ecology has requested that Boeing remove all CJM with concentrations of PCBs exceeding 1 milligram per kilogram (mg/kg) "because of potential for releases of caulk [CJM] to the property and to the storm drain system" (Ecology 2010). Boeing understands that Ecology will continue to use 1 mg/kg as the remediation level for total PCBs in CJM until sufficient technical information is available to suggest a different remediation level. Boeing has employed a two-dimensional approach to PCB-containing CJM at NBF in an effort to simultaneously remove significant amounts of PCB-containing CJM and evaluate the relationship between PCB concentrations in CJM and the risk of onsite and offsite exposure: CJM removal in the PEL area of the North Lateral drainage basin (as documented in this report), and a human health risk assessment (HHRA) and transport evaluation for PCB-containing CJM (Landau Associates 2010b). The results of the HHRA and transport evaluation activities will be documented in a separate report.

Removal and disposal of material anticipated to potentially have total PCB concentrations greater than or equal to 50 mg/kg, based on available data, was conducted in accordance with the TSCA under the requirements of the self-implementing procedures for the cleanup and disposal of PCB remediation waste [40 C.F.R. § 761.61(a)]. The TSCA removal area was identified based on previous sampling of CJM in the PEL area, which included two sample locations with PCB concentrations greater than or equal to 50 mg/kg. Although the CJM in this area was removed in 2002, the CJM in this area was considered to be TSCA material for the removal and disposal described in this report. The TSCA removal area is shown on Figure 2. Removal and disposal of material anticipated to have total PCB concentrations less

than 50 mg/kg was conducted in compliance with Model Toxics Control Act (MTCA) requirements and as an Interim Action in accordance with the NBF/GTSP Agreed Order. The non-TSCA removal area was identified based on samples of CJM from other parts of the PEL with total PCBs less than 50 mg/kg. The non-TSCA removal areas are also shown on Figure 2.

Characterization sampling and confirmation sampling was not performed prior to or following removal and disposal of CJM in the TSCA and non-TSCA areas. All CJM material in the PEL area was removed and disposed of; therefore, there was no material remaining from which to collect samples.

2.0 JOINT MATERIAL REMOVAL AND RESEALING ACTIVITIES

Between August and October 2010, approximately 3,900 linear ft of CJM was removed from the PEL area. All CJM was removed from the PEL area of the North Lateral drainage basin regardless of PCB content, with the exception of CJM in areas where concrete was documented by Boeing to have been installed after 1980. Concrete areas in the PEL area, including concrete areas with CJM removed as TSCA and non-TSCA waste, and concrete areas installed after 1980, are shown on Figure 2. Removal and disposal of CJM was conducted in a manner that minimized the potential for release of PCBs to the environment, while still allowing for proper disposal of the material. CJM removal was conducted by Boeing's Contractor Glacier Environmental of Mukilteo, Washington. Removal activities included setting up an exclusion zone, contamination reduction zone, and support zone at each area where CJM was removed. All proper personal protective equipment (PPE) was worn for each CJM removal task, in accordance with the health and safety plan provided in the Work Plan. Removal procedures included saw cutting, manual extraction, pressure washing, residual scraping, and cleanup. These removal activities are described in the sections below.

2.1 SAW CUTTING

In most areas of CJM removal, CJM was removed from the concrete expansion joint through the use of saw cutting techniques by cutting along each side of the joint with a concrete saw. The saw blade was set to cut to the bottom of the existing joint and skim the side of the joint. During cutting, the blade was cooled and lubricated with water. A walk-behind flat concrete saw with a 5/8-inch blade was used for all saw cutting activities where access allowed. A hand-held flat concrete saw was used in locations that were not easily accessible to the walk-behind saw cutter, such as against building foundations. Drum vacuums were used to control and capture the water and slurry generated during the cutting operations. Removed solid material was placed in drums.

2.2 MANUAL EXTRACTION

After both sides of the expansion joint were cut, as much material as possible was manually extricated by hand and knife blade. Manual extraction was also used in hard-to-access areas where the walk-behind saw cutter or the hand-held flat concrete saw could not effectively maneuver. Removed solid material was placed in drums.

