UNIVERSITY OF MISSOURI, COLUMBIA
MISSOURI UNIVERSITY RESEARCH REACTOR
LICENSE NO. R-103
DOCKET NO. 50-186

# CONTAINMENT STRUCTURE CONDITION ASSESSMENT IN SUPPORT OF LICENSE RENEWAL

JULY 31, 2001

REDACTED VERSION*

SECURITY-RELATED INFORMATION REMOVED

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ASSESSMENT REPORT FOR:
MURR – Renewal & Re-licensing
Project Number: 000761

# Containment Structure Condition Assessment

At
UNIVERSITY OF MISSOURI - COLUMBIA

COLUMBIA, MISSOURI

FOR:
THE CURATORS OF THE UNIVERSITY OF MISSOURI

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July 2001
SL-5405


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## EXECUTIVE SUMMARY

A Containment Structure Condition Assessment of the University of Missouri Research Reactor, (MURR), was conducted from April 25, 2000 through April 29, 2000. The reinforced concrete Containment Structure was examined to assess the capability to perform satisfactorily in minimizing leakage through the pressure boundary, when subjected to the design pressure of 2 psi, over the next 26 years.

The concrete structure elements, the inner pressure boundary coating, the roofing materials and the penetrations were checked to ensure that the Containment Structure pressure boundary could be maintained. The various items were in good condition with no significant signs of deterioration.

An assessment of the Containment Structure seismic resistance was performed using seismic ground motion criteria consistent with those applicable at the Callaway Nuclear Power Plant. The Containment Structure was determined to be structurally adequate to resist the Operating Basis Earthquake (OBE) and Safe Shutdown Earthquake (SSE) Seismic Events.

Repair Recommendations are made for the identified minor deterioration of the Containment Structure concrete, coatings and penetrations.

An Allowable Live Load Sketch is provided to limit excessive loads on the Grade Level.

Considering the condition of the various structural elements, with the Repair Recommendations and utilizing the Allowable Live Load Sketch, the Containment Structure will give good service life for at least the next 26 years.

## 1.0 Purpose/Objective

The objective of this report is to present the Summary of Findings of the Containment Structure Condition Assessment of the University of Missouri Research Reactor, (MURR), Containment Structure. An examination was performed from April 25, 2000 through April 29, 2000.

The reinforced concrete Containment Structure was examined to assess the capability to perform satisfactorily in minimizing leakage over the next 26 years when subjected to the design pressure of 2 psi. The examination included the interior coatings to assess integrity and projected life. In addition, the concrete, roof structure and roofing system were examined.

Separately, an assessment of the Containment Structure seismic resistance was performed using seismic ground motion criteria consistent with those applicable at the Callaway Nuclear Power Plant. The assessment utilized simple equivalent static techniques to account for the dynamic seismic effects.

The following Sections summarize the results of the examination. Examination notes are provided in Attachment 1. - Walkdown Notes. Repair recommendations referenced in this report are given in Section 9.1 - Repair Recommendations.

## 2.0 Background

The reactor is housed in the concrete Containment Structure that was built in the mid 1960s. The Containment Structure is a pressure boundary, which maintains isolation for accidental radiation release. The structure integrity was examined in regards to visible concrete cracks, degraded coating on the inside pressure boundary surface, and deterioration of the roofing system and the penetrations. In addition, a seismic assessment was performed using engineering analysis.

Concrete elements can crack, even if reinforcing steel (rebar) is added, due to settlement problems, overloading of the elements with heavy loads or poor workmanship. In addition, under normal bending or axial tension stress, concrete is expected to crack to engage the tensile strength of the reinforcing. Poor workmanship and settlement problems are usually quickly identified while overloading may be due to a single event, at any time. A hairline concrete crack, (a crack the width of a hair), most likely will not indicate a structural problem. Wider cracks may indicate displacement of concrete elements and would be considered a structural problem.

Concrete cracks can also degrade the pressure retention capability of the structure by creating additional leakage pathways. Concrete already is a porous material that can

leak even without a crack. Coatings are used to seal the uncracked concrete or create a membrane to stop gases from reaching any cracks.

The Containment Structure is coated on the inside surface to reduce the small airflow that uncoated concrete may allow. A path for airflow out of the isolation of the Containment Structure can occur if a coating fails at, or near, the location of a concrete crack.

Along with a visual examination, the annual Leak Rate Testing, (LRT), is a good indicator of the concrete integrity. A concrete elastomeric coating that is not brittle and can stretch, may cover over and seal small concrete cracks. If a coating is cracked, indicating a concrete crack underneath, then typically a wider crack is present.

The roofing system helps seal the outside surface of the concrete roof for air leakage along with protecting the building from weather.

The penetrations allow conduits and pipes to enter containment without compromising the pressure boundary. The personnel access door (door 277), and the equipment door at the Beam Port Level are both considered penetrations for this report.

It is not known if the original design of the Containment Structure included seismic loading. The seismic assessment is performed to consider ground motion criteria consistent with those applicable at the Callaway Nuclear Power Plant.

## 3.0 Containment Structure Concrete

The visible concrete elements of the structure were examined. Only a few square feet of the inside surface is uncoated while a large portion of the outside surface is uncoated.

Approximately 12 concrete cracks were noted, see Attachment 3. - Concrete Crack Layout Sketch. Eleven of the cracks were located on the top and/or the bottom surfaces of the ceiling of the North Area of the Beam Port Elevation. Of the eleven, due to lack of access, only the hairline floor cracks in Room 218 could be verified. The floor cracks in Room 222 were partly obscured by floor tiles. The floor cracks in the inner corridor and the hallway to the outer corridor walkway, have been reworked by mechanically opening the cracks to add sealant. The sealant reduces leakage for the LRT. The twelfth concrete crack is a vertical hairline crack on the West Containment wall approximately 4 feet above the Grade Level. The only reason this crack is visible is because originally installed equipment has been removed from the wall leaving uncoated concrete. The crack is not visible in the coated area between the uncoated areas. See Repair Recommendation #3 in Section 9.1 - Repair Recommendations, for

coating bare concrete with DECADEX (crack repair per Repair Recommendation #1 is not required).

Additionally, there are concrete cracks in the construction joints of the floor of the Grade Level, (above the North area of the Beam Port Level), to the Laboratory Building, (located in Attachment 3.- Concrete Crack Layout Sketch). These concrete cracks are in the joints between the Laboratory Building and the Containment Structure where expansion material, designed to expand and contract with the different building movements, was not used. Lack of expansion material is a serviceability issue as a crack may develop creating an inconsistency in the floor surface. See Repair Recommendation #1 in Section 9.1 - Repair Recommendations, to rework the construction joints maintaining a useable floor, without bumps.

It is possible that floor cracks have occurred due to excessive floor loading. In order to avoid new crack formation and propagation in the future, it is recommended that the applied live loads in the affected areas be limited as shown in Attachment 4. - Allowable Live Load Sketch.

1) During the Leak Rate Test the following was observed: In the North Tower, fourth Elevation, there is a small leak through the concrete wall at the location of a structural member supporting the fifth elevation, behind the web at the West end. See Repair Recommendation #6 in Section 9.1 - Repair Recommendations, to plug the leak.

2) During the Leak Rate Test the following was observed: In the East Tower, fourth Elevation, one of the structural members supporting the fifth elevation has medium to heavy rust. See Repair Recommendation #7 in Section 9.1 - Repair Recommendations, to remove the rust and recoat the member. This repair can be used for all carbon steel recoating outside of containment.

## 4.0 Containment Coatings

The Containment Structure pressure boundary integrity is enhanced by a protective coating on the inside surface of the exterior wall and roof. In the mid 1990s, most of the interior surface was coated with a DECADEX coating system manufactured by Liquid Plastics, Limited, Lancashire, England, (see References). DECADEX is a waterborne, synthetic rubber copolymer, which cures to form an elastomeric membrane and is used primarily as a roofing material. DECADEX is used on the outside surface of some of the Canadian Nuclear Plant concrete containments.

The DECADEX system installed has a gray colored primer/sealer with two cream colored topcoats. The specific DECADEX coating system of the four listed in the current vendor literature is not identified, but appears to be either P10 or FL10. Per the

vendor information for any of the systems, durability in an outdoor application is 10 to 15 years.

The DECADEX coating system has discoloration or streaks on portions of the inside surface of the containment structure. Some of the areas with streaks are the North wall, the South wall and parts of the West wall, (see Attachment 2. - Pictures). The streaks of a darker shade are variable and do not have a consistent shape or location. Walkdown information, with pictures, concerning the DECADEX streaking was forwarded to Harry B. Comfort of the Marcus Corporation, East Haddam, CT, the United States supplier of DECADEX. Mr. Comfort responded by letter, describing the streaking as, "... a result of moisture and contaminants/dirt being drawn out of the wall and through pinholes in the membrane after the walls have been pressurized and depressurized, " (see References and Attachment 5. - Marcus Corp, DECADEX Coating Repair Recommendation - Vendor Letter). Sargent & Lundy has reviewed the vendor letter response and agrees with the with the potential coating repair methods, listed as Repair Recommendation #2 & #3 in Section 9.1 - Repair Recommendations. The DECADEX technical data description states that the coating is vapor permeable, therefore, Sargent & Lundy concludes that: a) another coat of DECADEX would certainly improve the containment appearance, b) it could be expected that the air loss during the pressure test might improve slightly, and c) if another coat was applied we would expect the streaks to appear again in a few years when the dust builds up again in the pores of the coating. The streaks do not indicate distress of the coating system. Sargent & Lundy does not recommend applying another coat of DECADEX at this time for containment serviceability. Touch-up of existing coatings and coating of bare concrete should be performed at this time.

The small areas not coated with DECADEX are distributed throughout containment in areas that were not accessible, i.e., behind duct work, or were left with a previous coating like portions of the fifth floor along the East wall. The previous coating system is a brittle coating, which extensively cracked. The previous coating was removed in the areas were the DECADEX system was used.

The Containment Structure exterior surface is generally uncoated but has a patchwork of sealing material, which was previously applied to improve the results of the annual LRT. The various sealing materials have different shades and appear to have been applied at different times. The material will be described as Unspecified Sealing Material (USM) to account for different types and application dates. After the DECADEX coating system was applied to the inside surface, the LRT results improved sufficiently that only minor leaks were observed through the walls. Two thirds of the exterior surface, above the laboratory roof level, is covered with siding. The areas under the siding were not examined.

The concrete floor of the inner corridor surrounding the Containment Structure, and the concrete floors of the Physics Laboratory (Room 222) and the Radio Chemistry Laboratory (Room 218) or otherwise, the roof of the Beam Port Level, are part of the pressure retention system. The high traffic corridor and the Laboratories have concrete cracks and deteriorated floor coverings. The cracks in the corridor have been patched, but may reopen decreasing margin in the LRT. The cracks should be patched in accordance with Repair Recommendation #1, and new floor coatings installed in the corridor and laboratories per Repair Recommendation #4 in Section 9.1 -Repair Recommendations.

Note: A floor coating system for the Beam Port Level floor is suggested in Repair Recommendation #5 in Section 9.1 - Repair Recommendations. This floor coating is an epoxy self-leveling, 100% solids, coating system which will reduce concrete dusting.

Four adhesion test dollies were used to obtain a general idea of the adhesive properties of the wall coating of the North Area, Beam Port Level. The test method was per ASTM D4541-95, Standard Test Method for Pull-off Strength of Coatings using Portable Adhesion Testers, (Section 10.0, Reference 10.1). One test result was 100 psi while the other results were 250 psi or greater. The smaller test result was a failure of the concrete substrate because of poor surface preparation and appeared to be an isolated condition, while the other three cases were primarily undercoat adhesion failures. An average test result of 200 psi or higher is considered acceptable per ANSI N512, Protective Coatings (Paints) for the Nuclear Industry. Therefore, the results that were obtained indicate good coating adhesion, and further testing is not warranted based on the visual inspection of the coating, which showed only minor discrepancies.

## 5.0 Roofing

The Containment Structure has an "IRMA" type roofing system, installed in 1995, completely replacing the previous roofing system. The roof was accessed from the North Tower opening. There were no signs of deterioration of the roofing membrane, the flashing, the pavers or the drainage system. There was only dirt debris visible at the few roof low spots. The only item of note was missing counter flashing on the North edge of the roof at the location of the North Tower.

There is no evidence that deterioration of the roof is significant or premature. Preventive maintenance as per Repair Recommendation #8 in Section 9.1 - Repair Recommendations, a biannual roof cleaning, will ensure a long service life to the roof materials. The expected life of the existing roof is 15 to 20 years.

## 6.0 Penetrations

There are penetrations through the Containment pressure boundary. The accessible penetrations were examined. Accessible penetrations are:

- Two electrical penetrations at the Beam Port Level in the South East corner;
- A mechanical water/pool penetration at the Beam Port Level;
- A mechanical penetration along the East wall at the Beam Port Level;
- A penetration at the fifth level in the West Tower;
- A penetration from the pipe trench to the reactor pool;
- The personnel access door at the Grade Level, door 277; and
- The equipment door at the Beam Port Level.

The penetration in the East Tower, in the upper levels is not accessible.

The pipe trench to pool penetration showed minimal signs of deterioration, which was not considered to be significant. The mechanical water/pool penetration shows no signs of deterioration. Note: Deterioration of the piping in the water/pool penetration is addressed in the Sargent & Lundy report, SL-5410 titled, "Review of Condition Assessments", Reference 10.4.

The two electrical and one mechanical penetration at the Beam Port Level and the penetration in the West Wall at the fifth level, all have USM. The penetration elements, such as, the steel plate material and the concrete do not show obvious deterioration, however, the large quantities and different colors of USM indicates that the penetrations have leaked at various times. Due to movements of the penetrants, the penetrations may leak in the future. See Repair Recommendation #6 in Section 9.1 - Repair Recommendations, to add sealant to the electrical penetrations.

The two Containment doors leak air in the LRT. Replacement of the door inflatable gasket has not eliminated the leakage. See Repair Recommendation #9 in Section 9.1 - Repair Recommendations, for a potential fix to the personnel door. The recommendation might also be used for the equipment door.

## 7.0 Leak Rate Test Observations

H. R. Miller witnessed the LRT conducted on April 24, 2000, when the Containment Structure is pressurized to 1 psig, (one-half of the design pressure of 2 psig). The LRT measured leakage was well within the allowable leakage indicating that the containment structure is functioning quite well. The exterior of the containment structure was examined for air leaks during the test. The following four leaks were observed:

- Door 277, the inside personnel access door to Containment on the 2nd floor or Grade level. The door was leaking all around the perimeter. (See Repair Recommendation #9 in Section 9.1 - Repair Recommendations)

- The ceiling of the Beam Port Floor North Area. The ceiling cracks are floor cracks in the corridors. The corridors are: the inner corridor which encircles the Containment wall; and the corridor that leads North to the outer corridor running along the outside of the Lab Building.

- Electrical penetrations at the Beam Port Floor, South wall by the East corner and the East wall by the South corner, have some minor leakage. (see Repair Recommendation #6 in Section 9.1 - Repair Recommendations)

- In the North Tower, fourth Elevation, a structural member supporting the fifth elevation, has a small leak behind the web. (See Repair Recommendation #6 in Section 9.1 - Repair Recommendations).

