



LAKE HAVASU CITY

# LAKE HAVASU CITY ARIZONA

## TANK REHABILITATION S-1C-24 (Project WT 7480)

### SUPPLEMENTAL TECHNICAL SPECIFICATIONS

**VOLUME 3**

**MARCH 2019**



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**LAKE HAVASU CITY  
TANK REHABILITATION  
(Project WT7480)**

**CONTRACT DOCUMENTS  
VOLUME 3**

**TABLE OF CONTENTS**

**SUPPLEMENTAL TECHNICAL SPECIFICATIONS**

|               |   |   |
|---------------|---|---|
| SECTION 09950 | – | PROTECTIVE COATINGS FOR STEEL WATER TANK                      |
| SECTION 09951 | – | REMOVAL AND DISPOSAL OF PROTECTIVE COATINGS WITH HEAVY METALS |
| SECTION 13110 | – | CATHODIC PROTECTION   |
| SECTION 13211 | – | TANK DISINFECTION   |
| SECTION 13212 | – | TANK STRUCTURAL REPAIR  |
| SECTION 15910 | – | CLOG RESISTANT ATMOSPHERIC TANK VENT                          |

**2019 TANK REHABILITATION FIGURES**

|          |   |                           |
|----------|---|---------------------------|
| FIGURE 1 | – | LOCATION MAP              |
| FIGURE 2 | – | TANK S-1C-24 VICINITY MAP |
| FIGURE 3 | – | CLOG RESISTANT ROOF VENT  |
| FIGURE 4 | – | 30" MANWAY                |
| FIGURE 5 | – | EXTERIOR LADDER DETAIL    |
| FIGURE 6 | – | FLOOR PATCH DETAIL        |
| FIGURE 7 | – | FLOOR REPAIR              |
| FIGURE 8 | – | SAFETY RAILING DETAIL     |
| FIGURE 9 | – | CENTER COLUMN SUPPORT     |

**SUPPLEMENTAL TANK INFORMATION**

|            |   |   |
|------------|---|---|
| APPENDIX A | – | TIC EVALUATION REPORT OF TANK S-1C-24<br>(REPORT PROVIDED FOR REFERENCE ONLY) |
|------------|---|---|

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## SECTION 09950

### PROTECTIVE COATINGS FOR STEEL WATER TANKS

#### **PART 1 – GENERAL**

##### **1.1 Summary**

- A.** Section Includes:
- 1.** Methods and procedures for surface preparation and painting of steel tanks.
  - 2.** Provide surface preparation, application of surface coatings, disinfection of interior surfaces, and other work necessary to successfully paint interior and exterior of the steel tank including attachments, drain pipes, accessories, and appurtenances.
- B.** Following Surfaces Shall Not be Painted Unless Otherwise Specified or shown on Drawings:
- 1.** Concrete.
  - 2.** Tank identification plate and water level indicator.
  - 3.** Glass surfaces of any gages attached to the tank.
  - 4.** Cathodic protection devices attached to the tank.
  - 5.** Plastic, copper tubing, nameplates, and other surfaces on which coating will not adhere or would interfere with operation of specific item.
- C.** CONTRACTOR to provide testing and repair of tank per Specification Section 13212.

##### **1.2 References**

- A.** Society for Protective Coatings (SSPC) Standards, most recent editions:
- 1.** SSPC SP10 - Blast Cleaning to Near-White Metal.
  - 2.** SSPC SP 6– Commercial Blast Cleaning
  - 3.** SSPC SP 15- Commercial Grade Power Tool Cleaning
  - 4.** SSPC-VIS 1-89 - No. 1 - Pictorial Surface Preparation Standards for Painting Steel Surfaces.
  - 5.** SSPC-PA1 - Paint Application Specification No. 1, Shop, Field and Maintenance Painting.
- B.** American Water Works Association (AWWA) Standards, most recent editions:

1. AWWA C652 - Disinfection of Water-Storage Facilities.
  2. AWWA D102 - Coating Steel Water-Storage Tanks.
- C.** NSF-61 - National Sanitation Foundation Standard 61, most recent edition.
- D.** SP0188-2006-Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

### **1.3 Submittals**

- A.** Submittals: In accordance with Section 01330.
- B.** Procedures and materials for removal of existing coatings. Submit the name of the company and abrasive to be used, the generic type of abrasive and product data sheets.
- C.** Procedures and materials for containment of removed existing coatings for approval by the ENGINEER.
- D.** Procedures and materials for disposal of removed existing coatings for approval by the ENGINEER.
- E.** Safety plan for removal of existing coatings for approval by the ENGINEER.
- F.** Submit coating plan and schedule for coating work. Plan shall include number of applications and application thicknesses.
- G.** Coating Materials, Application Methods, Solvents, Thinners, and Other Products to be Used on the Project Shall be Submitted to the ENGINEER for Approval:
1. Supply "paint out" samples to ENGINEER for approval before ordering primer or finish. Samples of all paint, finishes, and other coating materials shall be submitted on 8.5-inch by 11-inch sheet metal. Each sheet shall be completely coated over its entire surface with one protective coating material, type, and color.
  2. Primers, top coats, and decorative coats shall bear the same respective batch numbers from the same manufacturer. Batch numbers shall not be mixed within a coat.
  3. Provide mixing instructions, thinning instructions, percent solids, spreading rate, weight, application time, temperature and humidity limitations, drying time, cure time, pot life, safety precautions, recoat cycle time and application method.
  4. Submit coating manufacturer's surface preparation recommendations including maximum/minimum height of surface profile on abrasive blast cleaned steel.

- 5.** The applicator's certificate shall list the dates and locations that the coating work was completed for the various surfaces coated, and shall also list the dry film thickness obtained for each coat. The CONTRACTOR shall submit said paint applicator's certificates to the ENGINEER within 10 days after completion of each paint system.
  - 6.** Compliance with VOC Regulations. The paint manufacturer shall submit to the ENGINEER certification that all coatings used on the job comply with local air pollution regulations limiting the amount of volatile organic compounds (VOC) contained in industrial coatings.
- H.** Submit product data and procedures for the dehumidification and temperature control system, and dust control system.
  - I.** Provide, prior to coating any surfaces of the tank, written certifications from the coating manufacturers stating that the coating materials, thinners, solvents, and equipment cleaning fluids provided by the manufacturers do not contain perchloroethylene or trichloroethylene. The CONTRACTOR shall also certify, in writing, that no material containing perchloroethylene, trichloroethylene, lead, chromium, or zinc in any form will be used for the interior coatings of the tank. This shall include all solvents, thinners, and cleaning fluids at the job site, regardless of where the materials were obtained.
  - J.** Submit Manufacturer's Certification: In all cases the paint manufacturer shall certify in writing that the coating materials are compatible with the service environment of the exterior or interior surface of a steel potable water tank. Provide ANSI/NSF 61 certification.
  - K.** Provide copies of the Material Safety Data Sheet for all materials used in coating operations including, but not limited to, coatings, paints, thinners, solvents, and cleaning fluids. Material Safety Data Sheets shall be readily available on-site at all times.
  - L.** Confirmation in writing of compatibility of caulk material with internal coating system
  - M.** Submit Qualifications of Coatings Applier.
  - N.** Submit manufacturer's technical data sheets and sample or samples of containment materials including screens, tarpaulins, sheets films and ground covers.
  - O.** Submit outrigger/containment structural support layout system to support containment material or proposed alternate method(s) and approach to controlling migration of waste materials generated

during existing coating removal and surface preparation activities.

- P.** Submit Quality Control and Testing Plan.
- Q.** Submit Disinfection Plan.
- R.** Submit manufacturer's specific ventilation requirements for product used on interior surfaces. Ventilation requirements shall be provided to ensure adequate evacuation of solvents and provide for timely coating system cure. Where ventilation is used to control hazardous exposure, all equipment shall be explosion-proof, of industrial design, and shall be approved by the ENGINEER. Household-type venting is not acceptable. Ventilation shall reduce the concentration of spray to the degree that a hazard does not exist by adducting air, vapors, etc. from the confined space. Air circulation and exhausting of solvent vapors is mandatory. Forced air adduction during blast, coating and/or painting application operations is mandatory. Dehumidification equipment shall be on site and utilized on a continuous basis only when/if ambient temperature is anticipated to be within 20 degrees F of dew point.
- S.** Name and qualifications of the resin manufacturer's representative who shall be present during the initial phase of the coating application to ensure that the manufacturer's mixing and application procedures are understood and being followed.
- T.** Written certification from the coating applicator verifying that coating was provided and applied as specified and that tests were performed and successful result obtained. Include the test results with this certification submittal.
- U.** Procedure for overspray containment

#### **1.4 Containment, Disposal, and Worker Safety for Removal of Coatings containing Heavy Metals**

- A.** Containment in accordance with federal, state, and local environmental protection agency regulations shall be provided during removal of existing coatings.
- B.** Disposal of removed coatings containing heavy metals shall be in accordance with all federal, state, and local environmental agency regulations. Consideration must be made for paint and blast residue.
- C.** Worker Safety: Strict adherence to all applicable OSHA standards for the protection of workers shall be maintained during coating removal work.

#### **1.5 Qualifications**

- A.** Qualifications of Coatings Applier:
  - 1.** Minimum of 5 years' practical experience.



2. Successful history in the application of protective coatings to steel tanks used for the storage of potable water with a minimum of 10 tanks coated and in use for a minimum of 10 years.
3. Arizona state-licensed painting CONTRACTOR (C-34).

## **1.6 Quality Control/Assurance**

- A.** CONTRACTOR is responsible for performing quality control testing and quality assurance measures as described in this Section, "Field Quality Control," and in the manner approved by ENGINEER. Testing shall be performed by NACE certified personnel.
- B.** CONTRACTOR shall use quality assurance procedures and practices to monitor all phases of surface preparation, application, and inspection throughout the duration of the Project. Procedures or practices not specifically defined herein may be used provided they meet recognized and acceptable professional standards and are approved by ENGINEER.
- C.** Materials furnished shall be subject to inspection by the ENGINEER and/or INSPECTOR authorized by the OWNER. CONTRACTOR shall comply with specifications for quality of materials and workmanship.
- D.** ENGINEER reserves the right to inspect CONTRACTOR's work procedures to ensure that procedures are in compliance with specifications, industry accepted inspection criteria, and coating manufacturer's published information. Provide safe accessibility to inspection personnel upon request of ENGINEER, including scaffolding and lighting.
- E.** Work accomplished in the absence of prescribed inspection may be required to be removed and replaced under the proper inspection, and the entire cost of removal and replacement, including the cost of all materials, shall be borne by CONTRACTOR.
  1. In the event that a pre-identified schedule is put in place and approved by the ENGINEER, some work may proceed without full inspection presence.
  2. Any rejection of said work at the time of inspection will require all unsatisfactory conditions to be repaired at CONTRACTOR's expense.
- F.** The cost of inspection services provided by the INSPECTOR will be paid by the OWNER.
- G.** The CONTRACTOR shall conduct all operations so as to confine abrasive blasting debris and paint over spray to within the bounds of the site. The Contractor shall take all precautions necessary to

prevent adverse off-site consequences of painting operations, and shall submit at the Preconstruction Conference for Coatings a procedure for over spray prevention. Any complaints received by the Owner relating to any such potential off-site problems will be immediately delivered to the Contractor. The Contractor shall immediately halt painting work and shall take whatever corrective action required to mitigate any such problems. All costs associated with protection of off-site properties and/or correction of damage to property as a result of painting operations shall be borne directly by the Contractor at no additional expenses to the Owner.

- H.** Owner approval of Contractor's over spray prevention procedures and Engineer's presence on project site does not free CONTRACTOR from responsibility for over spray. Daily approval of procedures will be required prior to start of spray operations.
- I.** Whenever required by the ENGINEER, the CONTRACTOR shall provide additional illumination to cover all areas to be inspected. The level of illumination for inspection purposes shall be determined by the ENGINEER.

### **1.7 Delivery, Storage, and Handling**

- A.** Deliver Materials to the Job Site in the Original Sealed Containers with Manufacturer's Name, Brand, Color, Date of Manufacture, Expiration, and Batch Number Clearly Legible:
  - 1.** Do not open containers or use materials until ENGINEER has physically inspected the contents and obtained necessary data from information printed on containers or labels.
  - 2.** Materials exceeding storage life recommended by the manufacturer shall be rejected.
- B.** Store coatings and paints in enclosed structures to protect from weather and excessive heat or cold. Store flammable coatings and paints to conform with city, county, state, and federal safety codes for flammable coating and paint materials.

### **1.8 Health and Safety**

- A.** General. In accordance with requirements of OSHA Safety and Health Standards for Construction (29CFR1926) and the applicable requirements of regulatory agencies having jurisdiction, as well as manufacturer's printed instructions, appropriate technical bulletins, manuals, and material safety data sheets, the CONTRACTOR shall provide and require use of personnel protective and safety equipment for persons working in or about the project site.
- B.** Illumination. Adequate illumination shall be provided while work is

in progress, including explosion-proof lights and electrical equipment. Light bulbs shall be guarded with a protective cage to prevent breakage. Lighting fixtures and bulbs shall comply with the requirements of Section 70 of the National Fire Protection Association (NFPA). "National Electric Code," for the atmosphere in which they are used. All lighting and other fixtures shall be ground fault type, as detailed in NFPA 70. The level of illumination shall comply with SSPC Guide 12.

- C.** All spray and air hoses shall be properly grounded to prevent accumulation of static electric charges. All electrical cords shall be heavy duty industrial insulated type cords with twist lock connectors. Household type electrical extension cords shall not be permitted.
- D.** Air supply hoses shall employ the proper Chicago-type claw coupling connectors and proper type for the service in which they are to be used.
- E.** Air hose connections shall employ new gaskets and shall use spring loaded steel wire safety devices (whip checks) to prevent hose whipping should the hoses become accidentally disconnected. Hoses used to transport coating materials shall be heavy duty wire reinforced hydraulic type hoses, with heavy duty screwed connectors.
- F.** The CONTRACTOR shall provide appropriate fire abatement devices and prohibit any flames, welding and smoking during mixing and application of materials. A minimum of two (2) 10 LB ABC type fire extinguishers shall be present in the work area whenever work is proceeding. All personnel shall be trained in the use of this type of fire extinguisher.
- G.** Sound levels: Whenever the occupational noise exposure exceeds the maximum allowable sound levels (OSHA 1910.95), the CONTRACTOR shall provide and require the use of approved ear protection devices.

### **1.9 Environmental Requirements**

- A.** Apply coatings in accordance with manufacturer's material data sheet with particular attention to curing and drying times and temperature and humidity ranges.
- B.** No coating shall be applied when the surrounding air temperature or the surface to be coated is below the minimum temperature allowed by manufacturer's recommendations for coating application or when it is expected that the air temperature will drop below the

minimum within two hours after coating application.

- C.** No coating shall be applied when the surrounding air temperature is forecasted to be less than 5 degrees F above the dew point within two hours after coating application.
- D.** No coating shall be applied to a steel surface which has a temperature over 120 degrees, or in accordance with manufacturer's recommendation, whichever is more stringent.
- E.** No Coating Shall be Applied to Wet or Damp Surfaces or in Rain, Snow, Fog or Mist:
  - 1.** Coating shall not be applied on frosted or ice-coated surfaces.
  - 2.** Dew point shall be measured by use of an instrument such as a Psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychrometric Tables or equivalent.
- F.** If above conditions are prevalent, coating application shall be delayed or postponed until conditions are favorable. The day's coating application shall be completed in time to permit the film sufficient drying time before damage by atmospheric conditions.
- G.** CONTRACTOR shall use dehumidification equipment to achieve required interior conditions.
  - 1.** Proposed dehumidification equipment must be submitted for review by the ENGINEER. Provide a minimum of three air changes per hour unless dehumidification equipment manufacturer's calculations substantiate fewer air changes.
  - 2.** The dehumidification equipment shall supply dry, fresh (not recirculated) air within 12 inches of the tank bottom from a system of duct work and blowers. Dehumidification equipment shall be on site and utilized only when/if ambient temperature is anticipated to be within 20 degrees F of dew point.
  - 3.** The dehumidification equipment (and heating equipment if required) shall maintain air temperature minimum 20 F degree above dew point during internal coating application.
  - 4.** Dehumidification shall be maintained until abrasive cleaning operations, coating operations, and cure are complete.