2.3 PRESSURE WASHING

Pressure washing was used as another method for removing smaller pieces of CJM. Pressure washing was also used to clean the joint areas prior to addition of the new sealant. Pressure washing with a fan tip was used to clean the slurry and debris out of the joint and from the top of the concrete surrounding the joint. Drum vacuums were used during all pressure washing operations to control and capture the wastewater.

2.4 RESIDUAL SCRAPING AND CLEANING

Following saw-cutting, manual extraction, and pressure washing (or any combination of the three removal techniques), hand grinders with dust directors were used to remove any residual material not previously removed and to prepare the joint for placement of backer rod and new sealant. Where required, a pressure washer with a fan tip was used to clean the adjacent concrete surface and remove any accumulated debris from the joint prior to filling. Drum vacuums were used during pressure washing to control and capture the wastewater. Street sweepers were also used by the contractor to scrub and vacuum dry surfaces around the work areas where CJM was removed.

2.5 RESEALING ACTIVITIES

When joint removal and cleaning activities were complete, polyethylene backer rod was placed along the length of each joint in preparation for resealing. The backer rod is also used to control the depth of the sealant. Following placement of the backer rod, a primer solution was sprayed inside the joint and over the backer rod. Concrete joints were resealed with Urexpan® NR-300 manufactured by Pecora Corporation. Urexpan® NR-300 is a two-part, chemically-curing, cold-applied self-leveling modified polyurethane elastomeric sealant. The Urexpan® NR-300 technical specifications data sheet is provided as Appendix A.

3.0 RUNOFF CONTROL

Control measures were implemented to capture wastewater, slurry, and debris generated during removal and replacement of CJM and to prevent CJM from entering the stormwater drainage system. The control measures implemented included the following:

- **Air-Powered Drum Vacuums.** These were used during all cutting and pressure washing activities and when removal activities were performed during periods of light rain.
- **Street Sweeper.** A street sweeper was used by the contractor to scrub and vacuum dry surfaces around the work area where CJM was being removed.
- **Weather Restrictions.** CJM removal and replacement was not performed during periods of significant rain, typically based on the presence of rainwater pooling inside the open joints.
- **Sequencing.** CJM removal was sequenced so that removal activities started in areas where CJM was anticipated to be non-TSCA waste and finished in the area of TSCA removal to prevent cross-contamination.
- **Catch Basin Filters or Other Control Devices.** Prior to removal of CJM, catch basin filters, inflatable plugs, water dams, and plastic linings were utilized where runoff from the work area could enter storm drain systems.

4.0 MANAGEMENT OF WASTE

All wastewater generated during removal of PCB-containing CJM and wastewater generated during decontamination activities was contained and properly managed as though it were remediation waste under TSCA in accordance with the self-implementing requirement in 40 C.F.R. 761.61 (a). Wastewater was collected and treated to less than 3 micrograms per liter (µg/L) PCBs using flocculants, particulate filters, and/or carbon treatment prior to entering the NBF Sweeper Decant Station for further treatment through solids settling and/or additional carbon filtration methods. Treated wastewater that met the NBF Sweeper Decant Station's discharge limits, as required by Boeing's King County Industrial Waste Permit, was discharged to the sanitary sewer. These measures conform to the TSCA regulations 40 C.F.R. § 761.50(a)(3) and 40 C.F.R. § 761.79(b)(1)(ii). A process flow diagram for solids and wastewater treatment procedures (for TSCA and non-TSCA regulated material) is provided on Figure 3. Due to the treatment capacity of the primary NBF Sweeper Decant Station, wastewater may have been processed in a temporary treatment system, meeting the requirements for discharge as described above. No treated wastewater was discharged to the Lower Duwamish Waterway.

All solid waste from the TSCA removal area was contained in drums, cubic yard boxes, or lined roll-off boxes and disposed of at the Waste Management NW landfill in Arlington, Oregon, a chemical waste landfill permitted under 40 C.F.R. § 761.75 to accept TSCA waste. All solid waste from other areas, which was anticipated to contain PCBs at concentrations less than 50 mg/kg, was managed in accordance with Chapter 173-303 WAC.