## 8.0 Seismic Assessment

### 8.1 Purpose/Objective

The purpose of this report is to provide an assessment of the Containment Building Structure seismic resistance using the seismic response spectra adjusted to reflect the ground acceleration response consistent with the criteria applicable at Callaway Nuclear Plant.

### 8.2 Methodology

- Structural assessment of reinforced concrete items (walls and slabs) was performed in accordance with criteria provided in Reference 8.5.4 (Ultimate Strength Design Method – USD)

- Material Strength is defined by the following parameters;
  - Concrete Compressive Strength: 3000 psi
  - Steel rebar yield strength: 40000 psi

  Based on the nuclear industry experience, these are reasonable, conservative values.

- Load Combinations considered in this assessment are:

  1.5 x DL + 1.8 x LL

1.25 x DL + 1.25 x OBE + 1.25 x LL

1.0 x DL + 1.0 x SSE + 1.0 x LL

Where:

DL - Dead Load (Self-weight of the structure being analyzed)

Dead Weight for various components of the Containment Building Structure was estimated from the information provided in Reference 8.5.3.

LL - Live Load (Crane Load, Personnel)

Based on the information provided by the MURR Engineering Staff, the total weight of the 15-TON Rated Load crane is 17.2 kips.

OBE - Operating Basis Earthquake (Normal operation of the plant is maintained during and after this event)

SSE - Safe Shutdown Earthquake (No damage to the equipment required to safely shut down the plant)

Seismic assessment is performed utilizing the Response Spectra provided in NRC Regulatory Guide 1.60, (Design Inputs Section, Document 2).

Since the subject response spectra are normalized for ground acceleration of 1 x g, the seismic acceleration values obtained from normalized spectra are adjusted for seismic acceleration of 0.2 x g to estimate the seismic response of the Containment Building Structure to the Safe Shutdown Earthquake - SSE event. The ground acceleration of 0.2 x g is selected for this assessment to verify the structural adequacy of shear walls when exposed to the seismic ground motion comparable to the one used at the Callaway Nuclear Plant (Design Input Section, Document 1). The logic for selecting Callaway Plant is that it is located in a relative proximity of the University of Missouri Research Reactor (MURR).

The seismic response assessment is based on the following simplified, but conservative, methodology:

- Equivalent Static Method is used to account for the dynamic seismic effects. This method determines seismic accelerations based on the fundamental frequency mode multiplied by 1.5 amplification factor to account for higher mode participation in non-rigid response type of behavior. Static force equivalent to the dynamic effect of the applied seismic loading is then calculated by multiplying the

mass of the structure by the acceleration adjusted by the amplification factor 1.5. In order to obtain the most critical response of the structure, it is necessary to estimate the lowest possible frequency of the system that would result in the highest seismic acceleration values.

Since the concrete piers between the bottom of the structure and rigid rock layer are relatively flexible compared to shear wall in-plain response, that "soft" response below ground level results in a lower system frequency (close to response spectra peak response accelerations). Therefore, the stiffness of piers is used in this assessment to estimate the fundamental system frequency and corresponding seismic acceleration values. Properties of the soil were determined from References 8.5.1 and 8.5.2 and dead weight of structural elements from Reference 8.5.3.

The combined effect of three orthogonal components of seismic motion was evaluated for the purpose of this assessment, as 100 % of the effects of one particular direction and 40 % of the effects corresponding to two other directions of motion at right angles to the principal motion considered. This approach is recommended in Reference 8.5.5 for general use, especially for the nuclear power plant design and evaluation.

- Based on the inspection of the configuration of the Containment Building Structures, it is reasonable to state that at least six shear walls may be active in resisting seismic lateral loads proportionally to their stiffness. Reactor Core Concrete structure is also capable of resisting considerable portion of seismic lateral loads. This fact was conservatively ignored in this assessment.

  Weight of Bridge Crane is conservatively applied to only one shear wall for seismic load in E-W direction and two shear walls in seismic load in N-S direction. In both cases, more shear walls will be active in resisting seismically excited weight of the Bridge Crane.

- Seismic Live Load of 50 psf is applied on each floor elevation, which is generally acceptable value used in nuclear industry.

- Containment wall assessment

Capacity of Containment Building walls between column rows 4 & 7, and C & F were evaluated to assess their capacity to carry the loads from load combinations described above. Two wall sections were considered for the purpose of this assessment:

- 12" thick section above grade level, reinforced with # 4 @ 8" vertical reinforcement
- 16" thick section below grade level, reinforced with # 4 @ 8" vertical reinforcement

For 12" thick shear wall, governing seismic load is SSE Load Case with lateral loads applied in N – S direction. Interaction Ratio between the maximum applied bending moment and 12" wall bending moment capacity is 0.864 < 1.0.

For 16" thick shear wall, governing seismic load is SSE Load Case with lateral loads applied in N – S direction combined with lateral water and soil pressure. Interaction Ratio between the maximum applied bending moment and 16" wall bending moment capacity is 1.0.

Additional design margin for stresses in shear walls can be obtained if refined analysis is performed that eliminates some of the conservative assumptions described in Section 8.2 - Methodology of this report.

- Concrete pier evaluation

  Bending stresses in piers caused by transfer of seismic motion were not considered based on the arguments provided in Reference 8.5.6.

## 8.3 Conclusion

Containment Building Structure is determined to be structurally adequate to resist the OBE and SSE Seismic Event, based on the assessment approach described in the METHODOLOGY subsection of this report.

## 8.4 Design Inputs

1. FSAR, Callaway Nuclear Power Plant
2. NRC Regulatory Guide 1.60, Rev. 1, December 1973

## 8.5 References

8.5.1 Subsurface Investigation, Soil Analysis and Foundation Recommendations for UMC Research Reactor, "Engineering Surveys & Services", May 23, 1988.

8.5.2 Subsurface Soil Module and Damping Factors for Dynamic Response Analyses, H. Bolten Saed and M. Idrias, December 1970.

8.5.3 University of Missouri, Research Reactor Facilities, sheet numbers: A-2 through A-39, and S-2, through S-16.

8.5.4 Building Code Requirements for Reinforced Concrete (ACI 318 – 63), Dated June, 1963.

8.5.5 NUREG – CR – 0098, "Development of Criteria for Seismic Review of Selected Nuclear Power Plants", Dated May, 1978.

8.5.6 NEHRP Recommended Provisions for the Development of Seismic Regulations for New Buildings, Part 2, Commentary.

## 9.0 Conclusions and Recommendations

The Containment Structure pressure boundary was examined for deterioration. A seismic assessment was performed on the structure. Minor deterioration of the Containment Structure concrete, coatings and penetrations were found. No deterioration of the Containment Structure roofing was noted. With the recommendations summarized below, the Containment Structure will give good service life for at least the next 26 years.

### 9.1 Repair Recommendations

**Repair Recommendation #1.**

Patch the concrete cracks, as noted in Attachment 3. – Concrete Crack Layout Sketch. The cracks should be patched as follows:

1. Remove coverings for at least 2 inches either side of the crack.

2. Remove existing sealant if any, and chip out the concrete for the depth of 0.75 inch and a width from 3/8 of an inch to 0.75 inch. The exposed concrete shall have no loose material.

3. Add new urethane sealant to match the concrete profile. Let cure.

4. Roughen sealant with fine sandpaper and place the first coat of the coating system recommended for the application as per Repair Recommendation #2, #3, #4, #5, or other covering as selected by MURR.

5. Place reinforcing tape or mesh in the uncured coating.

6. Add next layer of the coating system recommended for the application as per Repair Recommendation #2, #3, #4, or #5.
   (From Section 3.0 – Containment Structure Concrete)

**Repair Recommendation #2.**

Overcoating existing DECADEX.

1. Surface preparation. Vacuum existing membrane the clean with a mild cleaning surfactant. Rinse the surface to remove residue and allow to dry.

2. First coat. DECADEX Bonding Primer applied at an approximate coverage rate of 350 square feet per gallon. Allow to cure and dry, approximately 1 to 2 hours.

3. Prior to the second coat, all cracks shall be stripe coated with DECADEX and reinforced with either Reemat Premium Conformable Fiberglass Scrim, or with Heavy Duty Reemat Flexitape. These reinforcing scrims are embedded within a 40 mil wet film thickness (WFT) coat of the DECADEX membrane and should be a minimum of 3 inches wide.

4. WALL COATING. Second coat. DECADEX applied at a minimum of 22 mils WFT by airless spray. Apply with no pinholes. Or,

5. CEILING COATING. Second coat. DECADEX applied at a minimum of 11 mils WFT by airless spray. Apply with no pinholes.

   Note: DECADEX can be applied to approximately ¼ inch thick per pass on a vertical surface without sagging.

**Repair Recommendation #3.**

Bare (or cleaned) concrete surfaces with DECADEX.

1. Surface preparation. Fill bungholes or voids greater than ¼ inch deep and/or wide with Monolevel FC or Monorub polymer modified, portland cement mortars. Allow mortars to cure.

2. First coat. DECADEX Bonding Primer applied at an approximate coverage rate of 300 to 325 square feet per gallon. Allow to cure and dry, approximately 1 to 2 hours.

3. Prior to the second coat, all cracks shall be stripe coated with DECADEX and reinforced with either Reemat Premium Conformable Fiberglass Scrim or with Heavy

Duty Reemat Flexitape. These reinforcing scrims are embedded within a 40 mil wet film thickness (WFT) coat of the DECADEX membrane and should be a minimum of 3 inches wide.

4. WALL COATING. Second coat. Two coats of DECADEX applied at a minimum of 22 mils WFT by airless spray. Apply with no pinholes. Spray the second 'layer' at a right angle to the first 'layer'. Or;

5. CEILING COATING. Second coat. Two coats of DECADEX applied at a minimum of 11 mils WFT by airless spray. Apply with no pinholes. Spray the second 'layer' at a right angle to the first 'layer'.

   Note: DECADEX can be applied to approximately ¼ inch thick per pass on a vertical surface without sagging.

**Repair Recommendation #4.**

For a pressure retaining, concrete coating system, (includes elastomeric membrane):

1. Surface preparation. Clean and dry, sweep blast to remove laitance and provide a profile similar to medium grit sandpaper.

2. First coat. SEMSTONE 5401 applied at 5 mils dry film thickness (DFT).

3. Second coat. SEMLASTIC 201 applied at 40 to 50 mils DFT. Allow to dry overnight and then wash and scuff sanded prior to the third coat.

4. Third coat. SEMSTONE 140SL at 50 to 65 mils DFT. The third coat should be comprised of a layer of CSM (chopped strand mat – ¾ oz.) imbedded in the SEMSTONE 140 SL. After a 25 mil base coat of the 140SL is laid and while still wet (uncured), lay in the CSM and roll out to eliminate air pockets and to fully bed the CSM into the basecoat of 140SL. Immediately apply another 40 mil layer of the 140SL over this to leave a smooth surface.

**Repair Recommendation #5.**

Concrete coating system for the Beam Port Level floor, (no elastomeric layer).

1. Surface preparation. Clean and dry, sweep blast to remove laitance and provide a surface profile similar to medium grit sandpaper.

2. First coat. SEMSTONE 5401 applied at 5 mils dry film thickness (DFT).

3. Second coat. SEMSTONE 140SL applied at 30 mils DFT.

   Note: 140SL is a 100% solids epoxy material suitable for chemical spills and ease of decontamination.

**Repair Recommendation #6.**

A generic repair during the LRT. a) Add RTV silicone sealant to the electrical penetrations as required,. b) Add RTV silicone sealant to the area around the West end of the structural member on the fourth level, supporting the fifth level, in the North Tower.
(From Sections 6.0 – Penetrations, and 3.0 - Containment Structure Concrete)

**Repair Recommendation #7.**

In the East Tower fourth level, clean the rust from the carbon steel framing member supporting the fifth level and recoat with two coats of Carboline 3358 for a total thickness of 4 to 6 mils. See Attachment 6 - Coating Vendor's Technical Information.
(From Section 3.0 - Containment Structure Concrete)

**Repair Recommendation #8.**

Preventive roof maintenance consists of a general roof and drain cleaning every spring and fall. Inspect flashing for damage and repair as required.
(From Section 5.0 - Roofing)

**Repair Recommendation #9.**

Rework Door 277, the Personnel Access Door, by coating the door at the gasket door interface. Per the door shop drawing, #260, the gasket bearing against the door establishes the pressure boundary. To allow the gasket to seal better against the steel door, the following coating system products, manufactured by the Carboline Co. of St Louis, MO. (see Attachment 6. - Coating Vendor's Technical Information), may be used:

- Surface Preparation: Hand sand to produce a dull finish.

- Primer: One coat of Carboline 3358 at 2-3 mils Dry Film Thickness (DFT),

- Top Coats: Three coats of Carboline Flexide HB each coat approximately 7 mils DFT. (From Section 6.0 - Penetrations)

## 10.0 References

10.1 American Society of Testing and Materials, ASTM, D4541-95, Standard Test Method for Pull-off Strength of Coatings using Portable Adhesion Testers.

10.2 American National Standards Institute, ANSI, N45.2.6-1973, Qualifications of Inspection, Examination and Testing Personnel for the Operational Phase of Nuclear Power Plants. 1973.

10.3 DECADEX Vendor information from the 'Liquid Roofing Systems' manual, dated Jan 2000, Liquid Plastics Limited of Lancashire, England.
Web site: www.liquidplastics.co.uk.

10.4 Sargent & Lundy$^{LLC}$, Report SL-5410, Revision 0, "Review of Condition Assessments".

10.5 Letter: Mr. Harry B. Comfort of the Marcus Corporation of East Haddam, CT to Mr. Henry R. Miller of Sargent & Lundy$^{LLC}$, dated: May 22, 2000, titled: Recoating of Decadex University of Missouri Research Reactor, 3 pages. The letter is also in Attachment 5. - Marcus Corp, DECADEX Coating Repair Recommendation - Vendor Letter).
Web site: www.marcuscorporation.com.

10.6 Sentry Polymers, Inc, P. O. Box 2076, 5500 E. Hwy 332 Freeport, Texas 77542 phone 800-231-2544, Web site: www.semstone.com

10.7 Carboline Co, 350 Hanley Industrial Court, St Louis, Missouri 63144, phone 314-644-100, Web site: www.carboline.com

# ATTACHMENT 1
# WALKDOWN NOTES

Walkdown Notes on the Containment Structure Condition Assessment.
Monday, April 24, 2000 through Friday, April 28, 2000.
Henry "Scotty" Miller, Monday through Friday.
Kevin McGuire, Tuesday through Friday.
Tom Ryan, Wednesday only.

## 1. General Discussion.

The majority of the Containment Building pressure retaining surfaces were inspected. The inspection was a visual nondestructive examination of the accessible concrete surfaces for integrity or cracks in the concrete, and coating deterioration. The coating inspection consisted of nondestructive visual examination for generic material type, degradation and a destructive examination of the concrete coating for adhesive capacity.