### **1.10 Warranty Inspection**

- A.** The CONTRACTOR shall warranty all work to be defect free for a period of one year from the time of final acceptance by the ENGINEER. A Warranty Inspection Shall be Conducted During the

Twelfth Month Following Completion of All Coating and Painting Work. The inspection shall be per AWWA D-102 Section 5.2 and these specifications. The draining of the tank will be accomplished when there will be minimum inconvenience to the OWNER. The CONTRACTOR should be present at this inspection, unless otherwise directed by the OWNER. All defective work shall be repaired in strict accordance with this specification and to the satisfaction of the ENGINEER.

- 1.** Notification: The OWNER will establish the date for the inspection and will notify the CONTRACTOR at least 30 days in advance. A pre-inspection conference shall be initiated prior to inspection to review dates, times, contact information, contingency plans, schedule and other pertinent information. The OWNER will drain the tank, the CONTRACTOR will be responsible for cleaning coated surfaces and removal of sediment if present. The CONTRACTOR shall provide, at his own expense, scaffolding, rigging to provide access to all points of the tank's interior and exterior coated surfaces, suitable lighting (in accordance with SSPC Guide 12) and ventilation for the inspection. This equipment shall be on site, fully assembled and operational minimum one-day prior scheduled inspection. Said inspection will require approximately seven working days.
- 2.** Inspection. The entire interior and exterior surfaces of the tank and its appurtenances shall be visually inspected to assess the integrity and performance of all coating systems as specified herein. All defective coating as well as damaged or corroded spots of the tank shall be satisfactorily repaired by and at the sole expense of the CONTRACTOR. All repaired areas shall then be tested as specified herein. Said repairs and testing procedures shall be repeated until the surface is acceptable to the ENGINEER.
- 3.** Inspection Report. The OWNER and/or their assigned representative shall prepare and deliver to the CONTRACTOR a written inspection report covering the first anniversary inspection, setting forth the number and type of failures observed, the percentage of the surface area where failure has occurred, and the names of the persons making the inspection. The OWNER may, at their own discretion, forgo preparation of a written report and instead provide representative(s) to meet with the CONTRACTOR to document deficiencies and corrections.

4. Schedule. Remedial work should be performed at the time of inspection (or within first trip). Any work beyond remedial will be scheduled by OWNER. Any delay on the part of the CONTRACTOR to meet schedule established by ENGINEER shall constitute breach of this CONTRACT and OWNER may proceed to have defects remedied as outlined under General Provisions.
5. Remedial Work. Any location where coating has peeled, bubbled, or cracked and any location where corrosion is evident shall be considered to be a failure of the coating system. The CONTRACTOR shall make repairs at all points where failures are observed by removing the deteriorated coating, cleaning the surface and removing all corrosion, and reapplying new coating. All coatings shall be repaired with the same coating system as the original coating system, unless otherwise recommended by the manufacturer and approved by ENGINEER. If the area of failure exceeds 25 percent of a specific coated or painted surface, the ENGINEER may require that the entire applied system be removed and reapplied in accordance with the original specification. The CONTRACTOR may make minor repairs at the time of inspection. The inspector will monitor the repairs to ensure the CONTRACTOR completes the work.
6. Costs. All noted costs for inspection and all costs for repair, cleaning, disinfection, bacteriological tests, scaffolding, lighting and ventilation equipment shall be borne by the CONTRACTOR and in computing his bid, the CONTRACTOR shall include an appropriate amount for testing and repair as no additional allowance will be paid by the OWNER for said inspection and repair.

### **1.11 Safety**

- A. The CONTRACTOR shall be responsible for and shall conform to all safety requirements regarding ventilation, electrical grounding, and care in handling coatings, paints, solvents, and equipment as set forth by regulatory agencies applicable to the construction industry and manufacturer's printed instructions and appropriate technical bulletins and manuals.

### **1.12 Existing Reservoir Coating System**

- A. The type of existing reservoir coating is unknown.
- B. Existing coating thickness measurements are presented in the evaluation reports in Appendix A.

- C. Samples of the existing coatings were laboratory tested for the presence of heavy metals. The existing coatings on some tanks appear to contain lead and/or chromium. Test results and further explanation are presented in the evaluation reports in Appendix A.
- D. CONTRACTOR shall be responsible for abatement of heavy metals as required in accordance with the scope of work identified in this specification and to be compliant with Federal, State, and local regulations applicable to both environmental and worker protections (e.g. EPA and OSHA regulations).

### **1.13 Existing Reservoir Cathodic Protection**

- A. Cathodic protection systems at all sites have impressed current. While working with internal coatings, contractor shall remove the existing anodes and other related cathodic protection equipment necessary to facilitate their work.

### **1.14 Preconstruction Conference for Coating**

- A. At least 14 days prior to the shop or field application of the coating system to the steel tank, schedule and arrange a conference with the ENGINEER, tank manufacturer, coating applicator, and the coating manufacturer to coordinate the following:
  - 1. Tank manufacturer's work to schedule for inspection coordination
  - 2. Surface preparation methods
  - 3. Procedure for overspray protection
  - 4. Specification compliance of blast abrasives and surface profile.
  - 5. Schedule of blast cleaning and coating application
  - 6. List of equipment for cleaning, coating, temperature, humidity and dust control.
  - 7. Weather limitations for acceptable work
  - 8. Furnish resume of all personnel assigned to the project.

## **PART 2 – PRODUCTS**

### **2.1 Manufacturers**

- A. Acceptable Coating Manufacturers:
  - 1. ICI Devoe.
  - 2. Tnemec Coatings.
  - 3. Raven Lining Systems.

4. Sherwin Williams
5. ENGINEER approved equal.

## **2.2 Materials**

- A. Use products of same manufacturer for all coats. Coating material components shall be of the same batch number whenever possible. Limit daily paint mixing to the use of the same batch numbers.
- B. Coatings used shall conform to the requirements of local and state air pollution regulatory agencies.
- C. Abrasive used in blast cleaning operations shall be new, and free of contaminants that would interfere with adhesion of coatings and shall not be reused unless specifically approved by the Engineer.

## **2.3 Interior Coating Materials**

- A. Coating materials for interior surfaces shall conform to regulations and applicable requirements of local, state, and federal air pollution and health regulatory agencies. Products containing perchloroethylene, lead, chromium, and/or zinc will not be permitted.
- B. Each of the manufacturers listed in Paragraph 2.1.A, are capable of supplying the coating materials specified. Submit proposed substitution requests in accordance with Section 01631 and requirements specified below.
- C. Color of interior coating shall be approved by the ENGINEER.
- D. Tank Protective Coating Systems:
  1. AWWA D102 Inside Coating System No. 3 (ICS-3). Two-component 100% solids epoxy coat system having ANSI/NSF 61 approval for potable water service. Minimum nominal dry thickness (total) DFT = 25-30 mils
  2. Application in one or two coats as recommended by the manufacturer.
  3. Application shall be in strict accordance with the manufacturer's published requirements.

## **2.4 External Tank Coating Materials.**

- A. Finish coat color shall be an approximate match to existing coat color and shall be approved by the Engineer before ordering of coating.
- B. Each of the manufacturers listed in Paragraph 2.1.A, are capable of supplying the coating materials specified. Submit proposed substitution requests in accordance with Section 01631 and requirements specified below.



**C. Tank Protective Coating System:**

- 1.** AWWA D102 Outside Coating System No. 5 (OCS-5). Three-coat system consisting of a first and intermediate coat of two-component epoxy and a finish coat of two-component aliphatic polyurethane coating. Minimum dry thickness (total) DFT = 9-12.5 mils.
- 2.** Primer coat to have nominal DFT of 3-4.5 mils.
- 3.** Intermediate coat to have a nominal 4.5-6 mils DFT. Finish coat to have a nominal 1.5-2 mils DFT.
- 4.** All field coats are preferred to be brush or roller applied. Spray application of tank exteriors on site requires use of containment screening.

**2.5 Caulking**

- A.** Caulking seam sealer shall be a flexible polyurethane, NSF-61 approved for use in contact with potable water and compatible with the epoxy lining used in the tank.
- B.** Caulking material shall be applied to all circumferential shell/roof interface, roof plate lap seams and any other crevices that preclude proper coating application.

**2.6 Containment System**

- A.** Containment system proposed by the CONTRACTOR must assure the protection of the surrounding environment and must provide sufficient protection to meet Arizona Department of Environmental Quality requirements.
- B.** Prior to installation the containment system design must be submitted and reviewed by the ENGINEER.
- C.** The Contractor shall keep the area of his work in a clean condition and shall not permit blasting materials to accumulate as to constitute a nuisance or hazard to the prosecution of the work of the operation of the existing facilities. All fugitive abrasives and associated nuisances used in surface preparation shall be confined to the project site. Any cost for clean up of adjacent properties associated to surface preparation activities shall be borne by the contractor.

**2.7 Dust Collectors**

- A.** Blast cleaning equipment shall be equipped with integral dust collection system or CONTRACTOR shall provide adequate external dust collecting system capable to contain dust generated during surface preparation.

## **2.8 Procedures for Obtaining Approval for Materials Not Listed**

- A.** Requests for Substitutions: In accordance with Section 01631.
- B.** Coatings used on this project shall be listed in list of material and equipment Suppliers. ENGINEER approved equals for coating manufacturers and suppliers must be submitted with the information stated below.
- C.** Proposed coating or paint system shall have a dry film thickness equal to or greater than that of the specified system.
- D.** Proposed Coating or Paint System Shall Employ an Equal or Greater Number of Separate Coats:
  - 1.** Primer and intermediate coating colors may be changed as long as there is a color difference between each coat.
  - 2.** Proposed coating or paint system shall employ coatings or paints of the same generic type.
- E.** All requests for substitution shall carry full descriptive literature and directions for applications, along with complete information on generic type, nonvolatile content by volume, and a list of three similar projects, all at least 1 year old, where the coatings or paints have been applied to similar exposure.
- F.** If the above-mentioned data appear to be in order, the ENGINEER may require that the CONTRACTOR provide certified laboratory data sheets showing the results of complete spectrographic and durability tests performed on the proposed substitute.
  - 1.** Tests shall be performed by an independent testing laboratory satisfactory to the ENGINEER, and all costs incurred in the testing program shall be borne by the CONTRACTOR.
  - 2.** In any case, the ENGINEER shall be sole and final judge of the acceptability of any proposed substitution.

## **2.9 Dehumidification Equipment**

- A.** The Dehumidification Equipment shall be a solid desiccant (not liquid, granular or loose lithium chloride) design having a single rotary desiccant bed capable of continuous operation, fully automatic, with drip-proof automatic electrical controller.
- B.** All chillers, heaters, or air conditioners may be used downstream of the dehumidifiers if they are approved for use by the manufacturer of the dehumidification equipment.

## **PART 3 – EXECUTION**

### **3.1 Acceptable installers/Supervisors**

- A.** Perform work by skilled craftsmen qualified to perform the required work in a manner comparable with acceptable standards of practice. Continuity of personnel shall be maintained and transfers of key personnel shall be coordinated with the ENGINEER.
- B.** Provide a supervisor to be at the work site during cleaning and application operations. Supervisor shall have the authority to sign daily quality control reports, coordinate work, and make other decisions pertaining to the contract fulfillment.

### **3.2 Preparation**

- A.** Prior to inspection. Blast cleaning shall be completed on all interior surfaces of the tank and its appurtenances. All interior surfaces must be visible and accessible. Abrasive blasting residue, debris, blasting supplies, cleaning equipment, and blasting equipment shall be removed from the interior of the tank. Only necessary equipment required for the inspection should remain in the tank.
- B.** Surface preparation as well as coating and paint application shall conform to applicable standards of American Water Works Association, the Society for Protective Coatings, and the manufacturers' printed instructions.
- C.** For external surface preparation, the CONTRACTOR shall determine his/her own means and methods to contain and trap all debris, with ENGINEER approval. All shrubs and bushes shall be covered to prevent damages from dusts.
- D.** All bare metal surfaces shall be thoroughly cleaned prior to the application of coatings. All oil, grease, dust, dirt, rust old paint, moisture, mill scale, and all other foreign substances which may interfere with or adversely affect the adhesion or durability of the new coating system shall be removed. Removal of any grease or oil shall be accomplished prior to mechanical or blast cleaning.
- E.** Material applied before approval of the surface by ENGINEER shall be removed and reapplied to the satisfaction of ENGINEER at the expense of the CONTRACTOR.
- F.** CONTRACTOR's coating and painting equipment shall be designed for application of materials specified and shall be maintained in acceptable working condition. CONTRACTOR's equipment shall be subject to approval of the ENGINEER.

- G.** Removal of grease and oil shall be in conformance with the specifications of the Steel Structures Painting Council, SSPC-SP1, Solvent Cleaning, where the use of solvents, emulsions, cleaning compounds, steam cleaning or similar materials and methods involve a solvent cleaning to avoid leaving a film or greasy residue.
- H.** Prior to abrasive blast cleaning, surface imperfections such as sharp fins, sharp edges, weld spatter, or burning slag shall be removed from the surface as specified in Section 13212-3.1.
- I.** Exterior metal surfaces, including but not limited to handrails and telecommunication boxes, shall be dry abrasive blast cleaned per SSPC SP10.
- J.** Field abrasive blast cleaning methods for all reservoir surfaces shall be submitted to the ENGINEER for approval. CONTRACTOR is responsible for maintaining dust emissions within the legal level and that level which would not create a nuisance.
- K.** Blast nozzle pressure shall be a minimum of 95 psi. and shall be verified by using an approved nozzle pressure gage at each start-up period or as directed by the ENGINEER. Number of nozzle crews used during all blast cleaning operations must be sufficient to insure timely completion of the project within the specified contract time frame. Additional nozzle crews shall be employed to expedite the work if so directed by the ENGINEER.
- L.** Abrasive blasting nozzles shall be equipped with "deadman" emergency shut-off nozzles.
- M.** Blast cleaning from rolling scaffolds shall only be accomplished within the confines of interior perimeter of the scaffold. Reaching beyond the limits of perimeter of the scaffolding will be allowed only if the blast nozzle is maintained in a position which will produce a profile acceptable to the ENGINEER. Proper position for the blast nozzle is at a perpendicular angle to the flat surface of the work to be blasted.
- N.** Blast cleaned surfaces shall be cleaned prior to application of specified coatings via a combination of blowing with clean dry air, brushing/brooming and/or vacuuming as directed by the ENGINEER. "Blowing down" shall be accomplished using an air hose at least 1/2" in diameter and equipped with a minimum 1/2" diameter pipe stinger with a shut-off ball valve and a water trap.
- O.** Existing irregular welded surfaces, weld metal accumulation, weld spatters, slag, sharp and rough edges, including those from scaffold

lugs, not previously properly removed or treated shall be ground smooth or removed, and then prepared for coating in accordance with SSPC-SP10, Near White Blast Cleaning. This work shall be accomplished prior to the application of any coatings.

- P.** Welds, when required by the ENGINEER, shall be neutralized with a suitable chemical compatible with the specified coating or paint material to be used.
- Q.** During abrasive blasting and cleaning operations, caution shall be exercised to absolutely insure that existing and new previously placed coatings and paints are not exposed to abrasion from blast cleaning operations. Cleaning and coating operations shall be so programmed and coordinated that dust, dirt, grit, old paint, rust, mill scale, etc., will not damage or fall upon wet or newly coated or painted surfaces.
- R.** Test surface preparation as specified herein Section 3.11 C.
- S.** For rehabilitation of an existing tank: Moderately Pitted Surfaces - A moderately pitted surface is defined as a surface having pits less than 1/16-inch-deep with a frequency of 4 to 5 pits per square foot. Prior to application of the specified coating system, the pitted surface shall be blasted to SSPC-SP10. The first coat may be thinned (not to exceed manufacturer's published recommendations) and applied by stiff bristle brush or roller to all pitted surfaces.
- T.** For rehabilitation of an existing tank: Badly Pitted Surfaces - A badly pitted surface is defined as a surface having pits greater than 1/16-inch-deep and less than 1/2 of the metal thickness with a frequency of 8-12 pits per square foot. Prior to application of the specified system, the pitted surface shall be blasted to SSPC-SP10. Prior to applying the specified system, the pits shall be filled with a caulk seam sealer applied by putty knife or stiff bristle brush.
- U.** Blasted surface(s) that do not meet minimum specified surface preparation standards will be re-cleaned by CONTRACTOR and re-inspected, and tested by the OWNER's representative prior to acceptance and application of coating material.
- V.** Application of the first coat shall immediately follow surface preparation and cleaning. Cleaned areas not receiving first coat within a 24-hour period shall be re-cleaned prior to application of first coat, unless surface(s) meet minimum specified surface preparation standards as tested by the ENGINEER.
- W.** Project is subject to intermittent shutdown if, in the opinion of the ENGINEER, cleaning, coating, and painting operations are creating a

localized condition detrimental to ongoing activities, personnel, or adjacent property.