5.0 DECONTAMINATION

Non-disposable and nonporous equipment, such as concrete saws, pressure washers, drum vacuums, and small tools, that came into contact with CJM was decontaminated after each use. Decontamination of equipment after removal of CJM from the TSCA removal area was performed using pressure washing, steam cleaning, and/or hand-wiping with the appropriate solvent in accordance with the decontamination procedures required under 40 C.F.R. § 761.79, or were discarded as contaminated TSCA waste and placed into a roll-off box to be disposed of at Waste Management NW landfill, a chemical waste landfill permitted to accept TSCA waste under 40 C.F.R. § 761.75. Only parts of the equipment that were likely to have been in contact with PCB-containing materials were decontaminated. All wastewater generated during decontamination was collected and treated as described in Section 4.0 above.

6.0 USE OF THIS REPORT

This report has been prepared for the exclusive use of The Boeing Company and applicable regulatory agencies for specific application to the NBF locality. No other party is entitled to rely on the information and recommendations included in this document without the express written consent of Landau Associates. Further, the reuse of information and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau Associates, shall be at the user's sole risk. Landau Associates warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

This document has been prepared under the supervision and direction of the following key staff.

LANDAU ASSOCIATES, INC.

Colette M. Griffith
Senior Staff Engineer

Kristy J. Hendrickson, P.E.
Principal

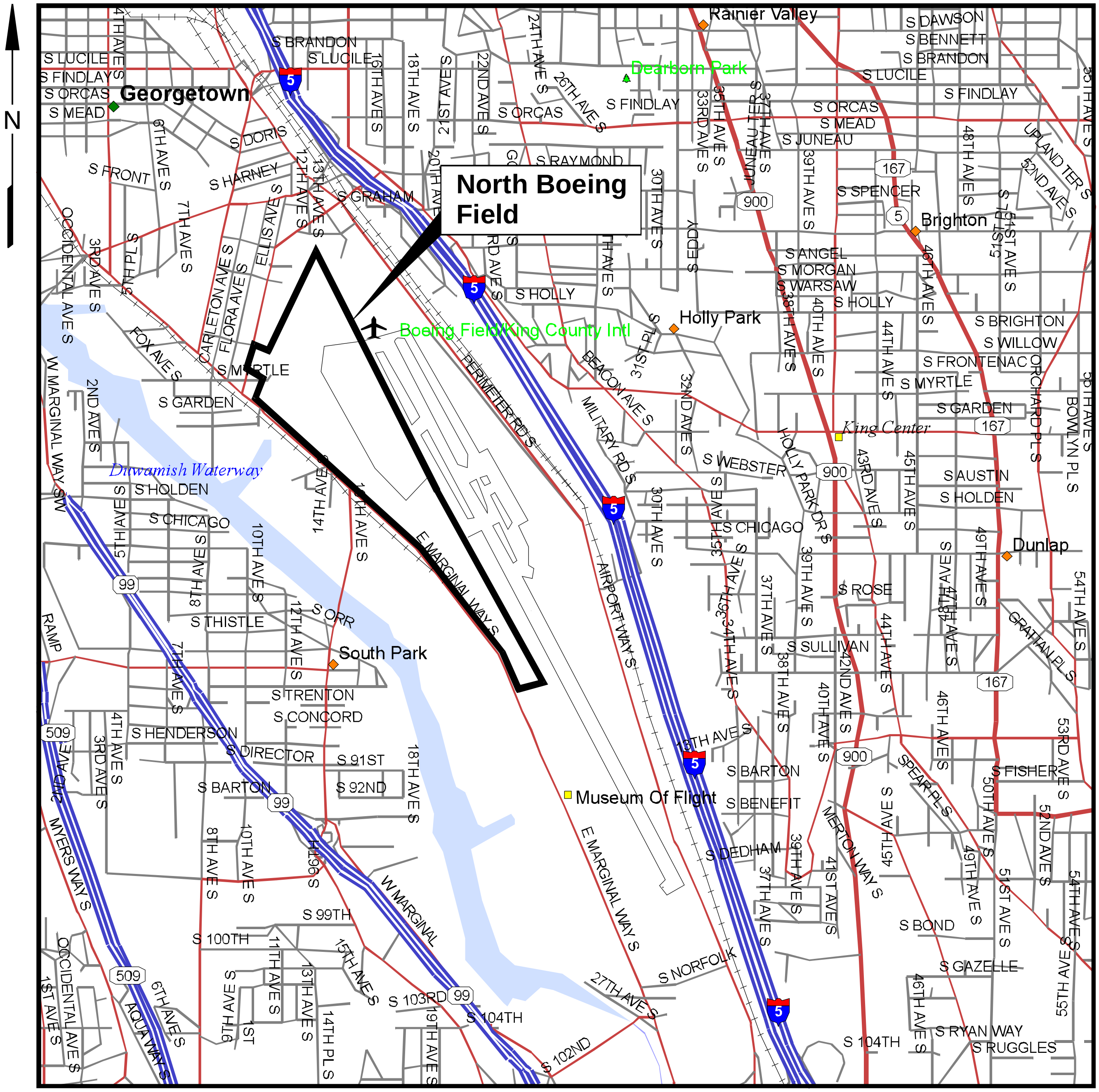
CMG/KJH/tam

7.0 REFERENCES

Ecology. 2010. Letter to Carl Bach, The Boeing Company, re: *Interim Action – Removal of Concrete Joint Material, North Boeing Field/Georgetown Steam Plant Agreed Order No. DE5685*. Mark Edens, Washington State Department of Ecology. March 25.

Landau Associates. 2010a. *Work Plan, Concrete Joint Removal, North Boeing Field, Seattle, Washington*. June 29.

Landau Associates. 2010b. *Work Plan, Human Health Risk Assessment and Transport Evaluation for Polychlorinated Biphenyls in Concrete Joint Material, North Boeing Field, Seattle, Washington.* August 12.



Map from DeLorme Street Atlas USA, 2002

0 ½ 1
Scale in Miles

Flume Realignment| V:\025\082\089\SD Structure & Surface Solids Investigation\Figure 1.cdr 8/29/2009

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North Boeing Field Seattle, Washington	**Vicinity Map**	Figure 1

Y:\Projects\025082\MapDocs\210\ConcreteJointRemovalGreen.mxd 11/9/2010 NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

- Concrete Area with Concrete Joint Material Removed and Replaced in 2010
- Concrete Area with Concrete Joint Material Documented by Boeing to have been Installed after 1980
- Concrete Area with Concrete Joint Material Removed as TSCA waste and Replaced in 2010
- Concrete Joint Material Removal Area Boundary
- North Lateral
- North-Central Lateral
- Other lines

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.
2. Concrete joint material was not removed in concrete areas documented by Boeing to have been installed after 1980.