The Containment Building is 64 feet high by 64 feet wide in two directions with a large area to the North at the Beam Port Floor. The building has five elevations: El 653, the 5$^{th}$ floor or top floor used for storage and equipment; EL 642, the 4$^{th}$ floor or Control Room floor; EL 631, the 3$^{rd}$ floor or offices; EL 618, the 2$^{nd}$ floor or Grade floor; and EL 602, the 1$^{st}$ floor or the Beam Port Floor. The Pipe Trench, which leads to a penetration to the pool, is approximately EL 590.

The Laboratory Building which is one story tall matching the Grade Floor Elevation surrounds the Containment Building.

No ladders or scaffolding was used in the inspection. Closer inspection using ladders or moving equipment was deemed not warranted based on the observations of the ongoing examination. Similarly, inspections in the locked rooms and storage areas were not pursued. Removal of siding on the exterior surface of the Containment Building was deemed as too expensive and not warranted by the results of the Containment Leak Rate Test, (LRT), and the accessible exterior wall walkdown.

A LRT is performed yearly. Sealing material was used to reduce air leakage through the concrete and to plug small openings. The various types of sealing material are called Unspecified Sealing Materials, (USM), in this report. No effort was made to identify the materials.

## ATTACHMENT 1
## WALKDOWN NOTES

In general some floors and all wall and ceiling concrete surfaces are coated. Some floors including the Beam Port floor North area and portions of the Grade Floor have floor tiles. Around the Grade Floor Containment wall exterior surface there are spaced sound attenuation tiles.

### 2. Leak Rate Test (LRT) Observations.

Early Monday morning April 25, 2000. Henry "Scotty" Miller witnessed the LRT. Containment was pressurized to 1 psig to check for leak tightness. The measured leakage was well within the allowable leakage. Localized areas of the exterior of containment was examined for air leaks using soapy water. Locations with leakage from the Containment interior were:

- Door 277, the inside personnel access door to Containment on the 2nd floor or Grade level. The door was leaking all around the perimeter.
- The ceiling of the Beam Port Floor North Area. The ceiling cracks are floor cracks in the corridors. The corridors are: the inner corridor which encircles the Containment wall; and the corridor that leads North to the outer corridor running along the outside of the Lab Building.
- Electrical penetrations at the Beam Port Floor, South wall by the East corner and the East wall by the South corner, have some minor leakage.
- In the North Tower, fourth Elevation, a structural member supporting the fifth elevation, has a small leak behind the web.

### 3. Pipe Trench Penetration, from the Beam Port Floor.

Wednesday April 26, 2000. No deterioration was noted at the penetration to the pool.

### 4. Beam Port Floor – Containment and North Areas.

Thursday April 27, 2000. The floor of the Containment Area is coated concrete mostly taken up by the reactor and equipment. No observations of the accessible areas were noted.

For the North Area, the walls have coating with little deterioration. The floor is tiled with a few tiles missing. Four suspected concrete cracks are noted along the ceiling, three from the East edge running to the West to the first concrete beam and the fourth crack running East –West in the middle between the concrete beams.

## ATTACHMENT 1
## WALKDOWN NOTES

### 5. Beam Port Floor - High Radiation Ports.

Friday, April 28. Investigation of the Hot Ports. The 17 ports on the South and 17 ports on the North for 34 total. Five ports were either opened or had plugs removed for a visual inspection. A remote camera, (a camera on a long cord that was snaked in the pipes), was used in two of the ports before the camera failed. The remaining ports were looked at unaided, with flashlights.

South ports 3, 13, 14 and North ports 4 and 17 were looked at. Light rust was visible with no signs of significant deterioration.

The wall around both the North and South High Radiation Ports show rust streaks from the pipe lining of the ports and delamination of the coatings immediately below the ports.

### 6. Beam Port Floor – North Area - Adhesion Tests.

Friday April 28, 2000. Completed the Adhesion test at four wall locations. The four dollies were placed in the morning of Thursday April 27$^{th}$.

East wall, Dolly 1 - 320 pounds per square inch, psi, failure was cohesion of undercoat.

East wall, Dolly 2 - 100 psi, failure of coating from concrete. Does not appear to have an undercoat, (concrete primer).

West wall, Dolly 3 - 250 psi, failure was half for the cohesion of the topcoat and half cohesion failure of the undercoat.

West wall, Dolly 4 – 300 psi, failure was half cohesion of the undercoat and half topcoat failure.

### 7. Containment Wall – Interior, Levels 2, 3, 4 and 5.

Thursday April 27, 2000. 1st level or Beam Port Level, East wall, In various places it appears that the prime coat of Decadex was coated over with a blue latex coating which has completely cracked. The remainder of the wall appears to have the complete Decadex coating system that has a light green finish.

Beam Port Level - South wall has some USM approximately 15 feet above the slab at The West end of the wall. Cannot tell if concrete cracks are present.

## ATTACHMENT 1
## WALKDOWN NOTES

Beam Port Level – West wall, see Item 5.

Beam Port Level – North wall, see Item 4.

Grade Level or 2nd Level – East wall is blocked by Lab, Room 275, which we did not enter.

Grade Level - West wall, South end, brown streaks on wall coming from above. Vertical concrete crack appears at 12 foot 4 inches from South wall. The crack appears to be 10 to 20 mils wide and is visible in the wall areas with no coating. It appears that originally installed HVAC duct was removed for the current platform installation.

Grade Level –South wall. Brown streaks from above. It appears that an HVAC duct was removed and the bare concrete was touched up.

Grade Level –North wall. Brown streaks from above.

Office Level or the 3rd Level - West wall, brown streaks on wall coming form above only in outer thirds of the wall. The outer thirds have siding on the outside. The middle third of the wall, with the West tower or the outside of the wall, has no streaks. Similar to South Wall and not like the North wall.

Office Level – South wall, brown streaks on wall coming form above only in outer thirds of the wall. The outer thirds have siding on the outside. The middle third of the wall, with the South tower or the outside of the wall, has no streaks. Similar to the East wall and not like the North wall.

Office Level – North wall, brown streaks on wall from above throughout the width of the wall. The streaks are not like the Pattern of the West and South walls.

Control Room Level or the 4th Level – South and North walls, brown streaks are present. No streaks on the West wall.

Equipment Level or the 5th Level – East wall only is accessible. The East wall in the North and South corners appears to have a thin latex coating over an elastomer coating. The latex coating is completely cracked. No coating deterioration noted on the roof members, the North wall and the South wall.

## ATTACHMENT 1
## WALKDOWN NOTES

**8. Outside Wall – North Tower.**

Tuesday April 25. Middle third of 63 foot wall width. Containment wall not within the Tower is covered with siding.

Fifth level or top floor. 25% of the wall had USM with locations with spay paint indicating previous leakage.

Fourth or mid level. USM on construction joints.

Third or lower level. USM on horizontal construction joint, East side of wall with patches of USM. Four areas with spray paint (previous leakage).

**9. Outside wall – South Tower.**

Thursday April 27. Middle third of 63 foot wall width. Containment wall not within the Tower is covered with siding.

Fifth level or top floor. 25% of wall surface area has USM. Three locations with spray paint indicating previous leakage.

Fourth or mid level. USM on construction joints.

Third or lower level. USM on horizontal construction joint, East side of wall with patches of USM. Four areas with spray paint (previous leakage).

**10. Outside wall – East Tower.**

Thursday April 27. Middle third of 63 foot wall width. Containment wall not within the Tower is covered with siding.

Fifth level or top floor. Construction joints covered with USM. Many spots (+30) or leaks, showing many colors of spray paint. Three different colors/types of USM. An HVAC duct obscures part of the Containment wall.

Fourth or mid level. Steel Plenum wall obscures three fourths of the Containment wall. One carbon steel framing member supporting the fifth level has medium to heavy rust.

Third or lower level. HVAC equipment/plenum obscures the Containment wall.

**ATTACHMENT 1**
**WALKDOWN NOTES**

**11. Outside Wall – West Tower.**

Wednesday April 26, 2000. Middle third of 63 foot wall width. Containment wall not within the Tower is covered with siding.

Fifth level or top level. Blockwall plenum wall obscures North end of the wall. Pipe penetration in the wall has a large quantity of USM around the pipe and a horizontal joint at the penetration elevation.

Horizontal construction joint, with USM, at 1 foot 11 inches above the floor slab which seems to line up with the top of the crane rail corbel on the inside of Containment. More than half the wall has been coated with an elastomeric coating.

Forth level or mid level. More than half the wall has USM. Appears to be voids in the concrete rather than concrete cracks. Tie wire holes are visible with many porosity holes at the surface.

Third level or lower level. USM is applied along the stairway.

**12. Outside Wall – General Exterior.**

Wednesday April 26, 2000 and Thursday April 27, 2000.

Beam Hole Elevation – South Wall – Wall painted green. No visible concrete cracks, about 1% of wall area has USM.

Beam Hole Elevation – East Wall – Wall is partially covered with a false wall of Room 111. Above room and to the South 3% of wall surface with USM, no visible concrete cracks.

Beam Hole Elevation – West Wall – is buried in dirt, not accessible.

Grade Floor - North Wall. Partially inaccessible with equipment and cabinets against the wall. USM in a few locations.

Grade Floor – West Wall. Some streaks of brown from ceiling and Containment wall intersection, (the ceiling is the roof of the Lab Building surrounding Containment), appearing to be old roof leaks since repaired with the new roof. USM in a few locations.

## ATTACHMENT 1
## WALKDOWN NOTES

Grade Floor – South Wall. USM at a few locations is including along the floor. Inaccessible areas due to equipment and sound pads.

Grade Floor – East Wall. USM for 25% especially along stairway. Some spray paint from previous LRTs showing. USM at the ceiling containment wall intersection, heavy negative pressure appears to be old USM.

**13. Roof – Exterior.**

Tuesday April 25, 2000. General appearance is good with little or no debris. Roof low spots have some dirt, i.e., brown color. Roof system is "IRMA" consisting of roofing, insulation and pavers. Only one cracked paver was noticed. Extra pavers are stored in two areas. Slope drainage – Looked OK. Field Membrane – no deterioration noted. Perimeter Flashing - present, with no deterioration. Counter Flashing – Coping – Edge Material – for three towers material was in place with no deterioration, the North Tower had no counter flashing installed. Projection Flashing – None. Construction Joints – If any, were covered with pavers/Insulation.

## Attachment 2 - Photographs

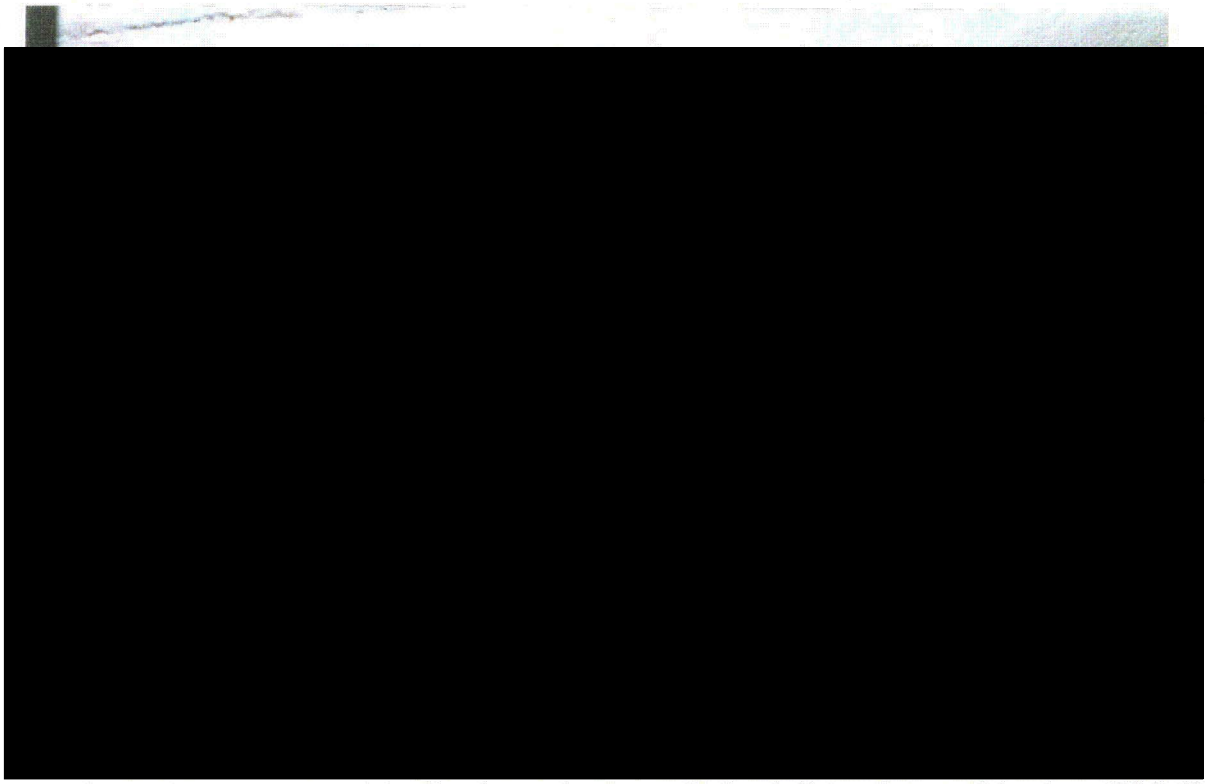
The following 27 pictures help illustrate the condition of the Containment Building during the Condition Assessment performed from April 25, 2000 through April 29, 2000.

Key: 'P# #' = Sequential picture number.
(# - # - #) = 1st number is the date, i.e. 27 means April 27, 2000;
2nd number is the roll number taken on that date; and
3rd number is the sequential picture number of the roll.