- X.** In the event of emergency shutdown by the ENGINEER, CONTRACTOR shall immediately correct deficiencies. All additional costs created by shutdown shall be borne by CONTRACTOR.
- Y.** Tank shall be adequately vented to avoid structural damage.
- Z.** The continuous use of diesel motors within the tank shall be prohibited to avoid contamination of the interior surfaces of the tank and its appurtenances. The use of diesel forklifts and man-lifts are permitted on a temporary basis, diesel motors shall not be in continuous operation within the tank for longer than 10 minutes. The use of propane motors is preferred.
- AA.** Conduct All Operations as to Confine Abrasive Blasting Debris and Paint Over Spray to Within the Boundaries of the Site:
  - 1.** Take precautions necessary to prevent adverse off-Site consequences of painting operations.
  - 2.** Complaints received by Owner relating to any such off-Site problems will be immediately delivered to CONTRACTOR for corrective action.
  - 3.** All costs associated with protection of off-site properties and/or correction of damage to property as a result of blasting and painting operations shall be borne directly by CONTRACTOR at no additional expense to Owner.
  - 4.** The Owner approval of CONTRACTOR's over spray prevention procedures and ENGINEER's presence on the project site shall not relieve the CONTRACTOR from responsibility for over spray. Daily approval of procedures will be required prior to start of spraying operations.

### **3.3 Interior Surface Preparation**

- A.** All existing interior coatings of the tank shall be completely removed and disposed of in accordance with regulations of appropriate agencies.
- B.** SSPC-SP10 Near-White Blast Cleaning
- C.** Small areas that are not suitable for blast cleaning: SSPC SP15 Commercial Grade Power Tool Cleaning
- D.** Surface profile shall be in accordance with the coating manufacturer's recommendation or SSPC-VIS 1 whichever is more stringent.
- E.** For tank requiring floor coating only, surface preparation and coating shall include 3 feet of tank wall above floor surface.

### **3.4 Exterior Surface Preparation for Tank Structural Repair**

- A.** Step One: All oily or greasy surface contaminants shall be removed by wiping the contaminated area with a clean rag wetted with solvent or degreasing solution in accordance with Society for Protective Coatings Specification SSPC-SP1 (Solvent Cleaning), then rinsed with clean water, wiped clean and dried.
- B.** Step Two: All chalking paint or other surface contaminants shall be removed by high pressure water blasting and scrubbing the complete surface with a suitable broom or brush as approved by the Engineer, wetted with a solution of a commercial detergent and water, or other approved cleaning solution. Cleaned surfaces shall then be rinsed with clean water, wiped clean and dried.
- C.** Step three: All shell surfaces shall be abraded by brush-off Blast cleaning (SSPC-SP7) with lowered air pressure and fine mesh abrasive. The purpose of this method is to thoroughly abrade all surfaces of the existing alkyd paint surfaces and to remove the marginally bonded paint and ensure zinc primer is not damaged by this method prior to applying the epoxy coating.

Cleaning methods other than noted above, which accomplish the specified results may be used, after approval by Engineer.

- D.** Step Four: All rusting, scaling or damaged areas shall only be vacuum blast cleaned in conformance with Society for Protective Coatings Specification SSPC-SP10 (Near-White Blast Cleaning). Remaining paint shall be firmly bonded to the substrate with blast cleaned edges feathered. Extreme care should be exercised to ensure remaining paint is not damaged by cleaning operations.
  - 1.** Cleaning methods other than vacuum blasting may be used, after approval by Engineer, which accomplish the specified results while containing all paint, abrasive, etc. during cleaning operations.

### **3.5 Coating Application – General**

- A.** CONTRACTOR shall complete all surface preparation and cleaning activities and obtain CITY approval prior to beginning coating operation.
- B.** Apply coatings as specified and as recommended by the manufacturers of the coatings used. Preparation and application of proprietary coatings specified herein shall be in strict accordance with the manufacturer's instructions as supplemented by these Specifications.
- C.** The CONTRACTOR shall be responsible for removing and disposing

all the existing interior coatings from the tanks.

- D.** Coating application shall conform to SSPC-PA1, SSPC-PA3, manufacturer of the coating and paint materials' printed literature, and as specified herein.
- E.** Apply Each Application of Coating and Paint Evenly, Free of Brush Marks, Sags, Runs, and with no Evidence of Poor Workmanship:
- F.** Coating and paint shall be sharply cut to lines.
- G.** Finished surfaces shall be free from defects or blemishes.
- H.** Use Protective Coverings and Drop Cloths to Protect Floors, Fixtures, Equipment, Prepared Surface, and Applied Coatings or Paints:
  - 1.** Personnel walking on exterior roof of tank shall take precautions to prevent damage or contamination of coated or painted surfaces.
  - 2.** Exercise care to prevent coating or paint from being spattered onto surfaces that are not to be coated or painted. Mesh wire screen on perimeter vents shall be free of coating overspray.
  - 3.** Surfaces from which material cannot be removed satisfactorily shall be repainted or recoated as required to produce a finish satisfactory to the ENGINEER.
  - 4.** Use of layer of blasting media to protect floor from over-spraying is not allowed.
- I.** Apply Brush Coat of the Specified Product to Irregular Surfaces Before General Application of the Respective Coat:
  - 1.** Brush irregular surfaces in multiple directions to ensure penetration and coverage.
- J.** Irregular surfaces include, but are not limited to welds, roof lap seams, nuts and bolts, ends of rafter flanges, and so forth. Mix coating components in exact proportions specified by the manufacturer. Exercise care to ensure removal of all materials from containers during mixing and metering operations.
- K.** All coatings shall be thoroughly mixed, using an approved slow-speed power mixer until all components are thoroughly combined and are of a smooth consistency. Coatings shall not be applied beyond pot-life limits specified by the manufacturer.
- L.** Thinning shall only be permitted as recommended by the manufacturer and approved by ENGINEER, and shall not exceed limits set by regulatory agencies. If the CONTRACTOR applies coatings that have been modified and/or thinned to exceed



established volatile organic compound standards, CONTRACTOR shall be responsible for fines, costs, remedies, or legal action and cost which may result.

- M.** Using a non-destructive, magnetic type thickness gauge, perform coating thickness tests upon completion of each coating operation.
- N.** Application shall be as directed by the manufacturer and approved by the ENGINEER. Drying time between coats shall be strictly observed as stated in manufacturer's printed instructions.
- O.** Perform mixing, thinning, initial application of the day, coating thickness testing for record, and holiday detection of coating in the presence of the ENGINEER.
- P.** At conclusion of each day's coating operations, a 6-inch wide strip of blast-cleaned substrate shall remain uncoated to facilitate locating the point of origin for the successive days coating operations. If dehumidification is employed, this 6-inch strip shall remain at any point of material application.
- Q.** Exercise care during spray operations to hold the spray nozzle perpendicular and sufficiently close to surfaces being coated to avoid excessive evaporation of volatile constituents and loss of material into the air or the bridging of cracks and crevices.
  - 1.** Reaching beyond limits of scaffold perimeter will not be permitted.
  - 2.** Remove over spray as directed by ENGINEER.
  - 3.** Paint shall not be applied when wind speed exceeds 15 miles per hour, when damage to surrounding properties is likely, or as requested by ENGINEER.

### **3.6 Interior Coating Application**

- A.** Only after completion of surface preparation of the interior roof, floor and shell surfaces as specified, all surfaces shall receive the specified epoxy coating.
- B.** Finish coat and underlying coat should have a distinguishable color difference.
- C.** After completion of final coat application of epoxy coating, as specified, all void areas shall be primed, if required, and filled with joint sealant as specified. Fill voids flush.
- D.** Coat, test and make any necessary repair to all internal surfaces of tank's wall and roof before applying coating to the tank's floor.
- E.** Application on the interior tank surface shall be by spray, with the exception of difficult-to-coat areas may be additionally strip coated with brush or roller.

- F. Application of coatings for tank with only floor coating shall include three feet of tank wall above floor surface.

### **3.7 Exterior Coating Application**

- A. All welds, rivets, corners, edges and like irregular surfaces are to be stripe coated as part of the first coat application. Brush stripe coats shall be employed at pits, depressions and crevices to work coating in.
- B. All other paint applied to the exterior of erected tanks will be applied by brush or roller, using manufacturers recommended thinner (if applicable) for the application method selected. No spray painting on exterior surfaces will be permitted without the use of containment screens.
- C. Intermediate coat should have a distinguishable color difference from existing, cleaned coating and the following top coat. Note that stripe coating is considered to be part of the first coat application.

### **3.8 Disinfection**

- A. Following the curing and ventilation period, clean, disinfect, and fill the tank in accordance with AWWA D652 (selected method to be approved by ENGINEER) and Specification Section 13211. Minimize amount of water to be disposed. Neutralize water as required for discharge.

### **3.9 Field Quality Control**

- A. The CONTRACTOR shall notify ENGINEER a minimum of three days prior to any field surface preparation or application of coatings.
- B. The OWNER will procure third-party inspector to provide quality assurance testing to confirm the test results determined by the CONTRACTOR's testing inspector.
- C. Tank Surface Cleanliness Will be Based Upon Compliance with SSPC-VIS 1-89:
  - 1. Anchor profile for prepared surfaces shall be tested with a K-T Surface Profile Comparator or Testex Press-O-Film System
  - 2. Testing for anchor profile and pattern will be performed by Owner's Representative using Testex Replica Tape (or CITY approved equal) for compliance and record the test results.
  - 3. The blasted surfaces shall meet minimum or be within the specified anchor profile and pattern.
- D. Inspection of the applied coating will be accomplished as a joint effort involving the CONTRACTOR's verification and the

Inspector's monitoring. CONTRACTOR shall bear primary responsibility for performing tests and for costs of performing tests.

- E.** Inspector will witness all testing as performed by CONTRACTOR. Coordinate with Inspector for daily witnessing of psychrometer and temperature readings.
- F.** Forward copies of daily reports to ENGINEER. Daily reports shall include, but not be limited to, psychrometer and temperature readings, summary of work, progress to date, and amount of coating used.
- G.** Check Thickness of Coatings and Paint with a Non-Destructive, Magnetic Type Thickness Gage in Accordance with AWWA D102 and Verified with Calibration Blocks:
  - 1.** Test interior coated surfaces for pinholes with an inspection device approved by ENGINEER.
  - 2.** Mark and repair pinholes in accordance with manufacturer's printed recommendations and retest.
  - 3.** No pinholes or other irregularities will be permitted in the final coating.
  - 4.** Acceptable inspection devices for ferrous metal surfaces include, but are not limited to Tinker-Razor Models AP and AP-W and PCWI Porosity Tester.
  - 5.** Interior coatings below the top capacity level shall be tested with SP0188-2006.
  - 6.** All surfaces ready to receive a coating must be approved by the ENGINEER before the application of the next succeeding specified coat.
- H.** Acceptable devices for ferrous metal surfaces include, but are not limited to "Inspector" or "Positest" or equal units for dry film thickness gauging. Inspection devices shall be operated in accordance with the manufacturer's instructions.
- I.** Upon completion of final coating operations, after curing interval in accordance with manufacturer's recommendations, perform holiday detection with a wire brush electrode, using the Tinker-Razor AP-W at 1,500 volts for the roof and shell and at 2,000 volts for the bottom.
  - 1.** Perform repair and retesting until surfaces are holiday free.
  - 2.** ENGINEER may verify adequacy of holiday testing by accomplishing holiday detection of selected areas, using ENGINEER's own holiday detector.

3. Upon completion of coating application to bottom surfaces, lower shell surfaces of completed epoxy coating which may have been subjected to damage from abrasive blast cleaning of bottom surfaces shall be holiday detected again and repaired as needed.

### **3.10 Final Curing**

- A. Comply with manufacturer's recommendations on sufficient cure time before filling tank.
- B. Use force-air ventilation at all times during and after the application of the interior coating systems. It is essential that the solvent vapor released during the application and from the deposited film be removed from the tank interior. During the coating application provide ventilating system with the capacity of at least 300 cfm per gallon of coating applied per hour. After the application of the finish coat, force ventilate the tank continuously at the rate of one air exchange per hour for a period of five days. If the ENGINEER has any doubt of the adequacy of the curing conditions, provide additional curing time with the continued forced-air ventilation.
- C. CONTRACTOR may find it necessary to extend the curing time or ventilation time beyond the requirements in order to comply with the regulatory agency requirements or to reduce the leached organic compounds to the required levels. All costs in connection with extended curing times shall be borne by CONTRACTOR.
- D. If an artificial heat source is employed to force cure the interior coating system, all activities shall conform to the coating manufacturer's instructions. Specific information regarding initial cure time prior to heating, localized positioning of heating duct, maximum localized temperatures, and temperature curing curves must be addressed in writing and approved by ENGINEER.
- E. After completing the curing cycle noted above, provide the ENGINEER verification that curing has been attained via an Acetone or Hardness Test:
  1. Acetone or hardness test requirements shall be as required by the coating manufacturer's written instructions.
  2. If final cure has not been attained, based on above tests, ventilation shall be continued until applied coating passes the acetone or hardness test.
- F. After final cure is approved by ENGINEER, remove fan or blower.

### **3.11 Cleanup**

- A.** Upon completion of the work, remove staging, scaffolding, and containers from the site or destroy in a manner approved by ENGINEER.
- B.** Remove coating spots upon adjacent surfaces and clean the entire job Site.
- C.** Remove all waste materials (hazardous or non-hazardous, in containers or on the ground) from the Site.
- D.** Clean, repair, or refinish damage to exterior surfaces of the tank, resulting from the work of this section, to the complete satisfaction of ENGINEER at no cost to Owner.
- E.** Upon Completion and Acceptance of All Coating and Painting Operations, site soil shall be retested in same locations tested prior to start of work, for presence of lead or other heavy metals.
  - 1.** Testing shall be accomplished by the same laboratory as the original testing.
  - 2.** If soils contain excessive levels of lead or other heavy metals above those levels determined by testing at start of work and beyond acceptable levels of current regulations, CONTRACTOR shall be responsible for removal and disposal of contaminated soil, and returning the site to its original condition.
  - 3.** Copies of laboratory analyses reports shall be forwarded to CONTRACTOR immediately upon receipt from laboratory, prior to start of any work.
  - 4.** Any required remediation schedule will be determined by the ENGINEER.

## **PART 4 – MEASUREMENT AND PAYMENT**

### **4.1 Measurement**

- A.** Refer to Section 01210, Measurement and Payment.

### **4.2 Payment**

- A.** Payment will be made at the contract lump sum price bid as indicated in Bid Items 39 and 40 of specification Section 01210, and shall be considered full payment for providing labor and materials to perform this work.

\*\* END OF SECTION \*\*

## SECTION 09951

# REMOVAL AND DISPOSAL OF PROTECTIVE COATINGS WITH HEAVY METALS

## **PART 1 – GENERAL**

### **1.1 Summary**

- A.** Section Includes:
  - 1.** Methods and procedures for removal and disposal of existing lead-based paint (LBP-paint with lead content equal to or greater than 0.5%) coating on steel tank exterior.
  - 2.** Methods and procedures for removal and disposal of existing paint with lead (PWL-paint with lead content less than 0.5%) coating on steel tank exterior.
- B.** CONTRACTOR to provide testing and repair of tank per Specification Section 13212.