0 150 300

Scale in Feet

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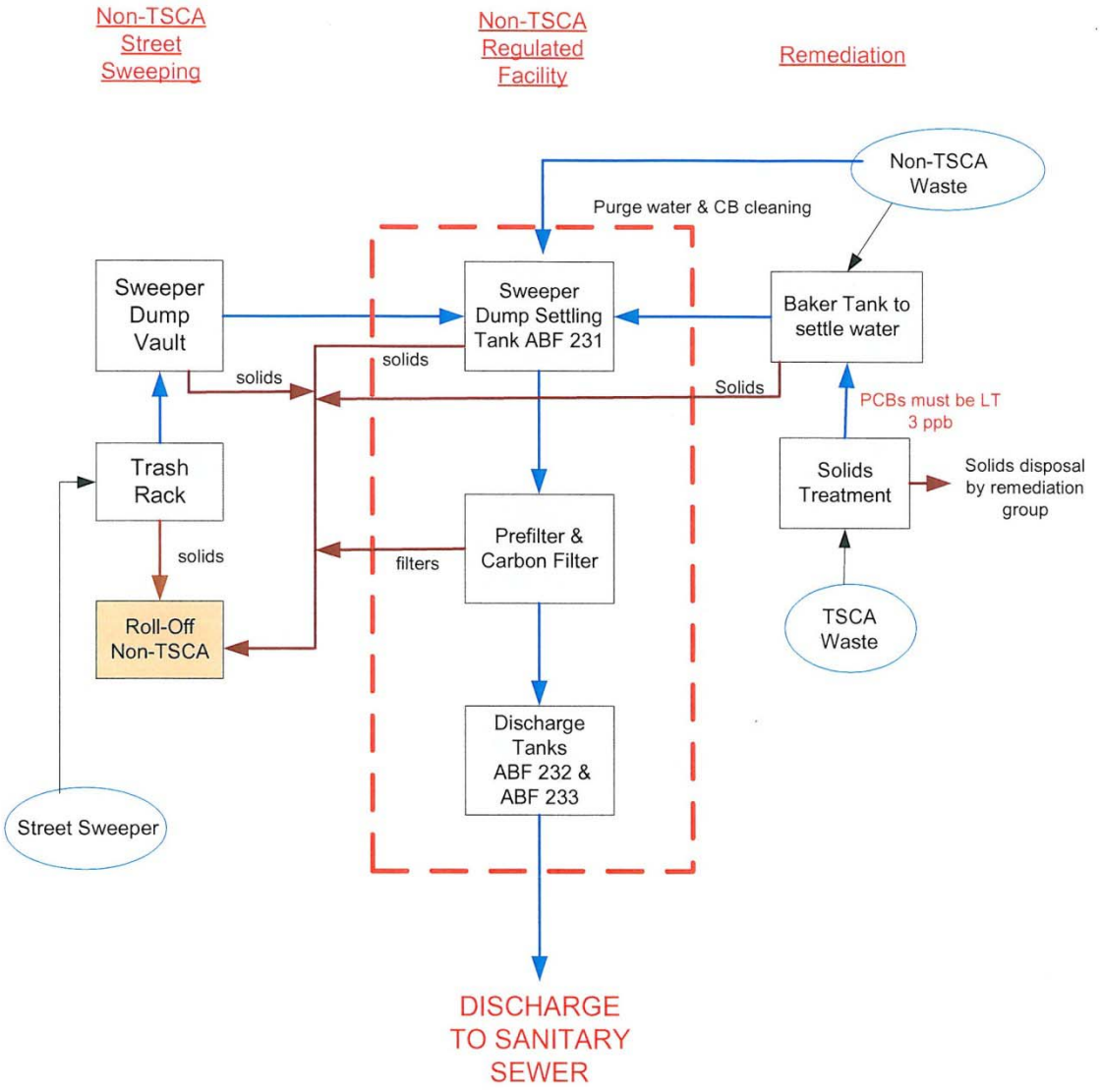
North Boeing Field
Seattle, Washington

Concrete Joint Removal Areas

Figure
2

North Boeing Field
Sweeper Decant Station
Process Flow Diagram
Site A4229-C



Source: The Boeing Company.

North Boeing Field Seattle, Washington	**North Boeing Field Sweeper Decant Station Process Flow Diagram**	Figure 3

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APPENDIX A

Urexpan® NR-300
Technical Specifications Data Sheet

Urexpan® NR-300

Jet Fuel & Blast Resistant Traffic-Grade Sealant

Specification Data Sheet

PECORA CORPORATION
Architectural Weatherproofing Products
U.S.A. • since 1862

1. BASIC USES

• Urexpan® NR-300 is designed specifically for sealing joints in airport runways, terminal ramps, hangars and transportation storage areas, but is equally effective in driveways, parking decks, sidewalks or other areas where the various fuels and liquids may come into contact with the sealant after curing.

2. MANUFACTURER

Pecora Corporation
165 Wambold Road
Harleysville, PA 19438
Phone: 215-723-6051
800-523-6688
Fax: 215-721-0286
Website: www.pecora.com

3. PRODUCT DESCRIPTION

Urexpan® NR-300 is a two-part, chemically-curing, cold-applied self-leveling modified polyurethane elastomeric sealant that withstands heavy vehicular traffic and is virtually unaffected by jet fuel, hydraulic fluids, oil or lubricants. It is available in two versions: hand mix (Type H) and machine mix (Type M), the only difference being the rate of cure.