P01. Containment Interior, Control Room Elevation, North Wall. Brown streaks on wall with no defined starting points. (27-2-17)

## Attachment 2 - Photographs

P02. Containment Interior, Office Level, West Wall. Brown streaks on South portion of wall but not the middle. South portion has siding on the exterior and the middle section is within the West Tower. (27-2-14)



P03. Containment Interior, South Wall. Looking down at brown streaks, handrail along bottom of the photo. (27-2-15)

## Attachment 2 - Photographs

P04. Containment Interior, South Wall. Brown streaks on wall. (27-2-16)

P05. Containment Exterior, Beam Port Floor, East Wall above Lab 111. Unspecified sealing material (USM). (27-1-20)

## Attachment 2 - Photographs

P06. Containment Interior, Grade Elevation, West wall. Vertical hairline concrete crack, (not visible in the picture), at 12 feet 4 inches from the South wall, visible in the uncoated concrete wall areas. Crack is parallel to the conduit. (27-2-12)

P07. Containment Interior, Beam Port Elevation, High Radiation Ports. 'S' or South Ports. Showing rust streaks from the pipe lining of the ports and delamination of the coatings immediately below the ports (27-2-09)

## Attachment 2 - Photographs

P08. Containment Interior, Beam Port Elevation, High Radiation Ports. 'N' or North Ports. Showing rust streaks from the pipe lining of the ports and delamination of the coatings immediately below the ports. (27-2-11)

P09. Containment Exterior, West Tower. Fifth level, penetration in Containment concrete wall with unspecified sealing material, (USM). (26-2-5)

## Attachment 2 - Photographs

P10. Containment Exterior, West Tower. Fifth level, horizontal joint with unspecified sealing material (USM) and spray paint denoting air leakage. Joint is at the elevation of the top of the crane rail corbel. (26-2-7)

P11. Containment Exterior, East Tower, fifth level. Many locations of spray paint and unspecified sealing material. (27-1-10)

## Attachment 2 - Photographs

P12. Containment Exterior, North Tower, fifth level. Unspecified Sealing Material (USM) and spray paint at Leak Rate Testing (LRT) leakage locations. (25-1-18)

P13. Containment Exterior, South Tower, fourth level support member. Unspecified sealing material (USM). (27-1-09)

## Attachment 2 - Photographs

P14. Containment Exterior, South Tower, fourth level. Unspecified sealing material (USM). (27-1-08)

P15. Containment Exterior, Pipe Trench (accessed from Beam Port Elevation). Pipe penetration to Reactor Pool. (poor picture quality) (26-1-11)

## Attachment 2 - Photographs

P16. Containment Exterior, Beam Port Floor. South Wall, door to Containment leaking air during Leak Rate Testing (LRT). (27-1-17)

P17. Containment Exterior, Beam Port Floor, South Wall, electrical penetration with unspecified sealing material (USM). (27-1-14)

## Attachment 2 - Photographs

P18. Containment Exterior, Beam Port Floor, East Wall Electrical Penetration. Unspecified sealing material. (27-1-19)

P19. Containment Exterior, Beam Port Floor. East Wall, Mechanical Penetration filled with water. (27-1-18)

## Attachment 2 - Photographs

P20. Containment Roof, in the South Tower looking East, typical details. Paver (tile) storage. (25-1-03)

P21. Containment Roof, East Wall to East Tower interface, typical flashing details. (25-1-06)

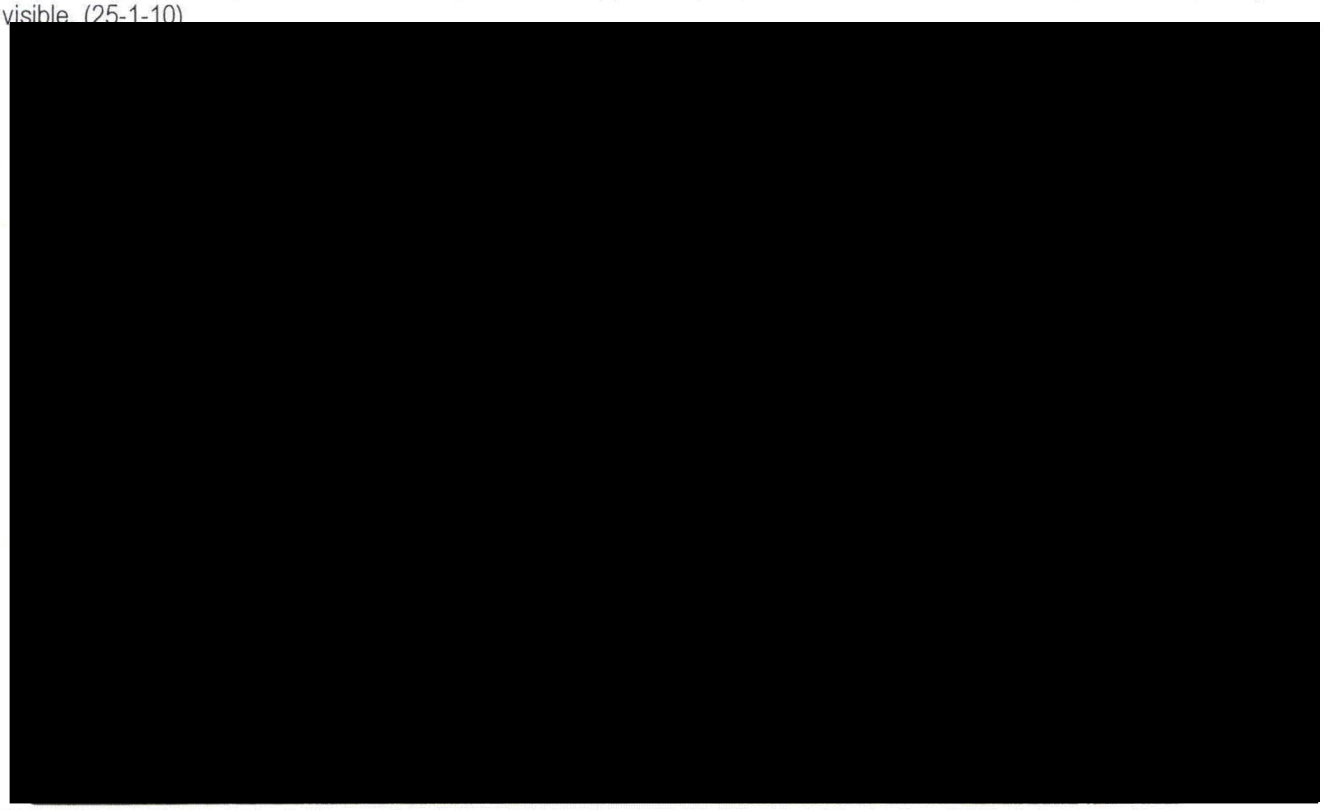
## Attachment 2 - Photographs

P22. Containment Roof, look to Northeast corner, typical details. (25-1-12)

P23. Containment Roof, Look at West Tower, typical details, gap in tower for roof drainage to tower roof drain. (25-1-08)

## Attachment 2 - Photographs

P24. Containment Roof, West Tower. Roof system 'IRMA', pavers (tiles) removed for look at insulation. Counter flashing is visible. (25-1-10)



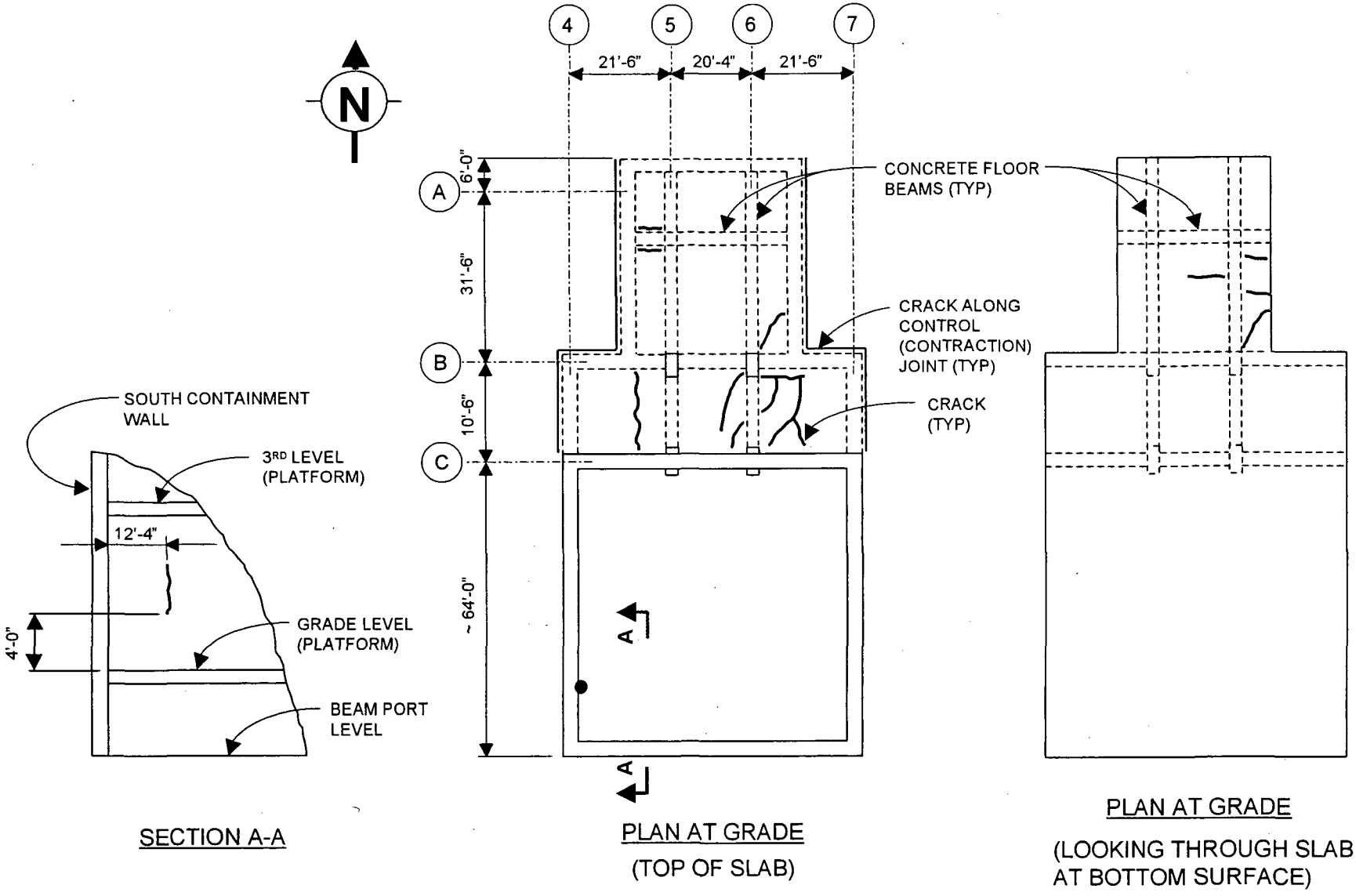
P25. Containment Roof, North Tower. Roof system 'IRMA', paver (tile) removed for look at insulation. Note: No counter flashing. (25-1-15)

## Attachment 2 - Photographs

P26. Containment Interior, Beam Port Floor – North Area, East Wall. Adhesion Test #1 (1A) and #2 (1B) locations. (27-1-22)

P27. Containment Interior, Beam Port Floor – North Area, West Wall. Adhesion Test #3 (left) and #4 (right) locations. (27-1-24)

**Attachment 3**
**Concrete Crack Layout Sketch**




**CONTAINMENT STRUCTURE CONCRETE CRACK LOCATIONS**

(LOCATIONS ARE APPROXIMATE)

## ATTACHMENT 4
## Allowable Live Load Sketch

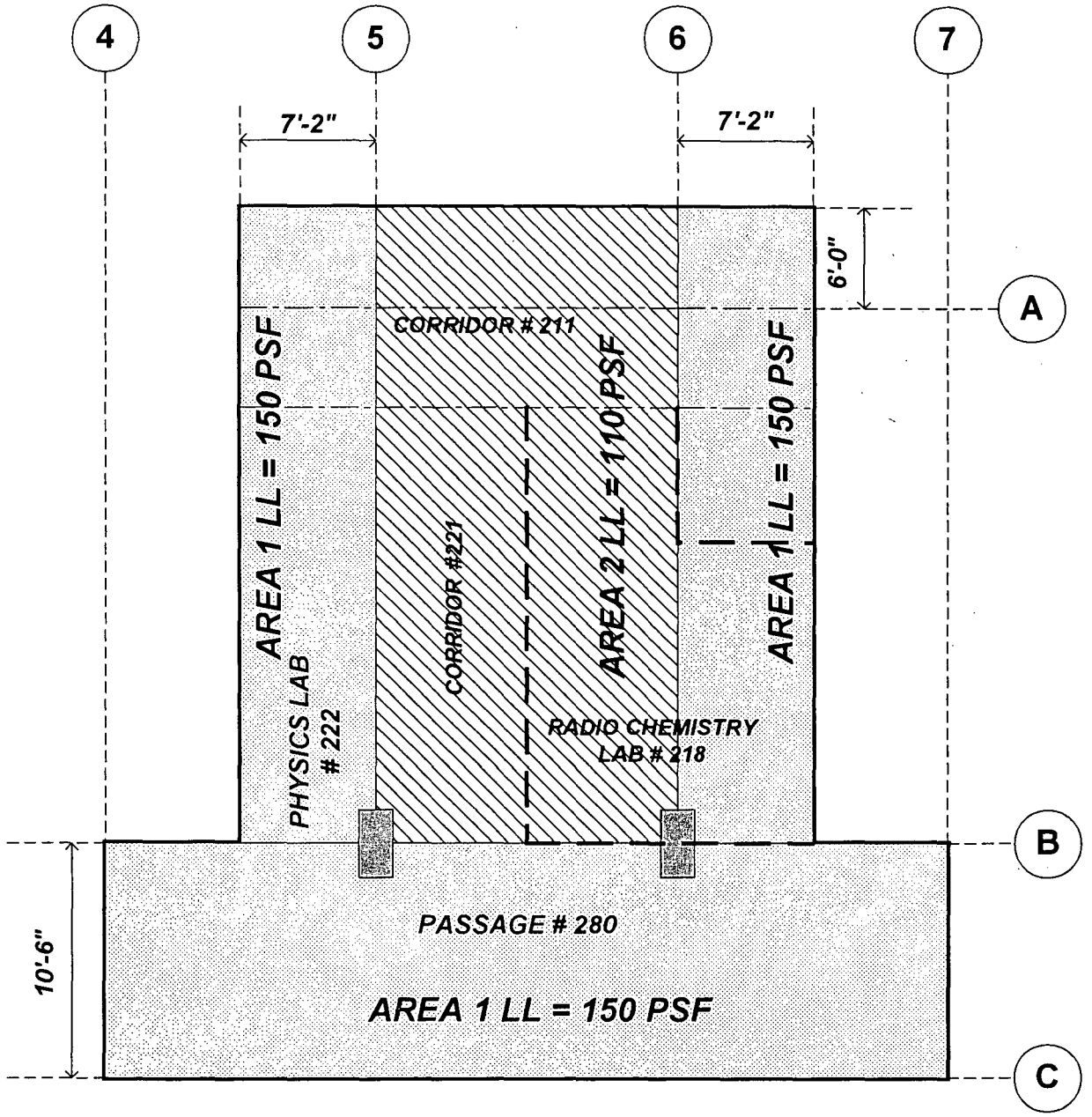



**FIG. 1**
( NOT TO SCALE)

## Attachment 5
## Marcus Corp., DECADEX Coating Repair Recommendation
## Vendor Letter

The following vendor letter concerning DECADEX coating repair recommendation is described in the main report Section 4.0 - Containment Coatings.

22 May, 2000

Mr. Henry R. Miller
Sargent & Lundy
55 East Monroe Street
Chicago, IL 60603-5780
Fax (312) 269-7041/2208

Re: **Recoating of Decadex**
**University of Missouri Research Reactor**

Dear Mr. Miller:

As a follow up to our recent telephone conversations regarding the conditions of the existing Decadex membrane on the concrete walls and ceilings of the reactor building at the University of Missouri, by this letter I would like to provide you with our thoughts on the streaking occurring on the membrane and our recommendations on how to recoat this material, how to treat cracks and the application of Decadex to new concrete surfaces.

With regards to the streaking, at this time, it is our opinion that these streaks are a result of moisture and contaminants/dirt being drawn out of the wall and through pinholes in the membrane after the walls have been pressurized and depressurized. To rectify this situation, it is our best recommendation that an additional full coat be applied to a uniform and pinhole free film after the existing membrane has been cleaned and dried.