### **1.2 References**

- A.** AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA):
  - 1.** AIHA Z88.6 Respiratory Protection - Respirator Use-Physical Qualifications for Personnel
- B.** U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD):
  - 1.** HUD 6780 Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing
- C.** U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA):
  - 1.** 29 CFR 1926.103 Respiratory Protection
  - 2.** 29 CFR 1926.21 Safety Training and Education
  - 3.** 29 CFR 1926.33 Access to Employee Exposure and Medical Records
  - 4.** 29 CFR 1926.55 Gases, Vapors, Fumes, Dusts, and Mists
  - 5.** 29 CFR 1926.59 Hazard Communication
  - 6.** 29 CFR 1926.62 Lead
  - 7.** 29 CFR 1926.65 Hazardous Waste Operations and Emergency Response
  - 8.** 40 CFR 260 Hazardous Waste Management System: General
  - 9.** 40 CFR 261 Identification and Listing of Hazardous Waste
  - 10.** 40 CFR 262 Standards Applicable to Generators of Hazardous Waste

- 11.** 40 CFR 263 Standards Applicable to Transporters of Hazardous Waste
  - 12.** 40 CFR 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
  - 13.** 40 CFR 265 Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
  - 14.** 40 CFR 268 Land Disposal Restrictions
  - 15.** 40 CFR 745 Lead-Based Paint Poisoning Prevention in Certain Residential Structures
  - 16.** 49 CFR 172 Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
  - 17.** 49 CFR 178 Specifications for Packagings
- D.** UNDERWRITERS LABORATORIES (UL):
- 1.** UL 586 Standard for High-Efficiency Particulate, Air Filter Units
- E.** ARIZONA DIVISION OF OCCUPATIONAL SAFETY AND HEALTH (ADOSH)
- 1.** Title 23 of the Arizona Revised Statutes
  - 2.** Title 20, Chapter 5 of the Arizona Administrative Code

### **1.3 Submittals**

- A.** Submittals: In accordance with Section 01330.
- B.** Procedures and materials for removal of existing coatings. Submit the name of the company and abrasive to be used, the generic type of abrasive and product data sheets. Comply with specification 09950, 3.4.
- C.** Submit for approval the following information:
  - 1.** Qualifications of the CONTRACTOR-employed "Competent Person" or "CP", identified as a person who is trained in the recognition and control of lead hazards in accordance with current federal, State, and local regulations. A Certified Industrial Hygienist (CIH) certified for comprehensive practice by the American Board of Industrial Hygiene, or a Certified Safety Professional (CSP) certified by the Board of Certified Safety Professionals, is the preferred choice.
  - 2.** Testing laboratory qualifications
  - 3.** Training Certification of workers and supervisors





and dated by the training provider meeting 40 CFR 745 (Subpart L) requirements, stating that the employee or supervisor has received the required lead training and is certified to perform or supervise deleading or lead removal.

**C. Third Party Consultant Qualifications**

- 1.** If applicable, Submit the name, address, and telephone number of the third party consultant selected to perform the sampling for determining concentrations of lead in dust or soil sampling. Submit proper documentation that the consultant is trained and certified as an inspector technician or inspector/risk assessor by the USEPA authorized State or local certification and accreditation program.

**1.5 Requirements**

**A. Competent Person (CP) Responsibilities:**

- 1.** Provide oversight of project evaluation and assessment, including providing interpretation and recommendations for worker and environmental protection, as they apply to the proposed work and in compliance with Federal, State, and local regulations.
- 2.** Verify all Contractor and Contractor's subconsultant personnel performing work at the site have the applicable training that meets all federal, State, and local requirements.
- 3.** If applicable, review and approve lead-based paint/paint with lead removal/control plan for conformance to the applicable standards. Ensure work is performed in strict accordance with specifications at all times.
- 4.** If applicable, continuously inspect lead-based paint removal/control work for conformance with the approved plan.
- 5.** If applicable, perform air and wipe sampling.
- 6.** Control work to prevent hazardous exposure to human beings and to the environment at all times.
- 7.** Certify the conditions of the work as called for elsewhere in this specification.
- 8.**

**B. Occupational and Environmental Assessment Data Report**

- 1.** The initial assessment completed by the CP shall determine the requirement for further monitoring and the need to fully implement the control and protective requirements including the lead compliance plan per 29 CFR 1926.62.
- 2.** If initial monitoring is deemed to be warranted by the CP based on their professional judgment and experience, submit occupational and environmental sampling results within three working days of collection, signed by the testing laboratory employee performing the analysis, the employee that performed the sampling, and the CP.
- 3.** If applicable based on the professional judgment of the CP and the results of occupation and environmental sampling, Contractor to submit a report that supports the determination to reduce full implementation of the requirements of 29 CFR 1926.62 and supporting the Lead Removal/Control Plan.
- 4.** If applicable, the initial monitoring shall represent each job classification, or if working conditions are similar to previous jobs by the same employer, provide previously collected exposure data that can be used to estimate worker exposures per 29 CFR 1926.62. The data shall represent the worker's regular daily exposure to lead for stated work.
- 5.** If applicable, submit worker exposure data gathered during the task based trigger operations of 29 CFR 1926.62 with a complete process description. This includes manual demolition, manual scraping, manual sanding, heat gun, power tool cleaning, rivet busting, cleanup of dry expendable abrasives, abrasive blast enclosure removal, abrasive blasting, welding, cutting and torch burning where lead containing coatings are present.

**C.** Lead-Based Paint/Paint with Lead Removal/Control Plan (LBP/PWL R/CP) if applicable

- 1.** Submit a detailed job-specific plan of the work procedures to be used in the removal/control of LBP/PWL. The plan shall include a sketch showing the location, size, and details of lead control areas, location and details of decontamination facilities, viewing ports, and mechanical ventilation system. Include a description of equipment and materials, controls and job responsibilities for each activity from which lead is emitted. Include in the plan, eating, drinking, smoking and sanitary procedures, interface of trades, sequencing of lead related work, collected waste water and paint debris disposal plan, air sampling plan, respirators, personal protective equipment, and a detailed description of the method of containment of the operation to ensure that lead is not released outside the lead control area. Include site preparation, cleanup and clearance procedures. Include occupational and environmental sampling, training, sampling methodology, frequency, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan. Include a description of arrangements made among contractors on multi-contractor worksites to inform affected employees and to clarify responsibilities to control exposures. The Removal/Control Plan shall also include an occupant protection program that describes the measures that will be taken during the work to protect the occupants of residential structures located in areas adjacent to the parcel where the work will be undertaken.

**D.** Medical Examinations, if applicable

- 1.** Initial medical surveillance as required by 29 CFR 1926.62 shall be made available to all employees exposed to lead at any time (1 day) above the action level. Full medical surveillance shall be made available to all employees on an annual basis who are or may be exposed to lead in excess of the action level for more than 30 days a year or as required by 29 CFR 1926.62. Adequate records shall show that employees meet the medical surveillance requirements of 29 CFR 1926.33, 29 CFR 1926.62, and 29 CFR 1926.103. Maintain complete and accurate medical records of employees for a period of at least 30 years or for the duration of employment plus 30 years, whichever is longer.

- E.** Training as applicable
  - 1.** Train each employee performing paint removal, disposal, and air sampling operations prior to the time of initial job assignment and annually thereafter, as applicable, in accordance with 29 CFR 1926.21, 29 CFR 1926.62, and State and local regulations where appropriate.
- F.** Respiratory Protection Program as applicable
  - 1.** Provide each employee required to wear a respirator a respirator fit test at the time of initial fitting and at least annually thereafter as required by 29 CFR 1926.62.
  - 2.** Establish and implement a respiratory protection program as required by AIHA Z88.6, 29 CFR 1926.103, 29 CFR 1926.62, and 29 CFR 1926.55.
- G.** Hazard Communication Program
  - 1.** Comply with requirements indicated in Section 00450 of these specifications.
  - 2.** Establish and implement a Hazard Communication Program as required by 29 CFR 1926.59.
- H.** Lead Waste Management if applicable - The Lead Waste Management Plan shall comply with applicable requirements of federal, State, and local hazardous waste regulations and address:
  - 1.** Identification and classification of hazardous wastes associated with the work.
  - 2.** Estimated quantities of wastes to be generated and disposed of.
  - 3.** Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and operator and a 24-hour point of contact. Furnish two copies of proof of EPA/State/local hazardous waste permit applications, permits/manifests and identification numbers, including transporter number, as applicable.
  - 4.** Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.
  - 5.** List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.

- 6.** Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented in accordance with 29 CFR 1926.65.
  - 7.** Work plan and schedule for waste containment, removal and disposal. Wastes shall be cleaned up and containerized daily. Proper containment of the waste includes using acceptable waste containers (e.g., 55-gallon drums) as well as proper marking/labeling of the containers.
- I.** Environmental, Safety and Health Compliance - In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of Federal, State, and local authorities regarding removing, handling, storing, transporting, and disposing of lead waste materials as they apply to each of the work areas and applications identified in the project scope. Comply with the applicable requirements of the current issue of 29 CFR 1926.62. Submit matters regarding interpretation of standards to the ENGINEER for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirement shall apply.
  - J.** Pre-Construction Conference specific to lead materials removal, if applicable - Along with the CP, meet with the ENGINEER and OWNER to discuss in detail the lead waste management plan and the lead-based paint/paint with lead removal/control plan, including work procedures and precautions for the removal plan.

## **1.6 Equipment**

- A.** Respirators
  - 1.** Furnish appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in atmospheres containing lead dust. Respirators shall comply with the requirements of 29 CFR 1926.62.
- B.** Special Protective Clothing
  - 1.** Furnish personnel who will be exposed to lead-contaminated dust with proper disposable and/or uncontaminated, reusable protective whole body clothing, head covering, gloves, and foot coverings as required by 29 CFR 1926.62. Furnish proper disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CP.
- C.** Rental Equipment Notification

1. If rental equipment is to be used during lead-based paint handling and disposal, notify the rental agency in writing concerning the intended use of the equipment. Furnish a copy of the written notification to the OWNER.

**D. Vacuum Filters**

1. UL 586 labeled HEPA filters.

**1.7 Project/Site conditions**

- A.** Perform paint removal work without damage or contamination (e.g. spreading of generated waste materials) of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better.

**PART 2 – PRODUCTS**

**2.1 Equipment and Products**

- A.** All equipment and products used during lead removal activities, if applicable, shall be in compliance with applicable Federal, State, and local laws, rules and regulations.
- B.** All equipment and products shall be subject to the review of the CONTRACTOR's Competent Person (CP) prior to use at the site. If equipment is not specifically called out in the Lead-Based Paint/Paint with Lead Removal/Control Plan (LBP/PWL R/CP), then a statement reviewed and signed by the CP identifying suitability of specific equipment by manufacturer, type and model number, including any applicable limitations, shall be submitted to the OWNER in accordance with Specification Section 01330 for approval prior to use at the site. All equipment proposed is to also comply with the requirements of other sections of this specification.

**PART 3 – EXECUTION**

**3.1 Evaluation**

- A.** CP to evaluate existing project data, including (but not limited to) prior sampling/testing results, age of existing tanks and coatings, and experience with similar existing coating systems.
- B.** Additional testing, if deemed to be necessary based on CP evaluation, will be conducted in accordance with these specifications at the direction of the CP.
- C.** CP to review and evaluate existing conditions and provide a written report to include all applicable data, interpretation, and recommendations for further action (if applicable) in accordance with Federal, State, and local regulations and this specification. If LBP/PWL R/CP is determined by the CP to be required, follow the

requirements outlined in the remainder of this part (PART 3).

### **3.2 Preparation if applicable**

- A.** Notification - Notify the OWNER and ENGINEER twenty (20) days prior to the start of any paint removal work.
- B.** Provide physical boundaries around the lead control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that lead will not escape outside the lead control area.
- C.** Warning Signs - Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.
- D.** Decontamination Shower Facility - Provide clean and contaminated change rooms and shower facilities in accordance with this specification and 29 CFR 1926.62.
- E.** Eye Wash Station - Where eyes may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes shall be provided within the work area.
- F.** Mechanical Ventilation System - Use adequate ventilation to control personnel exposure to lead in accordance with 29 CFR 1926.62.
- G.** To the extent feasible, use local exhaust ventilation connected to HEPA filters or other collection systems, approved by the CP. Local exhaust ventilation systems shall be evaluated and maintained in accordance with 29 CFR 1926.62.
- H.** Vent local exhaust outside the containment only and away from building ventilation intakes.
- I.** Use locally exhausted, power actuated, paint removal tools.
- J.** Personnel Protection - Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking or application of cosmetics is not permitted in the lead control area. No one will be permitted in the lead control area unless they have been appropriately trained and provided with protective equipment.

### **3.3 Erection if applicable**

- A.** Lead Control Area Requirements - Establish a lead control area by situating critical barriers and physical boundaries around the area or structure where LBP/PWL removal/control operations will be performed.
- B.** Full containment – If required by the CP, contain removal operations



by the use of critical barriers and HEPA filtered exhaust, incorporating a negative pressure enclosure system with decontamination facilities and with HEPA filtered exhaust. For containment areas larger than 1,000 square feet install a minimum of two 18 inch square viewing ports. Locate ports to provide a view of the required work from the exterior of the enclosed contaminated area. Glaze ports with laminated safety glass.

### **3.4 Application if applicable**

- A.** Work Procedures - Perform removal of lead-based paint in accordance with approved lead-based paint/paint with lead removal/control plan. Use procedures and equipment required to limit occupational and environmental exposure to lead when lead-based paint is removed in accordance with 29 CFR 1926.62. Dispose of removed paint chips and associated waste in compliance with Environmental Protection Agency (EPA), State, and local requirements.
- B.** Manual or power sanding of surfaces is not permitted unless tools are equipped with HEPA attachments or wet methods. The dry sanding or grinding of surfaces that contain lead is prohibited. Provide methodology for LBP removal/control in work plan. Remove paint within the areas designated on the drawings in order to completely expose the substrate. Take whatever precautions necessary to minimize damage to the underlying substrate. Avoid flash rusting and deterioration of the substrate. Provide surface preparations for coatings in accordance with Section 09950.
- C.** Provide methodology for LBP/PWL removal/abatement/control and processes to minimize contamination of work areas outside the control area with lead-contaminated dust or other lead-contaminated debris/waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead. Describe this LBP/PWL removal/control process in the LBP/PWL R/CP.
- D.** Perform exterior removal as indicated in federal, State, and local regulations and in the LBP/CPR/CP. The worksite preparation (barriers or containments) shall be job dependent and presented in the LBP/PWL R/CP.
- E.** Personnel Exiting Procedures - whenever personnel exit the lead-controlled area, they shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn during the work day:
  - 1.** Vacuum themselves off.

2. Remove protective clothing in the contaminated change room, and place them in an approved impermeable disposal bag.
3. Shower (Showering is the preferred method of personal decontamination. However, extenuating circumstances may prevent the use of a shower at the work site.)
4. Wash hands and face at the site, don appropriate disposable or uncontaminated reusable clothing; move to an appropriate facility; shower.
5. Change to clean clothes prior to leaving the physical boundary designated around the lead control area.

### **3.5 Field Quality Control if applicable**

- A. Air and Wipe Sampling - Air sample for lead in accordance with 29 CFR 1926.62 and as specified herein. Air and wipe sampling shall be directed or performed by the CP.
  1. The CP shall be on the job site directing the air and non-clearance wipe sampling and inspecting the lead-based paint removal/control work to ensure that the requirements of the contract have been satisfied during the entire lead-based paint removal operation.
  2. Collect personal air samples on employees who are expected to have the greatest risk of exposure as determined by the CP. In addition, collect air samples on at least 25 percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.
  3. Submit results of air samples, within 72 hours after the air samples are taken.
  4. Before any work begins, collect and analyze baseline wipe and soil samples in accordance with methods defined in federal, State, and local standards inside and outside of the physical boundary to assess the degree of dust contamination at the facility prior to lead-based paint removal/control.
  5. Collect surface wipe samples at a location no greater than 10 feet outside the lead control area at a frequency of once per day while lead removal work is conducted. Surface wipe results shall meet criteria in paragraph "Clearance Certification."
- B. Air Sampling During Paint Removal Work - Conduct area air sampling daily, on each shift in which lead-based paint removal operations are performed, in areas immediately adjacent to the lead control area. Sufficient area monitoring shall be conducted to ensure unprotected

personnel are not exposed at or above 30 micrograms per cubic meter of air. If 30 micrograms per cubic meter of air is reached or exceeded, stop work, correct the condition(s) causing the increased levels. Notify the Contracting Officer immediately. Determine if condition(s) require any further change in work methods. Removal work shall resume only after the CP and the OWNER give approval. For outdoor operations, at least one sample on each shift shall be taken on the downwind side of the lead control area.