Limitations: Not recommended for joints contaminated with oil, grease, wax, curing compounds, concrete sealers, form release agents, etc. Not for use in joints less than 1/4" (6 mm) wide.

Note: Urexpan® NR-300 is not to be used as a structural component or in longitudinal expansion joints that are intended to be used on a constant traveling surface.

PACKAGING

- 4-gallon units (15.14 L) Hand mix
- 10-gallon units (416.35 L) Machine mix
- 110-gallon unit Machine Mix

A unit consists of equal volumes of base and activator.

COLOR

- Dark Bronze - Base
- Golden Bronze - Activator

4. TECHNICAL DATA

Applicable Standards: Meets the requirements of Federal Specifications: SS-S-200E; SS-S-195B & TT-S-00227E: ASTM D-1850; ASTM C-920 & PA DOT 408/90.

Independent Testing: When submitting samples of NR-300 to outside agencies for the purpose of specification testing, please contact Pecora Technical Services for a sample submittal form. Fill out the form completely and return. The test sample then will be shipped to you for submittal.

Joint Design: The width of the joint should be a minimum of 8 times the anticipated movement. The width or depth of the joint should not be less than 1/4" (6 mm). In joints up to 1/2" (12 mm) wide, the depth of the sealant should be equal to the width. In joints wider than 1/2" (12 mm), but not exceeding 1" (25 mm), the depth should be maintained at 1/2" (12 mm). For joints wider than 1" (25 mm), please consult our Technical Services department.

5. INSTALLATION

Surface Preparation: Surfaces must be clean and dry. The presence of moisture will cause gassing before the sealant achieves ultimate cure. Oil, grease, wax, form release agents, curing compounds, laitance and old caulking compounds must be removed by sandblasting or sawing to sound, virgin concrete for optimum sealant performance.

Priming: Primers should always be used in extended exterior exposure applications where horizontal joints may be subject to conditions of standing water, ice, jet fuel or other liquids. With Urexpan® NR-300, P-75 is used on concrete and P-100 on metal. Primers should be dry before the sealant is applied. Drying time for P-75 is one hour at 75° F (24° C) and 15 minutes for P-100. The sealant must be applied within 8 hours after priming. For further information on primers, send for Technical Bulletins #25 and #28.

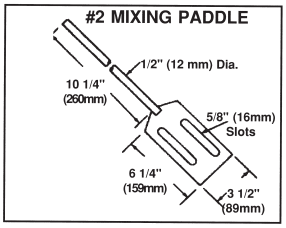
Note: Priming is never a substitute for proper surface preparation as outlined in the section above.

TYPICAL PHYSICAL PROPERTIES at 75°F (24°C), 50% RH

Test Property	Value	Test Procedure
Hardness, Shore OO		
Initial	12-15	ASTM C661
Ultimate	23-24	ASTM C661
Initial Cure		
Hand mix (hours)	24	ASTM C679
Machine mix (minutes)	30	ASTM C679
Jet Fuel Immersion (hours)	24	Meets req. of SS-S-200E
Maximum Movement Capability		
Extension (%)	12.5	ASTM C719
Compression (%)	12.5	ASTM C719
Extension (%)	50.0	SS-S-200E
Pot Life		
Hand mix (hours)	4	Pecora Corporation
Machine mix (minutes)	15	Pecora Corporation
Resilience recovery (%)	75	ASTM D5329
Tack-Free to Touch		
Hand mix (hours)	6	ASTM C679
Machine mix (minutes)	30	ASTM C679
Open to Traffic		
Hand and Machine mix (hours)	48	Pecora Corporation
VOC Content (g/L)		
Activator	100	D3960
Base	100	D3960

Joint Backing: Close cell polyethylene backer rod should be used to control the depth of the sealant. Use a size that will compress 25% when inserted into the joint. Non-porous semi-rigid backing materials may be used if a bondbreaker tape is applied to prevent adhesion of the joint filler. Dry, clean sand may be used as a joint filler in interior areas where freezing temperatures are not anticipated and joint movement is minimal.