**Overcoating Existing Decadex -**
To overcoat existing Decadex, the surface shall be cleaned of all dirt, debris, chalking and any other surface contamination prior to be primed and recoated. We recommend that the existing membrane be cleaned with by a moderate power wash (500 psi or whatever is required without damaging the membrane) with the fan tip held at a distance not to damage the membrane and a mild cleaning surfactant, as required. All surfaces shall be rinsed of all cleaning agent residues and all to thoroughly dry prior to priming and coating.

In accordance with the instructions on the material technical data sheet and container label, mix and apply Bonding Primer to the prepared existing Decadex membrane. Apply the Bonding Primer by airless spray, roller and/or brush, or any combination of these methods, at an approximate coverage rate of 350 $ft^2$/gallon. Allow the Bonding Primer to cure and dry, approximately 1 – 2 hours depending on ambient conditions, prior to applying the Decadex membrane.

In accordance with the instructions on the material technical data sheet and container label, stir and apply one coat of Decadex membrane to the prepared and primed areas

MARCUS
Marcus Corporation

Engineered Restoration
and Protection Systems
for Imperfect Substrates

10-B Matthews Drive
East Haddam, CT 06423
860-873-3778
Fax 860-873-8242

## Attachment 5
## Marcus Corp., DECADEX Coating Repair Recommendation
## Vendor Letter

to be treated. By airless spray, apply one coat to the walls at a minimum 11 mils wet film thickness (WFT) (146 $ft^2$/gallon without wastage and surface roughness considerations) and one coat to the ceiling at a minimum 22 mils WFT (73 $ft^2$/gallon without wastage and surface roughness considerations). Ensure a full, uniform and pinhole free application. Apply additional material as required. Since Decadex can be applied to a thick section on a vertical surface (i.e. approximately ¼" thick per pass), additional material can be added without worrying about it sagging down the wall during a wet on wet application.

Prior to the full recoat application, all cracks shall be stripe coated with Decadex and reinforced with either Reemat Premium conformable fiberglass scrim or with Heavy Duty Reemat Flexitape. These reinforcing scrims are embedded within a 40 mil WFT coat of the Decadex membrane and should be a minimum of 3" wide. The type of reinforcing scrim should be chosen based on the orientation and dynamic nature of the crack.

**Applying Decadex to New Concrete -**
When treating new concrete substrates, follow the instructions in the material technical data sheets for surface preparation, priming and material application.

Fill all bugholes or voids greater than ¼" deep and/or wide with Monolevel FC or Monorub polymer modified, Portland cement mortars. Allow mortars to cure prior to applying primer and Decadex membrane.

In accordance with the instructions on the material technical data sheet and container label, mix and apply Bonding Primer to the prepared existing Decadex membrane. Apply the Bonding Primer by airless spray, roller and/or brush, or any combination of these methods, at an approximate coverage rate of 300 - 325 $ft^2$/gallon. Allow the Bonding Primer to cure and dry, approximately 1 – 2 hours depending on ambient conditions, prior to applying the Decadex membrane.

MARCUS

Prior to the full coat application, all cracks shall be stripe coated with Decadex and reinforced with either Reemat Premium conformable fiberglass scrim or with Heavy Duty Reemat Flexitape. These reinforcing scrims are embedded within a 40 mil WFT coat of the Decadex membrane and should be a minimum of 3" wide. The type of reinforcing scrim should be chosen based on the orientation and dynamic nature of the crack.

In accordance with the instructions on the material technical data sheet and container label, stir and apply two coats of Decadex membrane to the prepared and primed areas to be treated. By airless spray, apply two coats to the walls at a minimum 11 mils wet film thickness (WFT) (146 $ft^2$/gallon without wastage and surface roughness considerations) per coat, and two coats to the ceiling at a minimum 22 mils WFT (73 $ft^2$/gallon without wastage and surface roughness considerations) per coat. Ensure a full, uniform and pinhole free application. Apply additional material as required. Spray the second coat at a right angle to the first coat.

## Attachment 5
## Marcus Corp., DECADEX Coating Repair Recommendation
## Vendor Letter

Mr. Miller, I hope this information meets your request, but if you have any questions or should require additional information, please contact me at (610) 478-8636 or on my cellular phone at (610) 334-5888. Thank you for your interest in our materials and technologies.

Very truly yours,

Harry B. Condori
Senior Engineer

Cc: Mr. Marc Schroeder – Marcus Corporation

MARCUS

# Attachment 6
# Coating Vendor's Technical Information

The following Technical Bulletins/Information are for the various coating systems described in the main report Section 9.1- Repair Recommendations.

**TECHNICAL BULLETIN**
August 1998

## SEMSTONE® 5401

### Epoxy Penetrating Primer

**(Formerly 5401-RB)**

### DESCRIPTIONS AND USES

SEMSTONE 5401 is Sentry Polymers' crosslinked penetrating epoxy primer with excellent wetting capabilities. It was designed to be flexible and can be used on concrete surfaces to provide firm anchorage and accept a variety of top-coats.

SEMSTONE 5401 is a two-component, polymeric epoxy. It is a high solids, low odor material that meets the most stringent VOC (Volatile Organic Content) regulations. SEMSTONE 5401 is used as a primer for properly prepared concrete. Its excellent wetting properties allows it to penetrate surfaces, bond and provide a firm surface for a variety of top-coat materials.

SEMSTONE 5401 may be applied using a conventional, airless or plural component spray rig as directed by the manufacturer. This product may also be applied by brush or roller.

Depending on expected service conditions, a variety of top-coat materials may be used. Consult Sentry Polymers Master Chemical Resistance Guide, or contact our Technical Service Department for top-coat material recommendations.

SEMSTONE 5401 is NOT recommended for immersion service, form void filling, or floor leveling. SEMSTONE 5401 is NOT to be used without an appropriate top-coat.

Sentry
POLYMERS, INC.
P.O. BOX 2076
5500 E. HWY 332
FREEPORT, TEXAS 77542
409-233-0312
800-231-2544

# Attachment 6
# Coating Vendor's Technical Information

## PACKAGING/COVERAGE

SEMSTONE 5401 is packaged in .5-gallon and 2-gallon units.

Each unit consists of a pre-measured Part A component and a pre-measured Part B component.

Coverage rates will be effected by the condition of the surface being coated (degraded vs. smooth, etc.). To figure THEORETICAL coverage per gallon, divide desired mil thickness into 1,604. (For example, theoretical coverage for a 5-mil thickness is: 1,604 divided by 5 = 320.8 square feet per gallon.)

For practical coverage, make necessary allowances for condition of the substrate, working conditions, waste, spillage, etc.

## TYPICAL PROPERTIES

| | |
|---|---|
| Solids by Volume: | 98% (±2%) |
| Mix Ration by Volume: | 1:1 (A:B) |
| Color: | Clear |
| Gloss: | High (Chalks rapidly in sunlight) |
| Pot Life @ 75°F: | 45 min |
| Volatile Organic Content: As Supplied: | 0.2 lbs/gal |
| Per EPA Method 24: | 0.8 lbs/gal |
| Recommended Dry Film Thickness Per Coat: | 6-to-8 mils |
| Theoretical Coverage Per Mixed Gallon: | 267 sq. ft. @ 6-mils* |
| Flash Point (Setaflash): Part A: | >205°F |
| Part B: | 176°F |

| Cure Time (approximate): | Temperature | Dry to Top-Coat | Final Cure |
|---|---|---|---|
| | 70°F | 8 hrs | 5 days |
| | 80°F | 6 hrs | 2 days |
| | 90°F | 4.5 hrs | 1 days |
| | 100°F | 4 hrs | 12 hrs |

| Recoat Times**: | Temperature | Recoat Time |
|---|---|---|
| | 50°F*** | 14-days |
| | 75°F*** | 7-days |
| | 90°F*** | 7-days |

* - Theoretical coverage only. Actual coverage rates will vary widely depending on surface condition and porosity of concrete. SEMSTONE 5401 must be applied in very thin films. Do NOT allow puddling or thick spots.

** - Surfaces must be dry and free of dirt, dust, oil, grease, chemicals and other contaminants immediately prior to applying top-coat materials to SEMSTONE 5401.

*** - Ambient temperatures, not in direct sunlight.

## STORAGE AND SHELF LIFE

Keep SEMSTONE 5401 tightly sealed in its original containers until ready for use. Store at 40-to-110°F, out of direct sunlight. Properly stored, SEMSTONE 5401 has a minimum shelf life of 12 months. Refer to batch number on the label for date of manufacture.

## APPLICATION GUIDELINES

### APPLICATION NOTES

A primer used to prevent the phenomenon of concrete outgassing should be applied when temperatures are dropping and should be allowed to cure until tacky before coating is applied.

Depending on porosity of concrete, a second coat of SEMSTONE 5401 may be required.

### SURFACE PREPARATION

Concrete: Immediately prior to application of coating, concrete substrate must be:

- Adequately cured (generally, at least 28 days; check with Sentry Polymers if concrete has cured less than 28 days).
- Structurally sound.
- Free of all dirt, dust, debris, oil, grease, fats, chemical contamination, salts, solvents, surface hardeners, incompatible curing compounds and form release agents, laitance and efflorescence.
- Concrete surfaces must be dry.

and must have:

- Tensile strength of at least 300 psi.
- pH in the range of 7-to-11.
- All fins, projections and splatter removed.
- All defects repaired using patching as described herein.
- Failed or otherwise incompatible old coatings removed.
- A surface texture similar to medium sandpaper (40-to-60 grit).

Refer to Sentry Polymers' separate document "Surface Preparation - Concrete" for further instruction in the preparation of concrete surfaces.

A test patch is recommended to check penetration into the concrete surface and verify compatibility with existing coatings. If SEMSTONE 5401 does not penetrate the concrete surface, it should NOT be used. Contact Sentry Polymers Technical Service department.

# Attachment 6
# Coating Vendor's Technical Information

### MIXING

Begin mixing the Part A component slowly using a Jiffy type mixer, then add the Part B. Keep the mixing blade at a slow speed and submerged in the product to minimize whipping of air into the material. Scrape the sides of the container occasionally to insure uniformity. Continue to mix for at least 2 minutes and material is uniform in color and consistency.

Thinning: If thinning is required for spray applications, please contact Sentry Polymers Technical Service for specific instructions.

### APPLICATION

Spray: May be applied by conventional, airless or plural component. Use all spray equipment in accordance with spray equipment manufacturer's recommendations.

Brush: Distribute evenly using full brush strokes.

Roller: Use a roller suitable for solvent base materials, to evenly distribute the material. Nap length will depend on the roughness of the substrate.

Apply only enough material to uniformly wet and penetrate the surface. Do NOT allow puddles to form or film build.

## SAFETY PRECAUTIONS

FOR INDUSTRIAL USE ONLY.

When using SEMSTONE 5401, be aware of these safety precautions:

- Avoid contact with eyes and skin.
- Do not ingest or inhale.
- Always wear chemical goggles, rubber gloves, and appropriate work clothing.
- Make provisions for forced ventilation when working in a confined area.
- Wear fresh air hood when spraying in confined area.
- Wear fresh air hood or organic mist respirator when spraying in an open area.
- Prolonged or repeated exposure to the mixed material or the unreacted Part A and Part B components may cause skin irritation or allergic reaction.
- Refer to material safety data sheets (MSDS) regarding individual components.

# Attachment 6
# Coating Vendor's Technical Information

1 YEAR LIMITED WARRANTY

For one year following sale, SENTRY POLYMERS, INC., Freeport, Texas ("SENTRY") will replace any of its products that do not conform to its manufacturing standards or, at its sole discretion, refund the proportionate sales price applicable to the nonconforming goods. Replacement product will be supplied at no charge, and FOB SENTRY'S facilities.

Information and suggestions supplied by SENTRY, whether in its published literature or otherwise, including samples, are believed to be accurate and reliable and are furnished in good faith. Such information and suggestions are supplied without charge and their use, and the use of SENTRY products is beyond SENTRY'S control. SENTRY'S products, information and suggestions are intended for USERS possessing skill and know-how in the industry. USERS are responsible, at their sole discretion and risk, to satisfy themselves regarding the suitability of SENTRY'S products, information and suggestions for their particular circumstances.

SENTRY MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, CONCERNING ITS PRODUCTS, INFORMATION AND SUGGESTIONS AND DISCLAIMS ALL WARRANTIES INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

SENTRY'S obligations under this limited warranty will be rendered null and void by any one or more of the following: SENTRY is not paid timely and in full at Freeport, Texas, for all goods and services sold by SENTRY for use on the applicable project; USER does not cooperate with SENTRY'S reasonable investigations regarding the alleged nonconforming product; the product has been misused, abused or improperly maintained.

The provisions of this warranty supersede any provisions to the contrary in any of USER'S forms or documents or otherwise unless such contrary provisions are specifically acknowledged and agreed to in writing by SENTRY after receipt by SENTRY. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF PERSONAL INJURY, INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

# Attachment 6
# Coating Vendor's Technical Information

**TECHNICAL BULLETIN**
October 1996

## SEMSTONE® 140-SL

### Epoxy Self-Leveling Floor Coating

## DESCRIPTION AND USES

SEMSTONE 140-SL is a self-priming, self-leveling epoxy floor coating system for light manufacturing and process areas, production areas, labs, aisle-ways and similar applications.

Optionally, it can be aggregate filled to economically extend its coverage.

SEMSTONE 140-SL is a two component system that possesses the following characteristics in common with all members of Sentry's 140 family of products:

- excellent resistance to:
  - chemical attack,
  - thermal shock,
  - wear and impact;
- superior bonding qualities;
- high cohesive strength;
- low permeability;
- low odor;
- 100% solids.

## PACKAGING/COVERAGE

SEMSTONE 140-SL is available in 1-gallon and 5-gallon units. Each unit consists of a premeasured Part A component and a premeasured Part B component.

Application thickness may vary depending on expected service conditions (i.e., chemical exposure, temperature, traffic load and other mechanical abuse, immersion service vs. splash-spill, etc.). Consult Sentry Polymers for specific thickness recommendations.

Coverage rates will be effected by the condition of the surface being coated (degraded vs. smooth, steel vs. concrete, etc.). To figure THEORETICAL coverage per gallon divide desired mil thickness into 1,604. (For example, theoretical coverage for a 60 mil thickness is: 1,604 divided by 60 = 26.73 square feet per gallon.) For practical coverage, make necessary allowances for condition of the substrate, working conditions, waste, spillage, etc.

sentry
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# Attachment 6
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## TYPICAL PROPERTIES - WET

| | |
|---|---|
| Solids by Volume: | 100% |
| Weight per Mixed Gallon: | 9.9 lbs |
| Pot Life @ 75°F: | 45-to-60 min* |
| Cure Times @ 75°F: Dry to Touch: | 12 hrs |
| Firm: | 24 hrs |
| Chemical Service: | 36 hrs |
| Primer: | (consult Sentry Polymers) |
| Flammability: | Nonflammable |

* significantly less at elevated temperatures

## TYPICAL PROPERTIES - CURED

| | |
|---|---|
| Color: | Light Gray |
| Hardness - ASTM D-2240 Shore D: Neat: | 70 |
| Compressive Strength - ASTM C-579: Aggregate Filled: | 13,500 psi |
| Tensile Strength - ASTM D-638: Neat: | 5,500 psi |
| Reinforced: | 7,800 psi |
| Flexural Strength - ASTM D-790: Neat: | 7,200 psi |
| Reinforced: | 13,000 |
| (ASTM C-580): Aggregate Filled: | 5,300 |
| Flexural Modulus of Elasticity - ASTM D-790: Neat: | 3.5 psi x $10^5$ |
| Reinforced: | 6.1 psi x $10^5$ |
| (ASTM C-580) Aggregate Filled: | 9.7 psi x $10^5$ |
| Bond Strength - ASTM D-4541: Concrete: | Failure in Concrete |
| Water Vapor Transmission - ASTM E-96: WVT: | 0.0120 grain per hr $ft^2$ |
| Permeability: | 0.0042 perm. -in. |

## STORAGE AND SHELF LIFE

Keep SEMSTONE 140-SL components tightly sealed in their original containers until ready for use. Store at 50-to-75°F, out of direct sunlight. Properly stored, SEMSTONE 140-SL has a minimum shelf life of one year.