- C.** Sampling After Paint Removal/Control - After the visual inspection, conduct soil sampling if bare soil is present during external removal/control operations and collect wipe samples according to the HUD protocol contained in HUD 6780 to determine the lead content of settled dust and dirt in micrograms per square meter foot of surface area and micrograms per gram (ug/g) parts per million (ppm) for soil.
- D.** Testing of Removed Paint and Used Abrasive - Test removed paint and used abrasive in accordance with 40 CFR 261 for hazardous waste.

### **3.6 Cleaning if applicable**

- A.** Cleanup - Maintain surfaces of the lead control area free of accumulations of paint chips and dust. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use compressed air to clean up the area. At the end of each shift and when the paint removal operation has been completed, clean the area of visible lead paint contamination by vacuuming with a HEPA filtered vacuum cleaner, wet mopping the area and wet wiping the area as indicated by the CP. Re-clean areas showing dust or residual paint chips or debris. After visible dust, chips and debris is removed, wet wipe and HEPA vacuum all surfaces in the work area. If adjacent areas become contaminated at any time during the work, clean, visually inspect, and then wipe sample all contaminated areas. The CP shall then certify in writing that the area has been cleaned of lead contamination before restarting work.
  - 1.** Clearance Certification - The CP shall certify in writing that air samples collected outside the lead control area during paint removal operations are less than 30 micrograms per cubic meter of air (or as required by Arizona regulations, if more restrictive); the respiratory protection used for the employees was adequate; the work procedures were performed in accordance with 29 CFR 1926.62 and 40 CFR 745; and that there were no visible accumulations of material and dust containing lead left in the work site. Do not remove the lead

control area or roped off boundary and warning signs prior to the OWNER's acknowledgement of receipt of the CP certification.

2. Certify surface wipe samples are not significantly greater than the initial surface loading determined prior to work.
3. For exterior paint removal/control work, soil samples taken at the exterior of the work site shall be used to determine if soil lead levels had increased at a statistically significant level (significant at the 95 percent confidence limit) from the soil lead levels prior to the work. If soil lead levels do show a statistically significant increase or is above any applicable Federal or State standard for lead in soil, the soil shall be remediated back to the pre-work level.
4. Clear the lead control area in industrial facilities of all visible dust and debris.
5. For lead-based paint hazard abatement work, surface wipe and soil sampling shall be conducted and clearance determinations made according to the work practice standards presented in 40 CFR 745.227.

### **3.7 Disposal if applicable**

- A. Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing that may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1926.62 and 40 CFR 262. Dispose of lead-contaminated waste material at a State approved disposal facility off the subject property in accordance with applicable Federal, State and local regulations and requirements.
- B. Place waste materials in U.S. Department of Transportation (49 CFR 178) approved 208 liter 55 gallon drums. Properly label each drum to identify the type of waste (49 CFR 172) and the date the drum was filled. For hazardous waste, the collection drum requires marking/labeling in accordance with 40 CFR 262 during the accumulation/collection timeframe. The CP, with the written approval of the OWNER, will assign an area for interim storage of waste-containing drums. Do not store hazardous waste drums in interim storage longer than 90 calendar days from the date affixed to each drum.
- C. Handle, transport, and dispose lead or lead-contaminated material classified as hazardous waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by

40 CFR 268. Comply with all State and local disposal requirements as required by State and local laws and regulations.

- D.** All material, whether hazardous or non-hazardous shall be disposed in accordance with laws and provisions and Federal, State, or local regulations. Ensure waste is properly characterized. The result of each waste characterization, Toxicity Characteristic Leaching Procedures (TCLP) per Resource Conservation and Recovery Act of 1976 (RCRA), will dictate disposal requirements.

### **3.8 Disposal Documentation if applicable**

- A.** Hazardous Waste Disposal - Submit written evidence to demonstrate the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA, State or local regulatory agencies. Submit one copy of the completed hazardous waste manifest, signed and dated by the initial transporter in accordance with 40 CFR 262. Contractor shall provide a certificate that the waste was accepted by the disposal facility.
- B.** Non-Hazardous Waste Disposal - Provide turn-in documents or weight tickets for non-hazardous waste disposal.

### **3.9 Payment for Disposal if applicable**

- A.** Payment for disposal of hazardous and non-hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-containing materials or non-hazardous waste delivered is returned and a copy is furnished to the OWNER.

## **PART 4 – MEASUREMENT AND PAYMENT**

### **4.1 Measurement**

- A.** Refer to Section 01210, Measurement and Payment.

### **4.2 Payment**

- A.** Payment will be made at the contract lump sum price bid as indicated in Bid Item 41 of specification Section 01210, and shall be considered full payment for providing labor and materials to perform this work.

\*\* END OF SECTION \*\*

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SECTION 13110  
**CATHODIC PROTECTION SYSTEM**

**PART 1 – GENERAL**

**1.1 SUMMARY**

- A.** Remove and replace existing impressed current cathodic protection system components inside of tank. Tank S-1C-24 has 14 anodes, nominal diameter of 85 feet, and height of 24 feet.
- B.** Replace header wire with new wire.
- C.** Remove, store and re-install existing mixed metal oxide anodes.
- D.** Replace permanent reference cell with new reference cell.
- E.** Repair hand holes and provide replacement gaskets as directed by ENGINEER. All roof penetrations including those for the CP system must be sealed for sanitary purposes in accordance with applicable laws governing potable water storage. Only appropriately sealed or screened penetrations, including conduit penetrations, will be allowed at completion of rehabilitation work.
- F.** Re-commission existing system to ensure system is operational.
- G.** Ensure system is turned off upon successful completion of re-commissioning. Turn off system upon successful re-commissioning.
- H.** Turn on system after successful completion of "11-month" warranty inspection and any associated repairs.

**1.2 REFERENCES**

- A.** National Association of Corrosion Engineers (NACE).

**1.3 SUBMITTALS**

- A.** Submittals: Comply with Section 01330.
- B.** Submit qualifications showing NACE certification as required herein.

**1.4 QUALIFICATIONS**

- A.** Testing: Performed by a Cathodic Protection Specialist.
- B.** Cathodic Protection Specialist defined as one of the following:
  - 1. NACE certified Cathodic Protection Specialist or Corrosion Specialist;
  - 2. Registered Professional Corrosion Engineer.

## **PART 2 – PRODUCTS**

### **2.1 PERMANENT REFERENCE CELL**

- A.** To match existing cell;
- B.** GMC Staperm Copper-Copper sulfate, CU-2-FW or approved equal
- C.** Minimum 30-year service life.

### **2.2 WIRE**

- A.** To match existing;
- B.** #10 HMWPE

## **PART 3 EXECUTION**

### **3.1 PREPARATION FOR RECOATING OF TANKS**

- A.** Deactivate existing impressed current system.
- B.** Document materials, locations, dimensions in order to re-install in same layout.
- C.** Remove existing CP system components inside tank. Cut wires, leave enough wire for splice and protect bare end during painting operations.
- D.** Store existing anodes in dry, clean, sealed bags, marked with date and location of tank from which anodes are taken in an indoor location.

### **3.2 INSTALLATION**

- A.** Reinstall materials and equipment in accordance with recommendations of manufacturer.
- B.** Provide new gaskets comprised of NSF/ANSI standard 61 certified material at all hand holes.
- C.** Ensure hand holes and other roof penetrations provide watertight condition. If necessary, caulk all hand holes and roof penetrations with Sikaflex-1a+ or ENGINEER approved equal. All caulk must be certified to NSF/ANSI standard 61 for potable water.



### **3.3 TESTING**

- A.** Perform testing by a Cathodic Protection Specialist employed by Contractor to ensure proper operation.
- B.** Deactivate after recommission testing for the entirety of the 12 month warranty period or until completion of "11-month" warranty inspection and any associated repairs.
- C.** Reactivate after warranty period/completion of warranty inspection and any associated repairs, prior to final project completion.

## **PART 4 – MEASUREMENT AND PAYMENT**

### **4.1 Measurement**

- A.** Refer to Section 01210, Measurement and Payment.

### **4.2 Payment**

- A.** Payment will be made at the contract lump sum price bid as indicated in Bid Item 43 of specification Section 01210, and shall be considered full payment for providing labor and materials to perform this work.

**\*\* END OF SECTION \*\***

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SECTION 13211  
**TANK DISINFECTION**

**PART 1 – GENERAL**

**1.1 Requirement**

- A.** The CONTRACTOR shall perform all cleaning, flushing, testing, and disinfection, including conveyance of test water from source to point of use, and including all disposal thereof, complete and acceptable for the tanks identified herein in specification section 00310 and appurtenant piping as specified herein and in accordance with the requirements of the contract documents.

**1.2 Related Work Specified Elsewhere**

- A.** The work of the following Sections applies to the Work of this Section.
- B.** Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

|  |               |
|--|---------------|
| Measurement and Payment                  | Section 01210 |
| Submittals                               | Section 01330 |
| Protective Coatings for Steel Water Tank | Section 09950 |

**1.3 Contractor Submittals**

- A.** The CONTRACTOR shall submit a minimum 7-day advance written notice of the proposed testing schedule for review and concurrence of the ENGINEER. The CONTRACTOR's proposed plans for water conveyance, control, backflow prevention, and disposal shall also be submitted in writing.

**PART 2 – PRODUCTS**

**2.1 Materials Requirements**

- A.** Temporary valves, bulkheads, or other water control equipment and materials, shall be as determined by the CONTRACTOR subject to the ENGINEER's review. No materials shall be used which would be injurious to the construction or its future function.
- B.** All materials that will come into contact with potable water must be ANSI/NSF 61 certified.

## **PART 3 – EXECUTION**

### **3.1 General**

- A.** Water for testing and disinfection shall be furnished by the CONTRACTOR. The CONTRACTOR shall make all necessary provisions for conveying the water from the source to the points of use.
- B.** Tanks and their appurtenant pressure piping shall be tested and disinfected. Disinfection shall be accomplished by chlorination. Chlorine dosages shall be as required by ADEQ Bulletin 8 and AWWA C652. All chlorinating operations shall be performed in the presence of a representative of the Owner or the ENGINEER.
- C.** Testing and disinfecting operations shall be combined. Testing of tank shall comply with AWWA D-100 11.10.3: "*Shell, bottom, and roof.* Unless otherwise specified, the tank shall be hydrotested after painting by filling the tank with water to the TCL. Any leaks in the shell, bottom, or roof (if the roof contains water) shall be repaired by chipping, gouging, or oxygen gouging to remove any defective welds, and rewelded. No repair work shall be done on any joints unless the water in the tank is at least 2 ft (0.6 m) below the point being repaired."
- D.** Disinfection operations shall be scheduled by the CONTRACTOR as late as possible during the contract time period so as to assure the maximum degree of sterility of the facilities at the time the WORK is accepted by the OWNER. Bacteriological testing shall be performed by a certified testing laboratory approved by the OWNER and at the expense of the CONTRACTOR. Results of the bacteriological testing shall be satisfactory with the Arizona Department of Environmental Quality.
- E.** Protective coatings shall be applied before all testing and disinfection operations have been completed.
- F.** Release of water from structures, after testing and disinfection have been completed, shall be as approved by the ENGINEER.

### **3.2 Preliminary Cleaning and Flushing**

- A.** Prior to both testing and disinfection, Tanks shall be cleaned by thoroughly hosing down all surfaces with a high pressure hose and nozzle of sufficient size to deliver a minimum flow of 50 gpm.

### **3.3 Disinfection of Reservoir and Appurtenant Pipelines**

- A.** Disinfection of the tanks shall meet the requirements of ADEQ Bulletin 8, Method One and AWWA C652 Method Two. A strong chlorine solution (200 mg/L available chlorine) shall be sprayed on all interior surfaces of the tank. The solution shall thoroughly coat all interior surfaces of the tank, including the inlet/outlet piping.
- B.** Drain piping shall be coated so that it will have a minimum chlorine concentration of 10 mg/L when filled with water.
- C.** The disinfected surfaces shall remain in contact with the strong chlorine solution for at least 30 min, after which potable water shall be admitted, the drain piping purged of the 10 mg/L chlorinated water, and the storage facility then filled to its overflow level.
- D.** Following this procedure and subject to satisfactory bacteriological testing and acceptable aesthetic quality, the water may be delivered to the distribution system.

## **PART 4 – MEASUREMENT AND PAYMENT**

### **4.1 Measurement**

- A.** Refer to Section 01210, Measurement and Payment.

### **4.2 Payment**

- A.** Payment will be made at the contract lump sum price bid as indicated in Bid Item 39 of specification Section 01210, and shall be considered full payment for providing labor and materials to perform this work.

**\*\* END OF SECTION \*\***

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SECTION 13212  
**TANK STRUCTURAL REPAIR**

**PART 1 - GENERAL**

**1.1 Description**

- A.** This specification covers the work required to rehabilitate 1 MG Steel Welded Water Tank S-1C-24. This is "turnkey" project. The CONTRACTOR shall provide all work, labor, materials, appliances, tools, equipment and services necessary for or incidental to perform all of the operations encompassed by the work of this Specifications, complete as specified herein.
- B.** Inadvertent omission of any necessary items of work, material, or equipment shall not negate the CONTRACTOR'S responsibility to provide these items at no additional cost to the OWNER.
- C.** Tank Industrial Consultants (TIC) conducted a field evaluation of Tank S-1C-24. The Reports summarizing TIC findings are provided in Appendix A.
- D.** CONTRACTOR shall verify with the OWNER that the tank is out of service and empty prior to start of any rehabilitation work.

**1.2 Scope**

- A.** This specification establishes methods and procedures for miscellaneous structural modifications. The CONTRACTOR shall furnish, fabricate and install all the items as required by these specifications.
- B.** Replace roof rafters and clips at locations directed by the Engineer. Inspect all structural steel surfaces following abrasive blasting operations. Notify the Engineer in writing where the loss of material exceeds fifteen percent (15%) of the original material thickness.
- C.** Inspect all structural steel surfaces following abrasive blasting operations. Notify the ENGINEER in writing where the loss of material exceeds fifteen percent (15%) of the original material thickness. Replace or install new roof, center column, rafters, and/or rafter attachment clips, as directed by the ENGINEER.
- D.** Tank floor areas are to be repaired based on tank grid provided by Tank Industry Consultants, vacuum tests on floor seams, observed surface leaks, as well as review of the existing conditions in the presence of the ENGINEER following abrasive blast operations. Prior to the start of the repair work, the CONTRACTOR shall submit shop drawings for the ENGINEER to review and approve recommendations and exhibits illustrating the repair of the floor.
- E.** Install appurtenances as described in Section 3.2.

### **1.3 Quality Assurance**

- A.** All work shall be accomplished in accordance with the coating manufacturer's requirements and all relevant OSHA, AWWA and State Standards.
- B.** Welding procedures and welding operators shall have been qualified in accordance with AWWA D100 Standard. All butt joints shall be complete penetration and fusion of joints. All completed welds shall be free of slag and all finish steel surfaces free from weld spatters.
- C.** Work accomplished in the absence of prescribed inspection may be required to be removed and replaced under proper inspection. The entire cost of removal and replacement, including the cost of all materials shall be borne by the Contractor, regardless of whether the work removed is found to be defective or not. Work covered up without approval of the ENGINEER, shall, upon order of the ENGINEER, be uncovered to the extent required. The CONTRACTOR shall bear the entire cost of accomplishing all the work and furnishing all the materials necessary for the removal of the covering and its subsequent replacement, as directed and approved by the ENGINEER.

### **1.4 Safety and Health Requirements**

- A.** Grounding: Welding leads and related equipment shall be grounded to prevent accumulation of charges of static electricity
- B.** Protective Clothing: During cutting, burning and welding operations, workers shall wear gloves, eye shields and other protective clothing. If working with lead or other heavy metals, regulations regarding handling of exposed clothing shall be strictly enforced.
- C.** Fire: Appropriate type fire abatement devices shall be provided by Contractor, and be readily available at the jobsite during all operations
- D.** Tank Access: Use appropriate precautions and OSHA requirements for entry and work inside tank and on roof.
- E.** Structural Support: Where repairs to tank structural systems (rafters, center post, door sheets, etc.) are proposed or required by the work scope, and prior to initiating the proposed work, Contractor shall provide to the Engineer a submittal detailing proposed temporary shoring and structural support, reviewed, approved and signed by an Arizona Professional Engineer proficient in structural systems design and evaluation, in accordance with Section 01330 of the Specifications.