Mixing: Type H - Pour equal volumes of activator and base into a clean container of sufficient capacity to permit mixing of the two components. Thoroughly blend the activator and base for a minimum of 5 minutes using a heavy-duty, low-speed drill (200 to 400 rpm) with a Pecora #2 Mixing Paddle or a Pecora Prop Mixer. Scrape sides and bottom of container frequently; keep the mixer below the surface to avoid entraining air.



Type M - Pour equal volumes of activator and base into the appropriate holding tanks of the mixing machine. Activator should be mixed prior to use, to remove any setting that may have occurred during storage and shipping. Use collapsable blade in large bung hole to avoid ambient air entrainment. Activator and base should arrive at the mixing head on a 1:1 ratio by volume. Before filling the joints, extrude and cure a test sample to see that a correct mix is achieved.

Note: In containers, it may be difficult to distinguish between activator and base colors. If it is necessary to do so, smear a sample of each on a white surface. The dark bronze material is the base, and the golden bronze colored material is the activator. See technical bulletin #78 for more information. Mix drums thoroughly before conducting color check.

Application: Fill joints at temperatures between 40° F (5° C) and 90°F (32°C). Lower temperatures will delay the cure; higher temperatures will decrease pot life and accelerate cure.

If the joint is inclined on a slope greater than 1.5%, it will be necessary to dam the joint at intervals with Backer Rod to prevent excessive flow. When the sealant has achieved partial cure, the Backer Rod can be removed and the resulting voids filled with sealant.

Cleaning: Clean tools, hands and spillage as soon as possible with xylene* or toluene*.

**(Solvents mentioned are toxic and flammable; observe manufacturers precautions and refer to Material Safety Data Sheets).*

Storage Life: Approximately 6 months when stored at temperatures lower than 80° F (27° C) in original, sealed containers. After a container has been opened, the contents should be used as soon as possible. Exposure to moisture in the air considerably shortens storage life.

Precautions: Despite its elasticity and abrasion resistance, Urexpan® NR-300 can be damaged by sharp objects such as spike heeled shoes, snowplow blades, studded tires, etc.

Contains diisocyanates; avoid prolonged breathing of vapors and contact with skin and eyes. Wash hands thoroughly with soap and water after use and before eating or smoking. Upon accidental contact with eyes, flush thoroughly with water and seek medical attention immediately. Refer to Material Safety Data Sheet.

FOR PROFESSIONAL USE ONLY.
KEEP OUT OF THE REACH OF CHILDREN.

6. AVAILABILITY AND COST

Pecora products are available from stocking distributors nationwide. For the name and telephone number of your nearest representative, call the number below or visit our website at www.pecora.com.

7. WARRANTY

Pecora Corporation warrants its products to be free of defects. Under this warranty, we will provide, at no charge, replacement materials for, or refund the purchase price of, any product proven to be defective when used in strict accordance with our published recommendations and in applications considered by us as suitable for this product. The determination of eligibility for this warranty, or the choice of remedy available under this warranty, shall be made in our sole discretion and any decisions made by Pecora Corporation shall be final. This warranty is in lieu of any and all other warranties, expressed or implied, including but not limited to a warranty of merchantability or fitness for a particular purpose and in no case will Pecora be liable for damages other than those expressly stated in this warranty, including but not limited to incidental or consequential damages.

8. MAINTENANCE

If the sealant is damaged and the bond is intact, cut out the damaged area and prime with P-200 Primer and recaulk. If the bond has been affected, remove the sealant, clean and prepare the joint in accordance with the instructions under "Installation".

9. TECHNICAL SERVICES

Pecora representatives are available to assist you in selecting an appropriate product and to provide on-site application instructions or to conduct jobsite inspections. For further assistance call our Technical Service Department at 800-523-6688.

10. FILING SYSTEMS

- Sweet's Catalog File: www. sweets. com
- General Building
  - 07100 Waterproofing
  - 07920 Sealants
- Civil Engineering
  - 07100 Waterproofing

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165 Wambold Road, Harleysville, PA 19438
Phone: 800-523-6688 • 215-723-6051 • FAX: 215-721-0286