Refer to batch number on label for date of manufacture.

## APPLICATION GUIDELINES

### TEMPERATURE CONSIDERATIONS

1. The temperature of the surface to be coated and the ambient air temperature should be at least 50°F while applying SEMSTONE 140-SL and while it cures.

   In general, we recommend against applying SEMSTONE 140-SL if the temperature is expected to drop below 50°F. Instead, use SEMSTONE 140-CT.

2. Twenty-four hours before application, all materials (components A and B, aggregate, etc.) should be stored at a 70-to-85°F, to facilitate handling.

### SURFACE PREPARATION - GENERAL

Surfaces must be dry and free of dirt, dust, oil, grease, chemicals and other contaminants immediately prior to applying each coat of SEMSTONE 140-SL.

### SURFACE PREPARATION OF CONCRETE

1. Immediately prior to application of coating, concrete substrate must be:
   - Adequately cured (generally, at least 28 days; check with Sentry Polymers if concrete has cured less than 28 days).
   - Structurally sound.
   - Free of all dirt, dust, debris, oil, grease, fats, chemical contamination, salts, solvents, surface hardeners, incompatible curing compounds and form release agents, laitance and efflorescence.
   - Concrete surfaces must be dry.

   and must have:
   - Tensile strength of at least 300 psi.
   - pH in the range of 7-to-11.
   - All fins, projections and splatter removed.
   - All defects repaired using patching as described herein.
   - Failed or otherwise incompatible old coatings removed.
   - A surface texture similar to medium sandpaper (40-to-60 grit).

Refer to Sentry Polymers' separate document "Surface Preparation - Concrete" for further instruction in the preparation of concrete surfaces.

2. Locate all expansion joints, control joints, floor drains, equipment base plates, and mid-floor termination points. Handle them as per Sentry Polymers separate document "Construction Details."

3. Degraded concrete on horizontal surfaces should be restored using SEMCRETE 610 Concrete Repair Mortar.

4. Honeycombs or any form voids in vertical surfaces must be filled. Use a mortar made with SEMCRETE 610 Concrete Repair Mortar.

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# Coating Vendor's Technical Information

### SURFACE PREPARATION OF INCIDENTAL STEEL

Equipment base plates, etc. to be coated along with the concrete should be abrasive blasted to a near white metal finish with a 1-to-2 mil anchor profile. (Ref. SSPC-SP-10)

### MASKING

Mask surfaces that are not to be coated. This material is difficult to remove, once applied.

### APPLICATION EQUIPMENT

1. SEMSTONE 140-SL may be applied using a spray rig, notched trowel, brush or roller.

2. Spraying Material Without Aggregate

   - See Equipment Specification - 397-250, Graco

3. Spraying Aggregate Filled Material

   - DO NOT use a plural component or a single component airless rig with aggregate filled material.

     a. Using a Model 973TSD-2-A modified 11:1 pump.

        - Set the Grover pump with a 3/4" ID, 15' long material line, and a 3' pole spray gun.
        - See Equipment Specification - 397-252, Grover Pump

     – or –

     b. Using a peristaltic spray rig, such as the Carrousel Pump by Quik Spray, Port Clinton, Ohio.

        - Set up the peristaltic rig with a 1" ID, 15' long material line and a 3' pole spray gun.
        - Pre-wet the hoses by pumping a small amount of mixed SEMSTONE 140-SL without aggregate through the lines and pole gun; about 1/2-gallon should be sufficient.

4. Always use spray equipment in accordance with manufacturer's instructions.

5. Care of Spray Rig Hoses

   - Take care to prevent the mixed material from setting up in your hoses. For best results, keep your hoses as short as possible, purge them immediately if work is interrupted, keep them out of direct sunlight and insulated from hot surfaces.

### MIXING AND APPLICATION

1. Prime the floor with SEMSTONE 110 Damp Proof Epoxy Primer/Sealer (optional) to avoid the outgassing problem. Allow primer to cure until firm to touch. (Refer to SEMSTONE 110 Damp Proof Technical Bulletin)

2. The components must be individually agitated immediately prior to use.

   Part A - Blend each Part A component to a uniform consistency in its individual container, using a Jiffy type mixer.

   Part B - Stir each Part B component to a uniform color in its individual container.

3. SEMSTONE 140-SL may be extended by adding silica sand. This can provide a more economical topping and is also useful when coating rough or mildly eroded concrete.

   - Use only clean, dry, bagged 20/40 mesh round silica sand. Consult Sentry Polymers for alternate aggregate recommendations.

     a. Pour half the mixed SEMSTONE 140-SL into another clean 5-gallon bucket.

     b. Slowly add sand to each bucket while blending with a Jiffy type mixer. Do both buckets immediately.

     c. You may add up to 3-parts, by weight, of sand to 1-part, by weight, of SEMSTONE 140-SL.

        > At a 3-to-1 ratio you get a mixture of grout-like consistency.

        > At a 2-to-1 ratio, you will obtain a still fluid mixture and extend coverage by 100%. This is the optimum mixture for spray applications.

     d. The mixture may be sprayed or applied by notched trowel.

        - When spraying SEMSTONE 140-SL filled with aggregate, work the pole gun in a circular motion to achieve an even coating thickness.

4. When working a large or congested area, it may be desirable for applicator to wear golf shoes.

5. To obtain a nonskid surface:

   a. Allow the initial coat to cure 8 hours.

# Attachment 6
# Coating Vendor's Technical Information

b. Wash the initial coat with soap and water, rinse it thoroughly with clear water, and dry it.

c. Apply a thin second coat.

d. Before this second coat reaches its initial set, broadcast your grit media onto the surface.

6. SEMSTONE 140-SL is self-leveling. When used on an area that has a pitch or slope, use a 2-to-1 silica sand mixture (see paragraph 3 above) in order to keep the material from sliding.

7. To coat vertical surfaces we generally recommend our SEMSTONE 140-S Epoxy Coating and Lining system.

8. Prepare surfaces for intercoat adhesion as follows:

   a. Allow SEMSTONE 140-SL to cure until firm before recoating.

   b. After the surface cures firm to the touch, but less than 24 hours, it must be washed with soap and water, rinsed and dried before recoating.

   c. Surfaces cured beyond 24 hours must be washed with soap and water, rinsed, dried and lightly sanded or abrasive blasted.

9. If work is interrupted, or at the end of the day, terminate the coating in a straight line.

## CLEANUP

Before it gels, SEMSTONE 140-SL may be cleaned from tools and equipment using hot, soapy water.

After SEMSTONE 140-SL gels, xylene or MEK will be required. Chlorinated solvents may be used if flammable solvents are not allowed.

## SAFETY PRECAUTIONS

FOR INDUSTRIAL USE ONLY.

Avoid contact with eyes and skin; do not ingest or inhale.

When working with SEMSTONE 140-SL, always wear chemical goggles, rubber gloves, and appropriate work clothing.

When spraying in a confined area, also wear a fresh air hood and make provision for forced ventilation.

When spraying in an open area, an organic mist respirator can replace the fresh air hood.

Prolonged or repeated exposure to SEMSTONE 140-SL may cause skin irritation or allergic reactions.

Refer to material safety data sheets regarding individual components.

# Attachment 6
# Coating Vendor's Technical Information

## *SEMLASTIC 201*
### *Self-Leveling Elastomeric Membrane*

SEMLASTIC 201 Self-Leveling Elastomeric Membrane is a self priming membrane that provides an excellent combination of elasticity and durability. It is an ideal base-coat in a waterproofing and wearing membrane coating or lining system. SEMLASTIC 201 is also used as a waterproofing membrane under seamless epoxy toppings.

## TECHNICAL INFORMATION

**Product**

SEMLASTIC 201 is a 100% solids, self-leveling, elastomeric, polyurethane, self priming membrane. It is a two component system consisting of a Part A resin and Part B hardener. It is designed as a membrane for waterproofing and wearing systems as recommended by Sentry Provides Technical Service Department.

**General Uses**

SEMLASTIC 201 offers both durability and elasticity as a membrane base-coat. The system is ideal for parking decks, pedestrian walkways, mechanical rooms, pulp and paper mills, chemical processing facilities, nuclear power plants, and whenever extensibility over cracks is desired to maintain flexibility. It can also be used under seamless epoxy toppings as a waterproofing membrane.

Other features of SEMLASTIC 201 include:

- No solvent odor and no thinner required
- Excellent adhesion direct to concrete (self-priming)
- Easy application characteristics
- Bridges cracks up to 1/16 inch in concrete
- Very low moisture vapor transmission
- Meets the most stringent VOC (volatile organic content) regulations

NOTE: SEMLASTIC 201 is not recommended for immersion service. Not normally recommended for any service without appropriate top-coat.



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## Typical Properties

| | | |
|---|---|---|
| Solids by Volume: (%) | | 99 (± 1%) |
| Pot Life @ 75°F: | | 30 minutes (less at higher temperatures) |
| Cure Time @ 75°F: | | |
| Dry to Top-coat* | | 8 hours |
| Dry to Traffic | | 48 hours |
| Final Cure | | 7 days |
| | | * Top-coat while material is still tacky. |
| Flash Point: (Setaflash) | | |
| Part A | | >414°F |
| Part B | | >371°F |
| Color: | | Gray |
| Primer: primer may be reuired in some situations where moisture is a problem - consult Sentry Polymers | | |
| Hardness (Shore A): | ASTM D-785-65 | 90 |
| Compression Set: (72 hrs @ 50% 22°C) | ASTM D-395 (psi) | 95% |
| Tensile Strength (70°F): (psi) | ASTM D-412-80 | 2175 |
| Elongation (70°F): (%) | ASTM D-412-80 | 100 |
| Coefficient of Thermal Linear Expansion: | ASTM D-696-79 | $13.1 \times 10^{-5}$/°C |
| Abrasion Resistance: | Taber | .014 g |
| Flexural Yield Strength: (psi) | ASTM D-790-81 | 290 |
| Water Absorption: (%) | ASTM D-570-81 | 0.26 |
| Tear Resistance: (lb/in) | ASTM D-470-82 | 2.1 |
| Resilience: | ASTM D-2632-71 | 3.4 |
| Burning Rate: (inch/min) | ASTM D-635-81 | 1.6 |

## Bid Specification Guide

Use SEMLASTIC 201 two-component, elastomeric polyurethane as manufactured by Sentry Polymers, Inc., Freeport, Texas.

Apply SEMLASTIC 201 at the specified thickness. Refer to the manufacturer's most currently published product and application literature for technical and application information.

## Handling Characteristics

SEMLASTIC 201 may be applied by notched squeegee, brush or roller, or spray. *Thoroughly mix each component separately then mix together.*

SEMLASTIC 201 has a recommended dry film thickness per coat of 20-to-30 mils. The theoretical coverage rate is 80 square feet at 20 mils per mixed gallon. Mixing and application losses will vary and must be taken into consideration when estimating job requirements.

## Packaging/Storage

SEMLASTIC 201 is packaged in 0.8-gallon and 4.76-gallon units.

Each unit consists of a pre-measured Part A component and a pre-measured Part B component.

Keep SEMLASTIC 201 products tightly sealed in their original containers until ready for use. Store at 50-to-75°F, out of direct sunlight. Properly stored, SEMLASTIC 201 products have a shelf life of 12 months.

# Attachment 6
# Coating Vendor's Technical Information

**Safety Precautions**

FOR INDUSTRIAL USE ONLY.

When using SEMLASTIC 201, be aware of these safety precautions:

- Contains combustible solvents. Keep away from sparks and open flames.
- Avoid contact with eyes and skin.
- Do not ingest or inhale.
- Always wear chemical goggles, rubber gloves, and appropriate work clothing.
- Make provisions for forced ventilation when working in a confined area.
- Wear fresh airline respirators when working in confined areas.
- Prolonged or repeated exposure to the unreacted Part A and Part B components may cause skin irritation or allergic reaction.
- Refer to material safety data sheets (MSDS) regarding individual components.

**Application Guidelines**

These instructions are not intended to show product recommendations for specific service. They are intended as an aid in determining correct surface preparation, mixing instructions and application procedure. It is assumed that the proper product recommendations have been made. These instructions should be followed closely to obtain the maximum service from the materials.

**Surface Preparation**

Surfaces should be clean, dry, sound and free off all laitence, dirt, dust, oil, grease or foreign contaminants. Do not apply to concrete that has been treated with hardeners unless test patch provides adequate adhesion. Sentry Polymers recommends light abrasive blasting to achieve an appearance similar to medium grit sandpaper. Take care to thoroughly clean surface after preparation to remove all chemical residues and cement fines.

Do not apply coating unless concrete has cured at least 28 days. Refer to Sentry Polymer's separate document "Surface Preparation - Concrete" for further instruction in the preparation of concrete surfaces to accept a Sentry Polymers coating system.

**Mixing**

Sentry Polymers recommends mixing full kits only. Mix each component individually. Combine individual components and mix thoroughly without entraining air or forming a vortex in the material.

**Application**

NOTE: Do not apply when the surface temperature is less than 55°F, above 90°F, or falls within 5°F of the dew point.

NOTE: Do not thin.

NOTCHED SQUEEGEE
Apply with a notched squeegee. 5/32 inch notched squeegee to apply at 20-mils, 3/16 inch notched squeegee for 30-mils.

# Attachment 6
# Coating Vendor's Technical Information

| | |
|---|---|
| **Application (cont.)** | May be applied using airless equipment.<br><br>The following spray equipment has been found suitable and is available from manufacturers such as Binks, DeVilbiss and Graco.<br><br>Airless: Pump Ratio: 30:1 (min.) / GPM Output: 3.0 (min.) / Material Hose: 3/8" I.D. (min.) / Tip Size: .025-to-.030" / Output psi 2,100-to-2,300<br><br>Teflon packages are recommended and are available from the pump manufacturer.<br><br>BRUSH or ROLLER<br>These are recommended for touch-up or cutting-in only. |
| **Re-coat** | Top-coat while material is still tacky.<br><br>Observe full cure time. Higher film thickness will lengthen cure times.<br><br>Check surface for contamination or epoxy blush and remove or clean before top-coating. |

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SENTRY MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, CONCERNING ITS PRODUCTS, INFORMATION AND SUGGESTIONS AND DISCLAIMS ALL WARRANTIES INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

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# Attachment 6
# Coating Vendor's Technical Information

product data sheet

carboline®

## CARBOLINE® 3358

VOC plus

### SELECTION DATA

**GENERIC TYPE:** Water-borne acrylic.

**GENERAL PROPERTIES:** A single package, high performance, direct-to-metal acrylic primer which has exceptional film strength and chemical resistance.