## **1.5 Submittals**

- A.** Floor repair plan
- B.** Temporary structural support and repair plan
- C.** Fabrication and erection drawings for all work.
- D.** All necessary information for the fabrication, including filler metal for welds, of the component part of the structure, presented on drawings to conform to recognized standard practice, AISC Manual Part 5, and AWS Code.
- E.** Vacuum weld test results
- F.** Certified mill test reports for steel plates and other structural components.
- G.** Drawings shall be provided in accordance with Section 01330, and specifically to reflect the removal and relocation of the existing ladder and safety rail. The drawings shall indicate ladder re-installation at a location adjacent to the existing ladder in order to ensure a clear roof-top landing area adjacent to the existing roof access hatch. The existing safety rail shall be likewise removed and re-installed to provide roof landing area adjacent to the existing access hatch. The submittal reflecting the proposed location of the ladder and rail will be subject to approval by the Engineer.
- H.** Manufacturer's literature on products including, but not limited to hardware such as bolts, nuts, washers, welding rods, and protective coatings.
- I.** Resumes of personnel for the project submitted upon Notice of Award.

## **PART 2 - MATERIALS**

### **2.1 General**

- A.** All materials specified are those, which have been evaluated for the specific use. Any proposed substitutions must be submitted to the ENGINEER per Contract Documents.
- B.** All steel plate components shall be fabricated from new ASTM A36 material. CONTRACTOR shall provide certified mill test reports for all steel plates.
- C.** All coating and paint materials shall be stored in enclosed structures to protect them from weather and excessive heat or cold. Flammable materials must be stored to conform with Federal, State, and local safety codes for flammable materials. At all times coatings or paints shall be protected from freezing.

## **PART 3 - EXECUTION**

### **3.1 General**

- A.** All work shall be executed in accordance with the requirements of the American Water Works Association Standard D100, latest revision and these specifications. Where the foregoing standards, recommendations, and specifications are conflicting, said conflicts shall be brought to the attention of the ENGINEER.
- B.** All work shall be executed by skilled craftsmen qualified to accomplish the required work in a manner comparable with the best standards of practice. Continuity of personnel shall be maintained and transfers of key personnel shall be coordinated with the ENGINEER.
- C.** The CONTRACTOR shall provide a Project Superintendent to be at the work site during all operations. The superintendent shall have the authority to sign any change orders, pay estimates, coordinate work, and make other decisions pertaining to the execution of their contract.
- D.** All installation and repair work shall be accomplished in such a way as to minimize reservoir down-time. All repair operations shall be completed so as not to impair completion schedule for project.
- E.** All equipment, piping, and surfaces of the reservoirs shall be protected from all damage and dust or other deleterious material infiltration during the operations of the Contractor. Any items damaged by the operations of the CONTRACTOR shall be replaced in kind or acceptably repaired to the satisfaction of the ENGINEER by the CONTRACTOR at no cost to the OWNER.
- F.** All work shall be made accessible to the ENGINEER at all times.
- G.** The OWNER may use own forces, engage full-time independent inspection services, or perform inspections intermittently. The CONTRACTOR is to supervise the job properly between inspections.
- H.** Prior to inspection. Blast cleaning shall be completed on all interior surfaces of the tank and its appurtenances. All interior surfaces must be visible and accessible. Abrasive blasting residue, debris, blasting supplies, cleaning equipment, and blasting equipment shall be removed from the interior of the tank. Only necessary equipment required for the inspection should remain in the tank.
- I.** The ENGINEER shall inspect the cleaning of pitted areas prior to welding and following post-weld repair applications.
- J.** Any burrs, weld spatter, sharp edges, corners, or rough welds that would cause difficulty in achieving a defect-free paint system, whether existing or resulting from current tank repair work, shall be chipped or ground smooth in conformance to NACE Standard RP0178-2003. It is not the intent to have the welds or "scars"

ground "flush". The object of the grinding is to eliminate sharp edges, corners, and overlaps to provide a surface for the application of a uniform thickness of coating or paint without voids or other defects.

- K.** Where it is necessary to abrasively blast clean or chemically strip coated or painted areas prior to, and after, any welding operations, work will be coordinated with the ENGINEER. Blasting for repair purposes is considered to be included in the pay item(s) for those repairs.
- L.** The Contractor's equipment shall be designed for installation of materials specified and shall be maintained in first class working condition. Contractor's equipment shall be subject to approval of the ENGINEER.
- M.** The CONTRACTOR shall provide, at his own expense, all necessary power and scaffolding required for his operations under the contract.
- N.** The continuous use of diesel motors within the tank shall be prohibited to avoid contamination of the interior surfaces of the tank and its appurtenances. The use of diesel forklifts and man-lifts are permitted on a temporary basis, diesel motors shall not be in continuous operation within the tank for longer than 10 minutes. The use of propane motors is preferred.

### **3.2 Modifications and Repair**

- A.** Rafters and other structural components of the tank: After ENGINEER'S inspection of the abrasive blast cleaned roof structure, ENGINEER shall designate each item to be added, replaced or modified.
  1. Replace or repair roof rafters and associated clips at locations directed by Engineer. Inspect all structural steel surfaces following abrasive blasting operations with OWNER.
  2. Replace or repair perimeter rafter end clips at locations directed by Engineer. Inspect all structural steel surfaces following abrasive blasting operations with OWNER.
  3. Remove and replace structure bolts, nuts, washers following abrasive blasting operations with the OWNER. Replace with galvanized bolts, nuts, and washers. Either 3. or 4., not both, will be authorized at the sole discretion of the OWNER or OWNER's authorized representative.
  4. Remove structure bolts, nuts, washers and replace with welded connections following abrasive blasting operations with the OWNER. Either 3. or 4., not both, will be authorized at the sole discretion of the OWNER or OWNER's authorized representative.

5. Remove and replace rafter end clips as directed by ENGINEER. Inspect all clips following abrasive blasting operations with the OWNER. Remove and dispose of existing clips and install new clips.

**B. Tank Floor.**

1. Tank floor areas are to be repaired based on tank grid provided by Tank Industry Consultants, as well as review of the existing conditions in the presence of the ENGINEER following abrasive blast operations. See Appendix A. Leaks observed at surfaces of plates and floor areas with thicknesses below 0.20 inches shall be repaired by seal welding a quarter inch (1/4") thick plate (minimum) to the existing floor plate. Prior to the start of the repair work, the CONTRACTOR shall submit shop drawings with recommendations and exhibits illustrating the repair of the floor, to the ENGINEER for approval. If floor requires repair of area that is excessively larger than bid quantity, a change order will be negotiated for this Work. Vacuum test on all new floor seams prior to application of the new protective coating system. Locate any leaks in new floor plate or welded joint using vacuum testing in accordance with AWWA D100, Section 11.12. Leaks observed in welds shall be repaired by gouging out the defective area and re-welding.
2. As directed by ENGINEER on Figure 6 and Figure 7, stabilize foundation, if indicated, and replace floor by removing indicated floor plate, scarifying, compacting, topping with a layer of geotextile fabric wrapped oiled sand, welding replacement floor plate and reinforcing pad as applicable with new A36 steel to existing tank floor, and infiltrating low compression slurry grouting from tank exterior. Vacuum test all new floor seams prior to application of the new protective coating system. Locate any leaks in new floor plate or welded joint using vacuum testing in accordance with AWWA D100, Section 11.12. Leaks observed in welds shall be repaired by gouging out the defective area and re-welding.

**C. Pit/Perforation Treatment:** Excessively pitted or perforated rafter web areas, or pitted areas on the roof or floor, shall be covered with a metal 1/4" thick plate. Plate shall extend beyond pit or perforation with a 100% fillet weld around perimeter of plate.

**D. Pit/Perforation Treatment:** Moderately Pitted Surfaces -A moderately pitted surface is defined as a surface having pits less than 1/16-inch-deep with a frequency of 4 to 5 pits per square foot. Prior to application of the specified coating system, the pitted surface shall be blasted to SSPC-SP10. The first coat may be thinned (not to exceed manufacturer's published recommendations) and applied by stiff bristle brush or roller to all pitted surfaces.

- E.** Pit/Perforation Treatment: Badly Pitted Surfaces - A badly pitted surface is defined as a surface having pits greater than 1/16-inch-deep and less than 1/2 of the metal thickness with a frequency of 8-12 pits per square foot. Prior to application of the specified system, the pitted surface shall be blasted to SSPC-SP10. Prior to applying the specified system, the pits shall be filled with an epoxy caulk seam sealer applied by putty knife or stiff bristle brush.
- F.** Center Vent: Remove existing center vent and install new center vents in accordance with provided detail and Section 15910. See Figure 3.
- G.** Shell Manhole: Install access manhole in accordance with provided detail. Location of shell manhole shall be at 180 degrees from existing shell manhole. Replace gaskets on all existing manholes. Confirm locations with OWNER prior to installation. Clean and recoat exterior shell where impacted by installation of shell manhole per Specification Section 09950. See Figure 4.
- H.** Remove ladder and ladder safety cage and install new exterior ladder and climb assist (Saf-T-Climb) with hinged locking vandal resistant door and hold open ("anti-closure") device in accordance with provided detail and OSHA Standards. The hinged locking door should prevent unauthorized access to the ladder. Install ENGINEER approved closure device for each access in the roof safety railing. Also included is the lowering of the toe bar so the gap between it and the roof is less than 1/4-inch. Reinstall ladder at a new position adjacent to existing location to provide clear landing at the top of the ladder in accordance with ENGINEER approved shop drawings; remove existing roof-top safety rail and re-install with additional railing to expand the ladder rooftop landing area adjacent to existing roof hatch in accordance with Engineer approved shop drawings. Clean and recoat exterior shell where impacted by installation of ladder, climb assist (Saf-T-Climb by Honeywell or approved equal), and hinged locking door per Specification Section 09950. See Figure 5 and Figure 8.
- I.** Enlarge Roof Manhole: Enlarge (remove and replace) roof manhole to comply with AWWA Standards. Install a 30" by 30" square hatch and new gasket and provide submittal for approval per Section 01330 for procedure to enlarge manhole. Roof manhole shall provide a water-tight (sanitary seal) when closed. Clean and recoat exterior shell where impacted by installation of roof manhole.
- J.** Miscellaneous Repairs: Where requested by OWNER, modify gap between toe bar and roof at roof safety railing. Provide blocking, sealing, or caulking at all penetrations or gaps in the tank envelope, except for those purpose-constructed vent areas that are appropriately screened. Inspect perimeter vents, bolts, and gaskets with presence of the ENGINEER and replace screens with 24 mesh

non-corrosive screen, replace gaskets and provide bolts as directed by ENGINEER. Clean and recoat vents and hardware as needed.

- K.** Repair of Retaining Ring: Remove, re-coat, and re-install existing steel retaining ring. Existing ring varies in distance from tank, excavate as needed but maintain maximum possible clearance from the bottom of existing tank to avoid undermining of the existing tank crushed rock foundation. Following removal and re-coating, re-install retaining ring. Re-installed retaining ring shall be vertical; anchored in place; and completely recoated on all surfaces. Retaining ring shall be secured with 5/8" diameter stainless steel bars a minimum of 20" long and spaced evenly along the retaining ring circumference at a constant, regular interval no greater than 20-feet. Stainless steel bars will be configured to hook over top of retaining ring, and each bar will be embedded in a concrete anchor no less than 1 cubic foot in volume located at least 3 inches clear below the bottom of the steel retaining ring. CONTRACTOR to re-empplace soil and crushed rock and place crushed rock surfacing as specified in Section 02200, in areas around retaining ring and in gaps beneath tank bottom and as directed by the ENGINEER. The steel retaining ring shall be a minimum of 12 in. from the shell or a sufficient distance to ensure crushed rock stability under the shell in the event the steel retaining ring is removed. The crushed rock surfacing adjacent to the shell shall completely fill the area between the tank shell and retaining ring, and shall be level with the tank bottom, extending at a level elevation to the back of the steel retaining ring.
- L.** Repair of Level Gauge Markings: Contractor shall provide new target gauge markings on tank. Existing target gauge markings shall be completely removed. Target gauge surface shall be cleaned prior to installation of new markings.
- M.** Remove Existing Interior Ladder: Remove existing interior ladder in tank as directed by ENGINEER. Work also includes preparation of surface for coating per Specification Section 09950.
- N.** Weld Shoring of Center Column: All work shall be performed in accordance with the provided detail, Figure 9, which includes the welding of a 1/2-inch thick, 66-inch by 54-inch base plate; installation of a 32-inch square tank floor bearing plate secured in place with three L-tabs; welding a 5-inch diameter, 3/8-inch thick steel-pipe-support; and coating to match interior of the tank. Contractor shall provide to the Engineer a submittal detailing proposed shoring and column bracing, reviewed, approved and signed by an Arizona Professional Engineer proficient in structural systems design and evaluation, in accordance with Section 01330 of the 09950.
- O.** Repair and Replace Rafter Strapping: Remove, repair, and replace rafter strapping as directed by ENGINEER subsequent to inspection

of tank structural components following abrasive blasting operations.

- P.** Cut Overflow Pipe Below Shell Vents: Cut down existing tank overflow pipe to an elevation 6-inches below the existing perimeter vents and replace pipe support. Work also includes preparation of surface for coating per Specification Section 09950.
- Q.** Cut 7-Foot Fill Pipe and Abandon Below Floor: Demolish the existing 7-foot tank fill/outlet pipe, provide structural support and floor patch at tank interior surface, and abandon pipe section below the floor surface. Work also includes preparation of surface for coating per Specification Section 09950.

### **3.3 Cleanup**

- A.** Upon completion of the work, all staging, erection brackets, scaffolding and debris shall be removed from the reservoir and site and disposed in a manner approved by the ENGINEER. The entire jobsite shall be left in a clean condition.
- B.** Test and disinfect tank per Specification Section 13211.

## **PART 4 – MEASUREMENT AND PAYMENT**

### **4.1 Measurement**

- A.** Refer to Section 01210, Measurement and Payment.

### **4.2 Payment**

- A.** Payment will be made at the contract unit price bid as indicated in Bid Items 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, and 56 of specification Section 01210, and shall be considered full payment for providing labor and materials to perform this work.

\*\* END OF SECTION \*\*

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SECTION 15910  
**CLOG-RESISTANT ATMOSPHERIC TANK VENT**

**PART 1 – GENERAL**

**1.1 Summary**

- A.** This specification covers the clog-resistant atmospheric tank vent that is to be installed at the center of the tank roof.

**1.2 Submittals**

- A.** Submit information from the vendor sufficient to indicate compliance with this specification.
- B.** Provide a pressure vs air flow rate curve.
- C.** Provide a vacuum vs. air flow rate curve.

**PART 2 – PRODUCTS**

- 2.1** Vent shall be of the pressure-vacuum-screened type described in AWWA D100, Section 7.5.
- 2.2** Vent shall have sufficient capacity to pass air so that the tank will not collapse, rupture, or fail at the following air flow rates:
  - A.** Air Flow leaving the tank through the vent: 4,000 scfm
  - B.** Air flow entering the tank through the vent: 7,000 scfm
- 2.3** The vent inlet diameter: min 24"
- 2.4** The vent shall be easily dismantled for cleaning.
- 2.5** The vent shall be screened with stainless steel 24 mesh screen to prevent the entrance of birds, insects, or contaminating materials.
- 2.6** In the event that the screen frosts over or becomes clogged with foreign material, a fail- safe system will be provided to relieve excess pressure or vacuum. The relief mechanism shall not be damaged by the occurrence and shall return automatically to the original operating position after the clogging is cleared.

- 2.7** The vent shall have a locking mechanism to prevent access to the tank.
- 2.8** The vent shall be aluminum construction.
- 2.9** Coat aluminum vent with shop applied fluoropolymer coating per Section 09900. Color to match finish color of the roof.
- 2.10** The vent shall be manufactured by Advance Tank Construction, or approved equal.

### **PART 3 – EXECUTION**

#### **3.1 General**

- A.** Install per manufacturer's instructions.

### **PART 4 – MEASUREMENT AND PAYMENT**

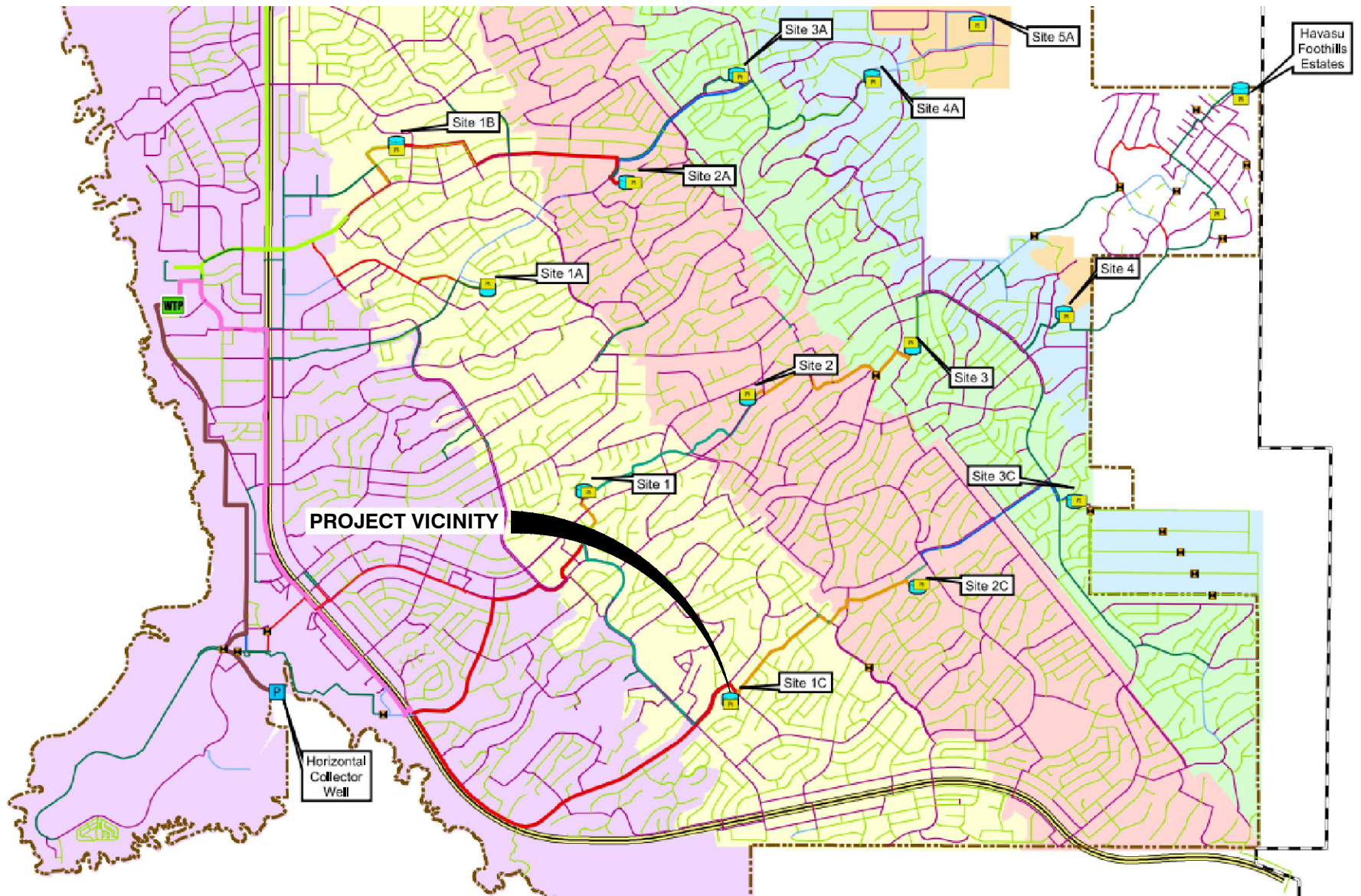
#### **4.1 Measurement**

- A.** Refer to Section 01210, Measurement and Payment.

#### **4.2 Payment**

- A.** Payment will be made at the contract lump sum price bid as indicated in Bid Item 44 of specification Section 01210, and shall be considered full payment for providing labor and materials to perform this work.

**\*\* END OF SECTION \*\***



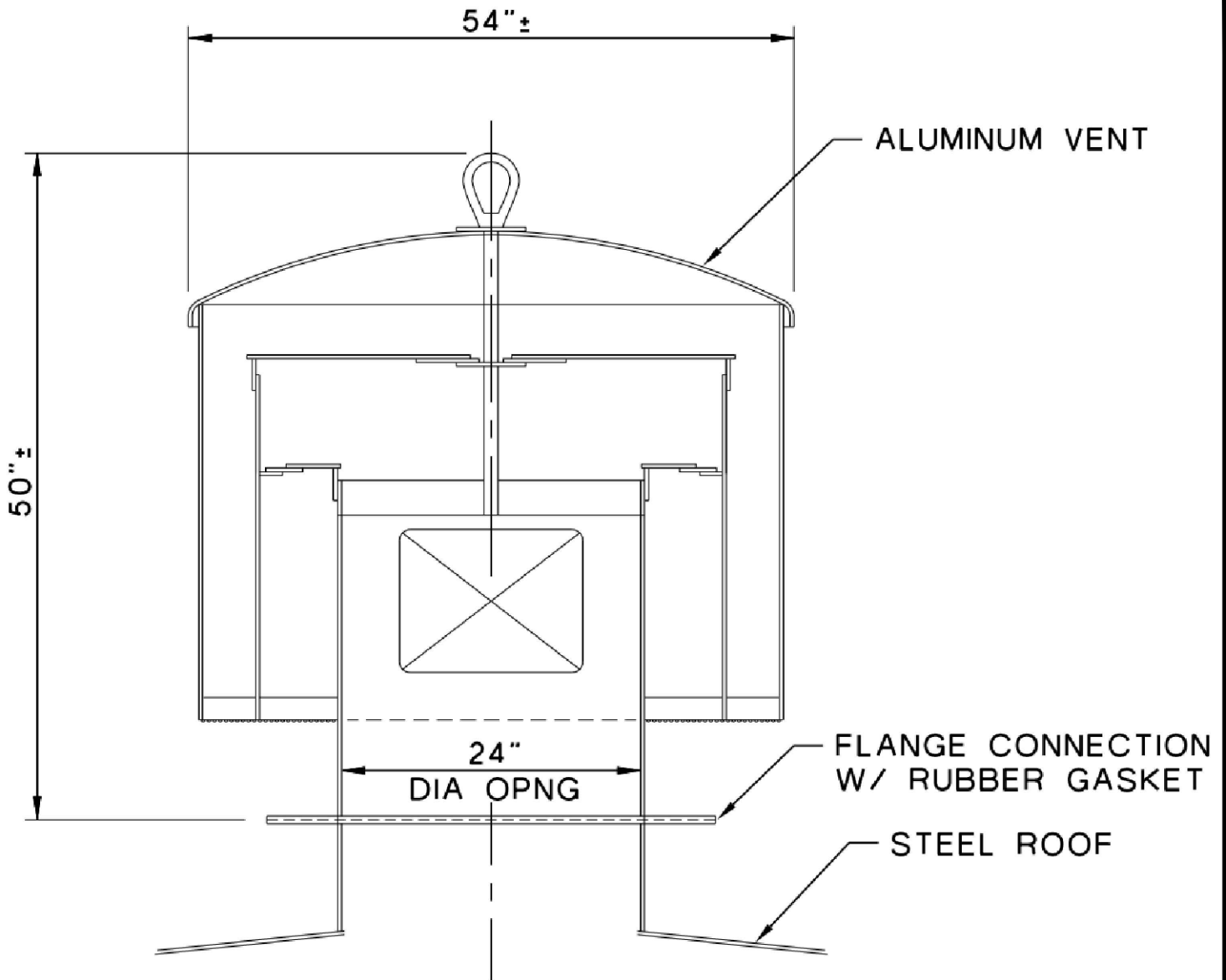
**2019 TANK REHABILITATION  
LOCATION MAP  
FIGURE 1**

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**2019 TANK REHABILITATION  
TANK S-1C-24 VICINITY MAP  
FIGURE 2**

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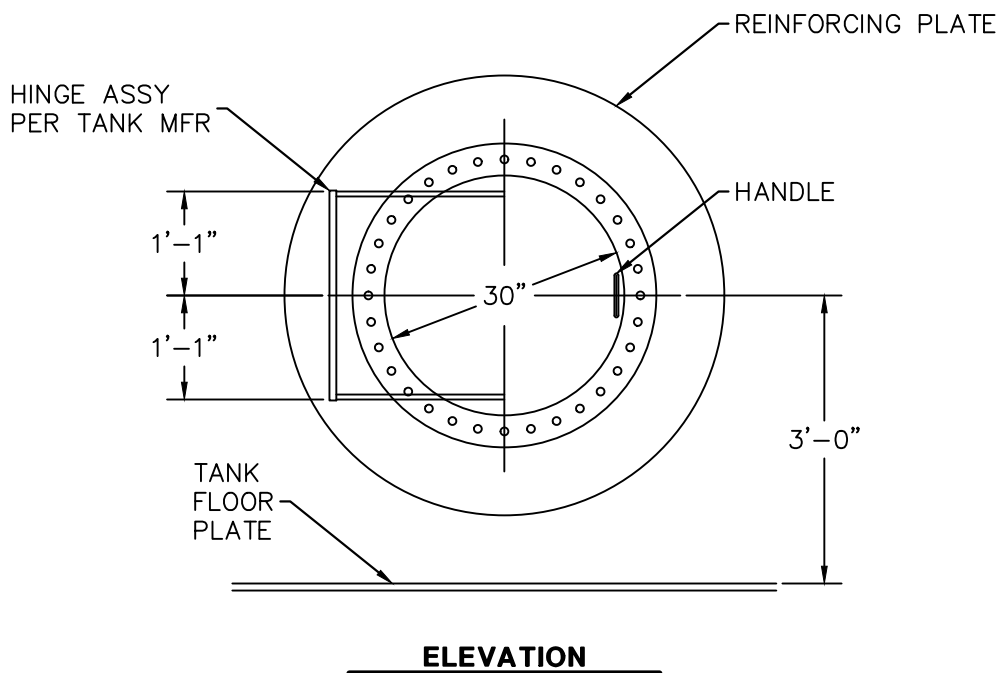
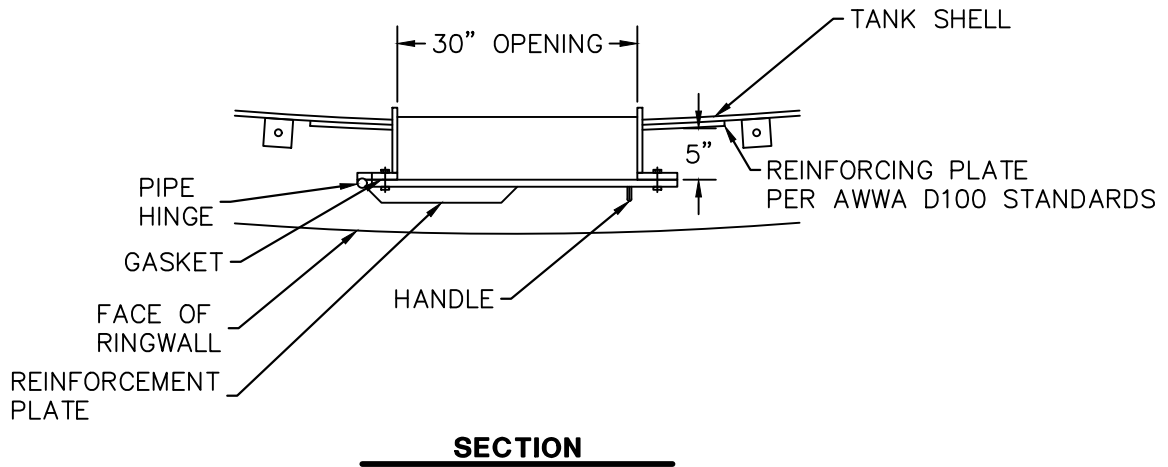


**NOTES:**

1. ALL BOLTS AND NUTS SHALL BE 304 STAINLESS STEEL
2. PROVIDE ISOLATION GASKET
3. VENT SCREENS SHALL BE 24-MESH NON-CORROSIVE SCREEN

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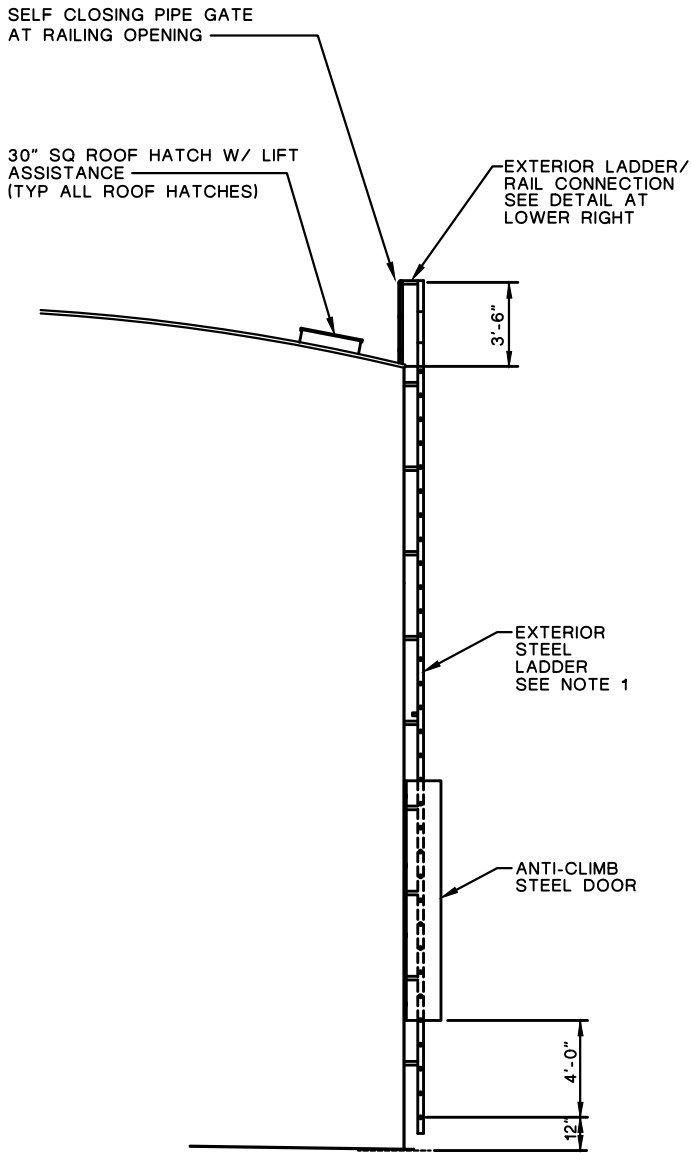
**NOTES:**

1. CONSTRUCTION SHALL CONFORM TO AWWA D100 (WELDED STEEL TANKS).

**2019 TANK REHABILITATION  
30" MANWAY  
FIGURE 4**

**ATKINS**

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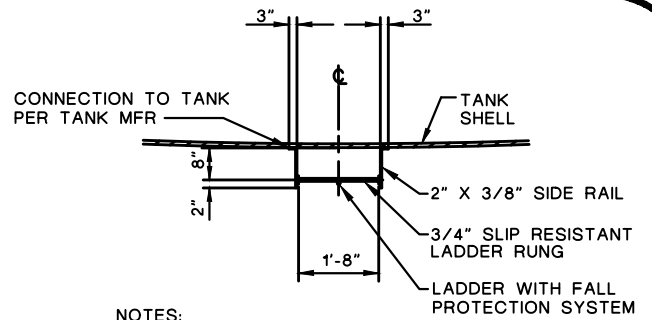


**TANK/LADDER SECTION**

1/4" = 1'-0"

**NOTES:**

1. RELOCATE LADDER AND EXISTING ROOF TOP SAFETY RAIL AND INSTALL ADDITIONAL SAFETY RAIL TO FLAT LANDING AT TOP OF LADDER REMOTE FROM HATCH PER 13212.
2. INTERIOR AND EXTERIOR STEEL TANK APPURTANANCES EXCLUSIVE OF STAINLESS STEEL (FALL PREVENTION SYSTEM, BRACES, ETC) SHALL BE COATED PER SPECIFICATION 09950. EXTERIOR COLOR: DESERT TAN TO MATCH EXISTING TANK
3. SAF-T-CLIMB FALL PREVENTION SYSTEM SHALL BE TYPE 316L SST AND INCLUDE TWO (2) SAF-T-CLIMB HARNESSES AND WEATHER PROOF SAF-T-CLIMB BOX FOR STORAGE.
4. ALL STAINLESS STEEL SHALL BE ELECTRICALLY ISOLATED FROM TANK STEEL.
5. ANTI-CLIMB STEEL DOOR SHALL BE EQUIPPED WITH AN ANTI-CLOSURE MECHANISM TO RETAIN THE DOOR IN THE OPEN POSITION WHEN LADDER IS BEING ACCESSED. MECHANISM SHALL BE INTEGRAL TO DOOR AND PROVIDE RESISTANCE TO ANTI-CLIMB DOOR CLOSURE DURING GUSTING WIND CONDITIONS.