- Low odor
- Excellent flexibility
- Excellent corrosion protection
- Excellent resistance to flash rusting
- Meets most VOC (Volatile Organic Content) regulations
- Acceptable for Incidental Food Contact

**RECOMMENDED USES:** As a primer for applications requiring a VOC compliant primer such as railcar, tank exteriors and structural steel. Can be used as a two or three coat all acrylic system with a Carboline 3359 topcoat.

**NOT RECOMMENDED FOR:** Immersion service.

**TYPICAL CHEMICAL RESISTANCE:**
(With appropriate topcoat)

| Exposure | Splash & Spillage | Fumes |
|---|---|---|
| Acids | Very Good | Excellent |
| Alkalies | Very Good | Excellent |
| Solvents | Fair | Good |
| Salt Water | Excellent | Excellent |
| Water | Excellent | Excellent |

**TEMPERATURE RESISTANCE:** (Non-immersion)
Continuous: 235°F (113°C)
Non-Continuous: 325°F (163°C)

At 250°F and above, slight discoloration and loss of gloss is observed.

**SUBSTRATES:** Apply over properly prepared metal or other surfaces as recommended.

**COMPATIBLE COATINGS:** May be applied over most tightly adhering coatings. A mist coat may be required when applied over inorganic zincs. Normally topcoated with Carboline 3359.

### SPECIFICATION DATA

**THEORETICAL SOLIDS CONTENT OF MIXED MATERIAL:**

| | By Volume |
|---|---|
| CARBOLINE 3358 | 37% ± 2% |

**VOLATILE ORGANIC CONTENT:***

| | | Calculated EPA Method 24 | Actual Per Gallon |
|---|---|---|---|
| As supplied: | lbs/gal | 1.28 | 0.56 |
| | g/l | 153 | 67 |
| Thinned: | | | |
| 6 oz/gal with Potable Water | lbs/gal | 1.28 | 0.54 |
| | g/l | 153 | 65 |
| 6 oz/gal with Additive 102 | lbs/gal | 1.89 | 0.89 |
| | g/l | 226 | 107 |
| 12 oz/gal with Additive 102 | lbs/gal | 2.40 | 1.18 |
| | g/l | 288 | 141 |

*May vary slightly with color.

**RECOMMENDED DRY FILM THICKNESS PER COAT:**
2-3 mils (50-75 microns)

Additional thickness may be required over rough surfaces for appearance.

Dry film thickness in excess of 3 mils per coat is not recommended.

**THEORETICAL COVERAGE PER GALLON:**
593 mil ft² (14.5 m²/l at 25 microns)
296 ft² at 2 mils (7.3 m²/l at 50 microns)

Mixing and application losses will vary and must be taken into consideration when estimating job requirements.

**STORAGE CONDITIONS:** Store indoors.
Temperature: 40-110°F (4-43°C) Humidity: 0-95%
KEEP FROM FREEZING

**SHELF LIFE:** 24 months when stored indoors at 75°F (24°C).

**COLOR:** Salmon 0400 and Buff 0200

**GLOSS:** Eggshell

### ORDERING INFORMATION

Prices may be obtained from your Carboline Sales Representative or Carboline Customer Service.

**APPROXIMATE SHIPPING WEIGHT:**

| | 1s | 5s | 50 Gal Drum |
|---|---|---|---|
| CARBOLINE 3358 | 11 lbs. (5 kg) | 53 lbs. (24 kg) | 565 lbs. (257 kg) |
| Additive 102 | 9 lbs. (4 kg) | 40 lbs. (18 kg) | N/A |

**FLASH POINT:** (Setaflash)

| | | |
|---|---|---|
| CARBOLINE 3358 | >200°F | (>93°C) |
| Additive 102 | 146°F | (64°C) |

June 97 Replaces June 96



0262

# Attachment 6
# Coating Vendor's Technical Information

## APPLICATION INSTRUCTIONS
## CARBOLINE® 3358

These instructions are not intended to show product recommendations for specific service. They are issued as an aid in determining correct surface preparation, mixing instructions and application procedure. It is assumed that the proper product recommendations have been made. These instructions should be followed closely to obtain the maximum service from the materials.

0262

**SURFACE PREPARATION:** Remove all oil or grease from the surface with Thinner 2 or Carboline Surface Cleaner 3 (refer to Surface Cleaner 3 instructions) in accordance with SSPC-SP 1.

**Steel:** Abrasive blast to a Commercial Finish in accordance with SSPC-SP 6 and obtain a 1-3 mil (25-75 micron) blast profile. Hand or power tool cleaning per SSPC-SP 2 or SSPC-SP 3 to produce a rust-scale free surface is acceptable.

Galvanized: New or aged galvanized should be lightly abraded to remove sheen and/or surface deposits.

**MIXING:** Power mix until uniform in consistency. Avoid excessive air entrainment.

**THINNING:** May be thinned up to 6 oz/gal with clean, potable water where conditions dictate.

Areas with cool substrate and warm ambient conditions can experience a surface skinning and separation. Under these conditions, the use of 6-12 oz/gal of Additive 102 assists in the proper film formation at the recommended dry film thickness, without surface skinning.

Use of thinners other than those supplied or approved by Carboline may adversely affect product performance and void product warranty, whether express or implied.

**POT LIFE:** This is a single component product which has an indefinite working time. Keep container covered when not in use.

**APPLICATION CONDITIONS:**

| | Material | Surface | Ambient | Humidity |
|---|---|---|---|---|
| Normal | 60-90°F (16-32°C) | 65-85°F (18-29°C) | 65-90°F (18-32°C) | 10-80% |
| Minimum | 50°F (10°C) | 50°F (10°C) | 50°F (10°C) | 0% |
| Maximum | 105°F (40°C) | 130°F (54°C) | 110°F (43°C) | 85% |

Do not apply when the surface temperature is less than 5°F or 3°C above the dew point. Do not apply if temperatures are expected to drop below 50°F (10°C) within 24 hours of application.

Special thinning and application techniques may be required above or below normal conditions.

**SPRAY:** Pre-rinse equipment with undiluted Carboline Surface Cleaner 3 followed by clean potable water before spraying. The following spray equipment has been found suitable and is available from manufacturers such as Binks, DeVilbiss and Graco.

**Conventional:** Pressure pot equipped with dual regulators, 1/2" I.D. material hose, .086" fluid tip and appropriate air cap.

**Airless:**

| | |
|---|---|
| *Pump Ratio:* | 30:1 (min) |
| *GPM Output:* | 3.0 (min) |
| *Material Hose:* | 3/8" I.D. (min) |
| *Tip Size:* | .017"-.019" |
| *Output psi:* | 1800-2200 |
| *Filter Size:* | 60 |

For two or more spray guns a 45:1 ratio pump is recommended.

For ease of application using airless spray equipment, remove the pick-up tube and immerse the lower unit directly into the material.

Teflon packings are recommended and are available from the pump manufacturer.

**BRUSH APPLICATION:** Use a synthetic bristle brush. Multiple coats may be required to achieve desired dry film thickness and acceptable hiding characteristics.

**ROLLER APPLICATION:** Use a short woven nap synthetic roller. Multiple coats may be required to obtain desired appearance, hiding and recommended dry film thickness.

**DRYING TIMES:** These times are based on a 2-3 mil (50-75 micron) dry film thickness and 50% RH.

| Surface Temperature | Dry to Handle and Topcoat |
|---|---|
| 50°F (10°C) | 3 hours |
| 75°F (24°C) | 2 hours |
| 90°F (32°C) | 1 hour |

The acrylic film forming process may require several weeks at 75°F (24°C) with proper ventilation to develop adhesion and water resistance. High humidity, high film thickness, insufficient ventilation or cooler temperatures will lengthen the Dry to Handle/Topcoat times due to slower water evaporation rate. Waterborne acrylics are sensitive to moisture during early cure and are susceptible to handling damage.

**CLEAN UP:** Use clean potable water, followed with suitable solvent to dry equipment.

**CAUTION: READ AND FOLLOW ALL CAUTION STATEMENTS ON THIS PRODUCT DATA SHEET AND ON THE MATERIAL SAFETY DATA SHEET FOR THIS PRODUCT.**

June 97 Replaces June 96

WATER-BASED PRODUCT. KEEP ABOVE 32°F (0°C). EMPLOY NORMAL WORKMANLIKE SAFETY PRECAUTIONS. USE WITH ADEQUATE VENTILATION AND WEAR GLOVES OR USE PROTECTIVE CREAM ON FACE AND HANDS IF HYPERSENSITIVE. KEEP CONTAINER CLOSED WHEN NOT IN USE. IN CASE OF SPILLAGE ABSORB AND DISPOSE OF IN ACCORDANCE WITH LOCAL APPLICABLE REGULATIONS.

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# Attachment 6
# Coating Vendor's Technical Information

**product data sheet**

carboline®

## FLEXXIDE® HB

### PRODUCT DESCRIPTION

**COMPOSITION:** Single-component waterborne vinyl acrylic.

**BASIC USE:** To provide excellent weatherproofing and water resistance.

Designed as a one or two coat system for most exterior and interior wall surfaces including: stucco, concrete, masonry, primed exterior-grade wood and primed steel. An ideal system for new construction, maintenance and surface renovation. Contains anti-microbial agents.

**LIMITATIONS:** Do not apply at temperatures below 45°F (7°C) or under conditions where temperatures may drop below 45°F (7°C) within 24 hours after application. Do not use below grade or on back filled retaining walls.

**SIZES:** Available in 5-gallon pails and 55-gallon drums.

**COLORS:** Manufactured in white and 10 standard colors. Custom colors available in 100-gallon order minimum.

**GLOSS:** Matte.

**COMPANION PRODUCTS:** The following companion products may be necessary to prepare the substrate properly. See application instructions for specific recommendations.

- Carboline Multi-Bond 120
- Flexxide Masonry Block Filler
- Carboline 3358
- Sanitile Patching Compound

**RECOMMENDED DRY FILM THICKNESS PER COAT:**

| | |
|---|---|
| Smooth: | 7 mils (175 microns) |
| Fine, Medium, Coarse: | 5 mils (125 microns) |

**TYPICAL PER COAT COVERAGE:** Mixing and application losses must be taken into consideration when estimating job requirements.

| | |
|---|---|
| FLEXXIDE HB Smooth: | 100 $ft^2$/gal ± 20 |
| FLEXXIDE HB Fine: | 50 $ft^2$/gal ± 5 |
| FLEXXIDE HB Medium: | 45 $ft^2$/gal ± 5 |
| FLEXXIDE HB Coarse: | 40 $ft^2$/gal ± 5 |

Coverage rates are estimates. Coverage rate may vary depending on the type and condition of the substrate. Apply test to confirm actual coverage rate.

### TECHNICAL DATA

#### PHYSICAL DATA (TYPICAL PROPERTIES)

| | |
|---|---|
| SOLIDS BY VOLUME | 48% ± 2% |
| Elongation (%) ASTM D2370 | 200% |
| Flexibility ASTM D1737 | |
| 180° bend 1/8" mandrel | Passes |
| Mold Resistance ASTM D3273 | Passes |
| Resistance to wind-driven rain | |
| TT-C-555B, paragraph 4.4.7 | No penetration |
| Weathering resistance, 5000 hrs., Fed. Std. 6152, 141a | Passes |

**Volatile Organic Content (VOC):**
The following are nominal values and may vary with color:

| | | |
|---|---|---|
| **As supplied** | Smooth: | 1.54 lbs/gal (184 g/l) |
| | Fine: | 1.35 lbs/gal (162 g/l) |
| | Medium: | 1.10 lbs/gal (132 g/l) |
| | Coarse: | 1.10 lbs/gal (132 g/l) |

**Shelf Life:** 24 months when stored indoors at 75°F (24°C).

**APPLICABLE STANDARDS:** Meets or exceeds the performance requirements of Federal Specification TT-C-555B, Types I and II. Meets EPA clean air requirements. This product is non-toxic per the Federal Hazardous Substance Act.

**Fire Rating:** Flame spread of less than 25 when tested in accordance with provisions of ASTM E84-79. The test method is identical to that specified in NFPA 255, UL 723, ANSI No. 2.5 and UBC 42.1. FLEXXIDE HB is qualified as a Class "A" coating.

**STORAGE CONDITIONS:** Store indoors.
DO NOT FREEZE
Temperature: 40-100°F (5-38°C) Humidity: 0-90%

### ORDERING INFORMATION

Prices may be obtained from your Carboline Sales Representative or Carboline Customer Service.

**APPROXIMATE SHIPPING WEIGHT:**

| 5 Gallon Pail | 55 Gallon Drum |
|---|---|
| 55 lbs | 600 lbs |

**FLASH POINT** (Setaflash):
Greater than 200°F (93°C)

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# Attachment 6
# Coating Vendor's Technical Information

## APPLICATION INSTRUCTIONS
## FLEXXIDE® HB

These instructions are not intended to show product recommendations for specific service. They are issued as an aid in determining correct surface preparation, mixing instructions and application procedure. It is assumed that the proper product recommendations have been made. These instructions should be followed closely to obtain the maximum service from the materials.

**SURFACE PREPARATION**

**New/Uncoated Construction:** Mortar joints should be thoroughly cured for a minimum of 15 days at 75°F (24°C) and 50% RH or equivalent prior to any coating work. Coating work can proceed over areas that are firm, dry and free of all foreign matter such as grease, oil, dust, dirt, laitance and efflorescence.

Check the pH of the surface with an Insta-Check Surface pH Pencil or other measuring device. If the surface pH exceeds a pH of 9, use Multi-Bond 120 or treat to reduce the pH below 9.

**Low Density Block:** Coat with Flexxide Masonry Block Filler at a coverage rate of 75-100 square feet/gallon. Allow Flexxide Masonry Block Filler to dry for 24 hours at 75°F (21°C) before applying FLEXXIDE HB.

**Regular Density Block, Stucco, Brick:** Flexxide Masonry Block Filler may not be necessary before application of FLEXXIDE HB.

**Precast or Poured-in-Place Concrete:** Allow to cure for 30 days at 75°F (24°C) and 50% RH or equivalent. Remove all form oils, incompatible curing agents, hardeners, laitance, efflorescence or other contaminants by abrasive blasting or high-pressure water blast (5,000 to 10,000 psi).

**Metal:** Prepare surface according to Carboline 3358 Product Data Sheet. Prime with Carboline 3358. Carboline 3358 must be clean, dry and properly cured before applying FLEXXIDE HB.

**Wood:** Prepare the surface according to Carboline Multi-Bond 120 Product Data Sheet and apply Carboline Multi-Bond 120.

**Previously Coated Construction:** Remove all chalk, loosely adhering coating, foreign matter and efflorescence by using low pressure water cleaning (up to 5000 psi). Prime surface with Carboline Multi-Bond 120.

**Repair Procedures:** Repair cracks and surface imperfections prior to application of FLEXXIDE HB as follows:

a) **Hairline cracks:** FLEXXIDE HB will normally bridge existing hairline cracks with no additional preparation being necessary.
b) **Small to medium cracks (up to 1/8"):** Use Sanitile Patching Compound, work into the crack with a broad knife and strike flush.

**NOTE:** Allow all crack repairs to cure a minimum of 18 hours at 75°F (24°C) before application of FLEXXIDE HB.

**MIXING:** Power mix to a uniform consistency.

**THINNING:** Not normally required. Material is ready to apply as supplied.

**APPLICATION CONDITIONS:**

| | Material | Surface | Ambient | Humidity |
|---|---|---|---|---|
| Normal | 60-90°F (61-32°C) | 65-85°F (18-29°C) | 65-90°F (18-32°C) | 10-85% |
| Minimum | 50°F (10°C) | 50°F (10°C) | 50°F (10°C) | 0% |
| Maximum | 100°F (38°C) | 130°F (54°C) | 120°F (49°C) | 90% |

Do not apply if temperatures are expected to drop below 50°F (10°C) within 24 hours of application.

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Do not apply when the surface temperature is less than 5°F or 3°C above the dew point. Water based products are sensitive to moisture during cure.

Do not apply to frozen block or any masonry surface that has not completely thawed and dried.

Special thinning and application techniques may be required above or below normal conditions.

**APPLICATION EQUIPMENT:**

**Spray:** The following recommendations are the result of equipment manufacturer's testing and field experience. Contact the specific equipment manufacturer if you are using equipment other than described here.

**FLEXXIDE HB Smooth:**
Pneumatic: Air Supply.
Airless/Pneumatic: 30:1 Graco President, Senator, Bulldog, or King. Use ½" x 25' max. or 3/8" x 50' max. hose. Use Silver gun with .015 - .025 Reverse-A-Clean tip.

Airless/Gas: Graco 433, 533 or 733 with ¼" x 25' max. or 3/8" x 50' max. hose. Use Silver gun with .015 - .025 Reverse-A-Clean tip.

**FLEXXIDE HB Textured:**
Hand hopper: Wallboard or Goldblatt 3/8" air line, ¼" orifice, 1/8" nozzle with 34-45 psi open line air. Spray 18"-24" from surface. Air/bottom feed pot: 30' max. of 1" or ¾" material hose and ½" air hose, double regular connected from tee, Binks 7E2 gun with ¼" orifice. Use ceramic or nylon insert for best service. Set regulators at 50 psi material and 50 psi atomizing pressures. Spray at 24" distance from surface.

**Roller:** Use 9" - 12" roller with 3/8" to ½" nap. Wet the roller thoroughly with water and spin it out before filling it with material. Apply liberally to the specified wet mils. Avoid dry rolling.

**DRYING TIMES:** These times are based on a 8 mil (200 micron) dry film thickness and 50% RH. High humidity, excessive film thickness, insufficient ventilation or cooler temperatures will lengthen dry times due to slower water evaporation rates.

| Surface Temperature | Between Coats (Minimum) |
|---|---|
| 50°F (10°C) | 48 hours |
| 60°F (16°C) | 24 hours |
| 75°F (24°C) | 12 hours |
| 90°F (32°C) | 12 hours |

**MAINTENANCE:** No maintenance is normally required. If coating becomes soiled due to unusual circumstances, routine washing with hot water and detergent solutions may be used. It is recommended that the detergent solution be applied to a test area to determine compatibility with the coating system. If system's surface becomes damaged, FLEXXIDE HB can be reapplied in the damaged area, following standard surface preparation and application procedures.

**CLEANUP:** Use Carboline Surface Cleaner 3 followed by a potable water rinse.

**CAUTION: READ AND FOLLOW ALL CAUTION STATEMENTS ON THIS PRODUCT DATA SHEET AND ON THE MATERIAL SAFETY DATA SHEET FOR THIS PRODUCT.**

**CAUTION: WATER-BASED PRODUCT. KEEP FROM FREEZING. ALKALINE SOLUTION. CONTAINS A MINOR AMOUNT OF COMBUSTIBLE SOLVENTS. IN CONFINED AREAS WORKMEN MUST WEAR FRESH AIRLINE RESPIRATORS. HYPERSENSITIVE PERSONS SHOULD WEAR GLOVES OR USE PROTECTIVE CREAM.**

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## Attachment 6
## Coating Vendor's Technical Information

MARCUS

technical DATA

# DECADEX - WALLS

### PRODUCT DESCRIPTION

Decadex is an advanced technology copolymer which cures to form a tightly adherent, decorative, weatherproof coating of outstanding effectiveness and durability. It is water based and free from odor and toxic risk, and is applied by brush or spray equipment. The cured membrane is elastomeric to facilitate movement with the substrate. It does not embrittle on aging or on exposure to sunlight resisting the unsightly flaking and cracking associated with conventional paint finishes. Decadex is particularly appropriate for the protection of reinforced concrete structures against carbonation as it is believed to be the only product available which has a proven record of effectiveness since 1970. Because of its vapor permeable composition, entrapped substrate moisture is able to escape without blistering the coating or weakening its adhesion, while the product simultaneously provides a tough impenetrable barrier against further water ingress. Decadex is available in a range of attractive colors and its chemical and pollution resistant surface is self cleaning to preserve its excellent appearance.

### REINFORCEMENT SYSTEMS

**Reinforcement systems to be used in conjunction with Decadex.**

**Read in conjunction with 'Reemat' Technical Data Sheet.**

NOTE: Stable cracks in walls should be filled with external quality flexible filler.

**Reemat Flexitape:**
An expandable Polyamide Tape in roll form, for the treatment of cracks and joints, available in two weights and different widths.

After surface preparation and priming, bridge narrow (e.g. up to 40 MILS) mobile cracks with Reemat Flexitape Light Duty embedded into the Decadex coating, allow to dry before applying two coats of Decadex overall.

For known movement cracks of larger or variable width (>40 MILS), and expansion joints, create a flexible bellows to avoid stress cracking. Apply a minimum 1" width of masking tape over the joint/crack, then apply a full layer of DECADEX, embedding the Reemat Heavy Duty Flexitape into it, centered on the joint/crack. Once dry, apply a further coat to obliterate the tape

NOTE: The Reemat Flexitape must exceed the masking by at least 1" either side to aid adhesion. On large flat surfaces Reemat Flexitape Heavy Duty is visible after application.

Reemat Flexitape Light. Duty - 1 gallon of Decadex to embed approximately 375 linear feet of 2" wide tape (linear footage decreases as tape width increases).

Reemat Flexitape Heavy Duty 1 gallon of Decadex to embed approximately 200 linear feet of 3" wide tape (linear footage decreases as tape width increases).

**Total Reinforcement:**
**The Reemat System:**
Reemat Reinforcement Systems are available to give overall reinforcement to the Decadex coating. The Reemat range comprises special quality glass fibre mats which improve the strength of the Decadex membrane and provide even greater resistance to impact and excessive thermal and structural movement, while maintaining a high degree of elasticity.

## Attachment 6
## Coating Vendor's Technical Information

# DECADEX - WALLS

### PREPARATION AND APPLICATION

As substrate and job specifications vary widely, Marcus Corporation offers a comprehensive recommendation service for individual cases covering preparation, application, curing etc. Remove oil/grease (with detergent and water or solvent). Remove laitance and all loose material by high pressure water blasting, sand blasting, power or hand wire brushing etc. Ensure all surfaces are clean, dry and sound.

**Surfaces must be structurally sound. Deteriorated or heavily spalled masonry or defective brickwork must be repaired or replaced.**

**Asbestos Cement**
Apply Decadex over Bonding Primer. The unreinforced Decadex system may be applied to corrugated asbestos cement sheet or similar asbestos-free boards. Reinforcement must be used on degraded or cracked surfaces and over fixings and laps.

**Bricks, Blocks and Stone**
Apply Bonding Primer before treatment with Decadex to fairfaced and Fletton bricks, smooth blocks, concrete blocks, (aerated/foamed blocks must be filled first), Ashlar and random stone.

Glazed bricks must be mechanically abraded.

**Cement, Plaster and Concrete Substrates**
Apply Decadex over Bonding Primer to sound semi-compressed cement bound boards and plaster finishes.

Glass Reinforced Concrete requires total reinforcement with Reemat Glass Fibre Mat. System details available on request.

Concrete and screeds must be a minimum of 10 days old and preferably 28 days, once moisture content is 20% or less apply Bonding Primer prior to Decadex.

### COVERAGE RATES
**SEE IMPORTANT NOTES ON BACK PAGE**

| Direct Applications | Rate Per Gallon | Wet Film Thickness | Approx. Dry Film Thickness |
|---|---|---|---|
| Decadex 1st Coat | 145ft² | 11 MILS | |
| 2nd Coat | 145ft² | 11 MILS | |
| TOTAL | 72.5ft² | | 14 MILS |

For embedment rates for REEMAT Flexitape see Reinforcement Systems section.

Always add total or partial reinforcement over degraded or multi-cracked substrates which cannot be reinstated back to a sound base or are expected to crack or contain multi-joints.

**Insulation**
On substrates to be totally encapsulated such as foam pipe sections and lightly dusting substrates (e.g. phenolic) Decadex should be applied over Bonding Primer.

Friable, weak and multi-jointed substrates require a reinforced Decadex system.

ASBESTOS INSULATION IS A SPECIAL CASE - CONSULT MARCUS CORPORATION- SEE LEAFLET 'THE ASBESTOS PROBLEM - A SOLUTION.'

**Lining Boards**
Surface absorbent boards e.g. Limpet, Plasterboard, Asbestolux etc. apply Bonding Primer before coating with Decadex. Consult Marcus Corporation for advice on priming precoated boards. All joints must be taped to ensure overall waterproofing.

**Mastics**
Apply without primer over cured polysulphide, but do not apply this mastic to Decadex. High modulus silicones can be applied to Decadex but no adhesion will be gained by Decadex over silicone. Use Bonding Primer over cured polyurethane.

**Paints**
Direct application on sanded gloss, oil, alkyd and epoxy paints. If not sanded use Bonding Primer. Sound, cleaned emulsion, lime wash, polyurethane, bitumen and pitch paints use Bonding Primer.

**Gloss Paints**
(Oil/Oxidative Drying) Do not use over or in close proximity to Decadex as drying will be retarded.

**Timber**
Apply Decadex over Bonding Primer on non-checking woods.

**Overcoating Decadex**
Clean off all contamination and apply a coat of Bonding Primer followed by Decadex .

## Attachment 6
## Coating Vendor's Technical Information

MARCUS

technical DATA

# DECADEX - WALLS

### TEST DATA (TYPICAL VALUES)

The following data is applicable to unreinforced Decadex. For greater detail request TECHNICAL BULLETINS indicated.

**Accelerated Weathering Test To DEF/10 5 3**
The samples were subjected to a total of 1,000 hours of accelerated weathering in accordance with method No. 26 of Defence Specification DEF/1053 and 400 hours of infra-red and ultra-violet radiation. The samples showed no defects or change in flexibility. Technical Bulletin Number 7/D.

**Ageing Test**
Decadex was subjected to six months exposure at 80°C (176°F). At the end of this period Decadex proved to be unimpaired. According to the Building Research Station Digest No. 51, it is suggested that 14 days exposure would equate to one years normal weathering. Technical Bulletin Number 11/D.

**Water Vapor Permeability To B.S. 3177 (Temperate)**
Permeability: 1.90 g/m²/24 hours or 0.17 perms or 9.65 x 10-3 g/s. MN. Technical Bulletin Number 3/D-W.

**Freeze/Thaw**
Freeze/thaw tests have been conducted by UMIST. The specimens were subjected to a five day series of cycles comprising 6 hours at -50°C, (-58°F) followed by 18 hours at 100°C (212°F). Their appearance and flexibility were identical after the tests to their original condition. Technical Bulletin Number 18/D.

**Chemical Resistance**
Standard 10% solution of acids and alkalis, including nitric acid and caustic soda, failed to cause breakdown of the Decadex membrane after seven days total immersion at 68°F. Technical Bulletin Numbers 6/DA and 6/DB.

**Salt Spray To ASTM B-117**
Samples were tested in accordance with Specification DEF/1053 No. 24 for a period of three weeks. The samples showed no deterioration of the surface or flexibility. Technical Bulletin Number 8/D.

**Impact Resistance Test To B.S. 3900: Part 3**
Withstands 197 MILS indentation on front and back of coated roofing felt sample without defect. Technical Bulletin Number 24/D.

**Anti-Carbonation**
Equivalent carbonation barrier to 5971 FEET OF AIR (Effective barrier to carbon dioxide=164 feet of air), (Carbon Dioxide resistance-Engelfried Technique). Technical Bulletin Number 218/D.

**Drying Times**
Approx. 2 hours in warm sunny conditions with a breeze. In cold conditions drying is retarded-allow 24 hours between coats. Avoid uneven thicknesses.

### EQUIPMENT

**Brushes**
A wide soft nylon or bristle brush gives best results. Do not use sweeping brushes.

**Spray Equipment**
Most types of industrial spray equipment are suitable (pressure 2500-3000 psi tip size 0.019"-0.029").

For full details on spray equipment see Technical Bulletin Number 64.

**Rollers**
Use only for applying primers on flat, low absorbency surfaces and for embedding reinforcement. However, under exceptional circumstances e.g. heavily textured surfaces, rollers may be used for applying Decadex or for texturing the surface of the product when applied as a third coat.

**Cleaning**
Clean brushes and spray equipment with water. Dried Decadex can be removed with cellulose thinners, xylol or toluol.

## Attachment 6
## Coating Vendor's Technical Information

# DECADEX - WALLS

### CONTAINER SIZES

DECADEX - 25 liters (6.6 gals)
SEALERS AND PRIMERS - 25 liters (6.6 gals)

### COLORS

**Dark Grey** BS 00A13
**Mid Grey** Non BS
**Light Grey** BS 10A03
**Mid Green** Non BS
**Sage** BS 12B21
**Light Green** BS 14C31
**Light Blue** BS 18E49
**Mushroom** BS 08B17
**Cream** BS 10C31
**Magnolia** BS 08B15
**Oxide Red** Non BS
**Black** Non BS
**White** Non BS
**Portland** Non BS

### IMPORTANT NOTES

Do not thin or brush out like conventional paint.

If more than 7 days elapse after applying first coat of Decadex apply Bonding Primer and allow to dry before applying second coat of Decadex.

Do not allow ponding to occur between coats on horizontal surfaces until the final coating has totally cured (up to 7 days) brush or mop away surface water during this time.

Do not apply the products in damp or rainy weather or below a minimum temperature of 3°C (37°F) providing this is above dew point.

Decadex applied to cement bound substrates or repair mortars in excess of stated moisture content or to uncured (green) base may result in a temporary discoloration.

Protect from frost and heat.

Use nose/face mask when spraying. Do not use on soffits liable to water penetration from above.

The coverage rates quoted are for smooth non-absorbent surfaces. Allowance should be made for uneven or absorbent surfaces and wastage. It is important to achieve the correct film thickness. To avoid uneven membrane thickness, apply each coat in a slightly different color e.g. white over light grey.

### HEALTH AND SAFETY

Full Material Safety Data Sheet is available on request.



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