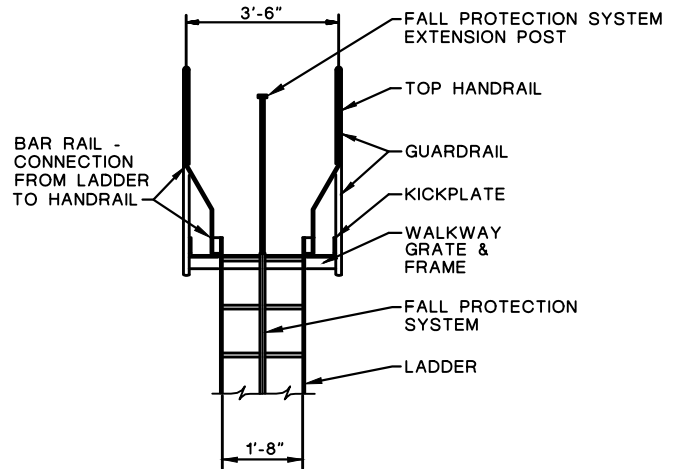


**NOTES:**

1. COATING SHALL BE APPLIED TO LADDER AS SPECIFIED IN SECTION 09950.

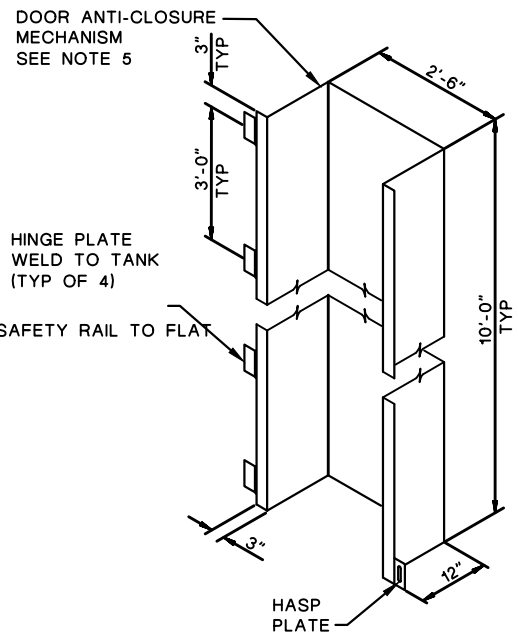
**LADDER SECTION**

1/2" = 1'-0"



**EXTERIOR LADDER/RAIL CONNECTION ELEVATION**

1/2" = 1'-0"



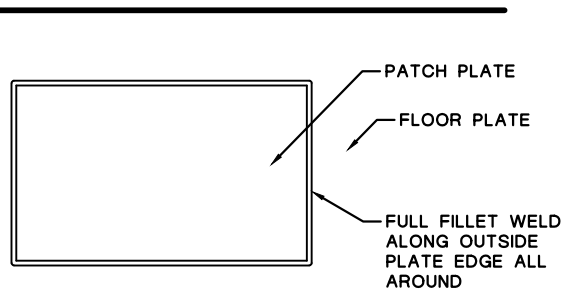
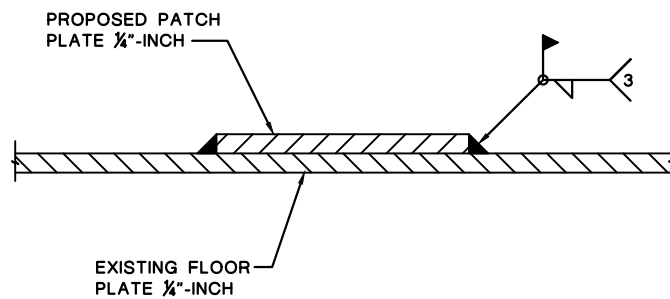
**ANTI-CLIMB STEEL DOOR**

1/2" = 1'-0"

**2019 TANK REHABILITATION  
EXTERIOR LADDER DETAIL  
FIGURE 5**



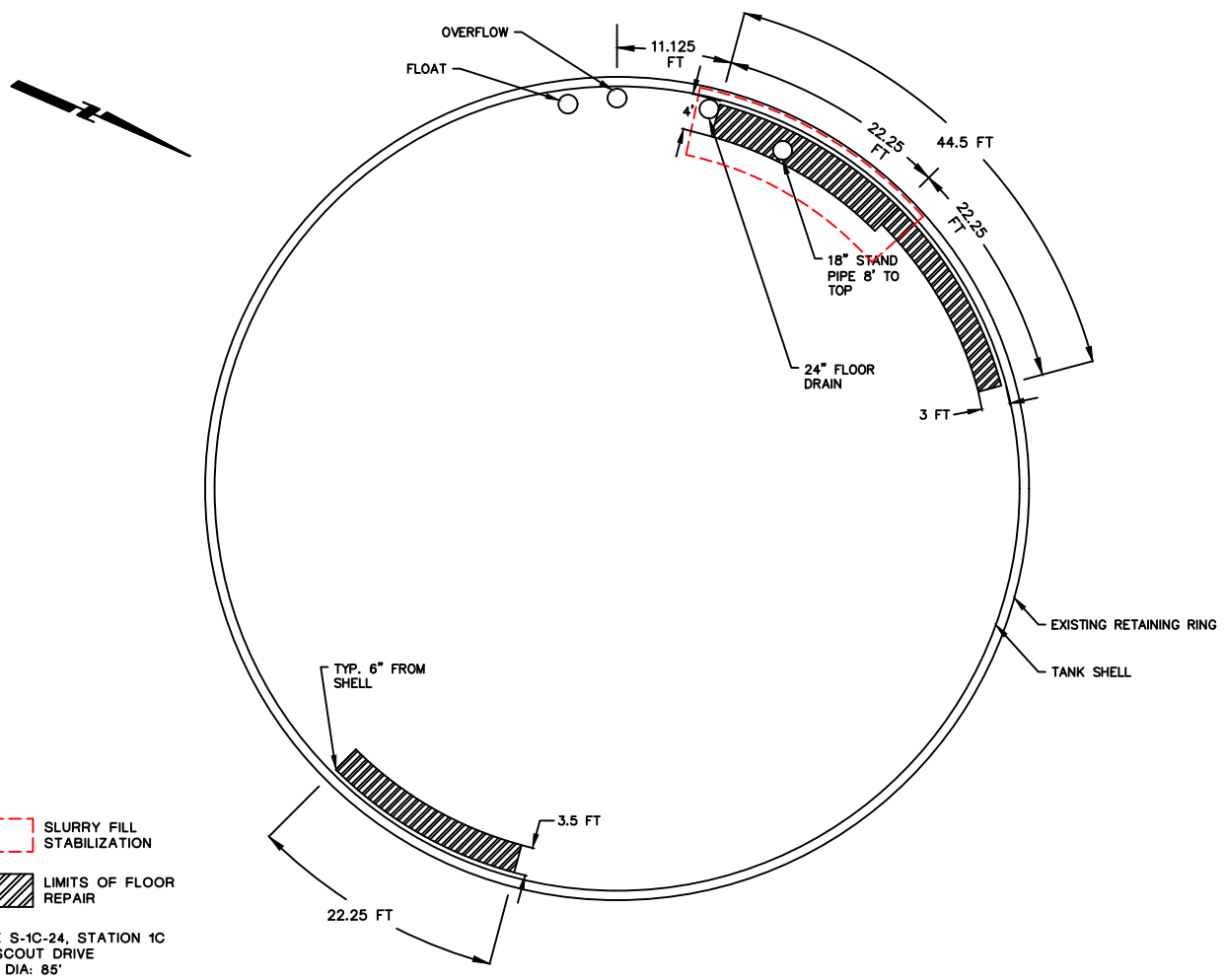
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**NOTES:**

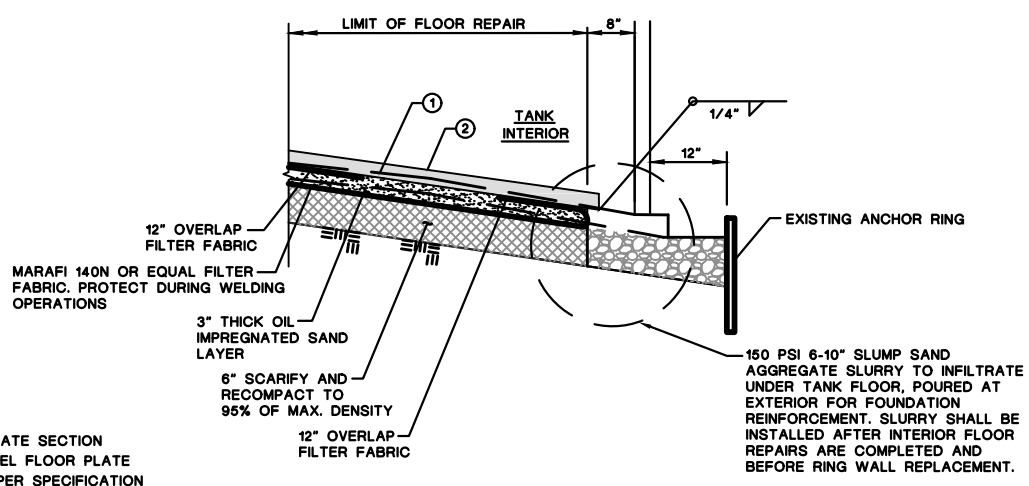
1. GRIND/FIT EXISTING FLOOR AT PROPOSED PATCH PLATE LOCATION TO ENSURE EDGE FILLET WELDS.
2. FLOOR WELDED TOP SIDE ONLY WITH FULL FILLET WELDS. FLOOR PLATE LAP TO BE  $\frac{1}{2}'' \pm$ .
3. WELD PLATES ALONG OUTSIDE SEAM TO ENSURE SEAM DOES NOT SEPARATE.

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**FLOOR PLAN, S-1C-24**

N.T.S.



**NOTES:**

1. REMOVE EXISTING FLOOR PLATE SECTION
2. ADD NEW 1/4-INCH A36 STEEL FLOOR PLATE
3. FOUNDATION PREPARATION PER SPECIFICATION SECTION 02200.

**FLOOR REPAIR DETAIL S-1C-24**

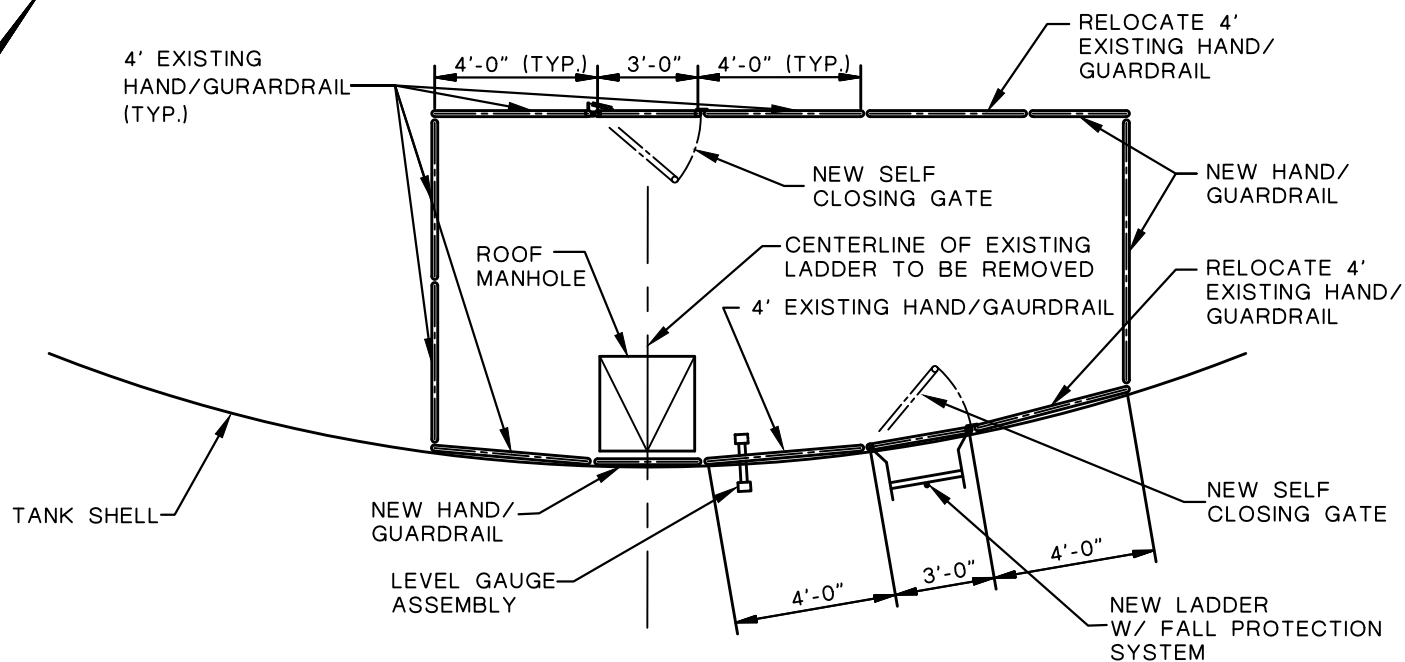
N.T.S.

**2019 TANK REHABILITATION  
FLOOR REPAIR  
FIGURE 7**

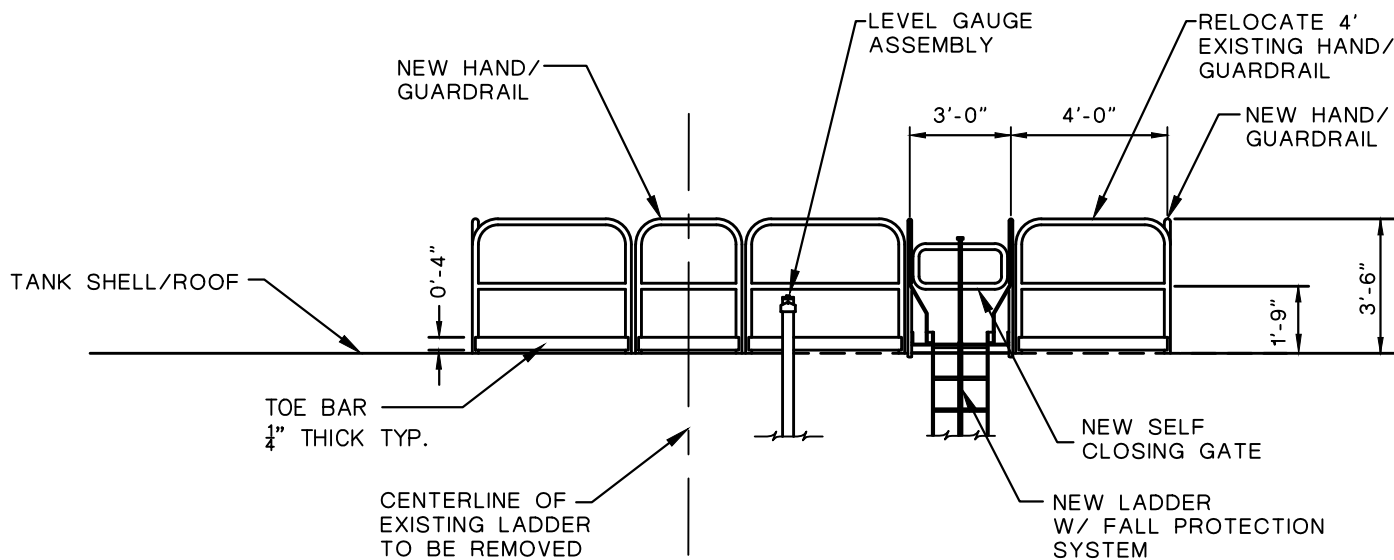


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**SAFETY RAILING PLAN VIEW**



**RAILING ELEVATION**

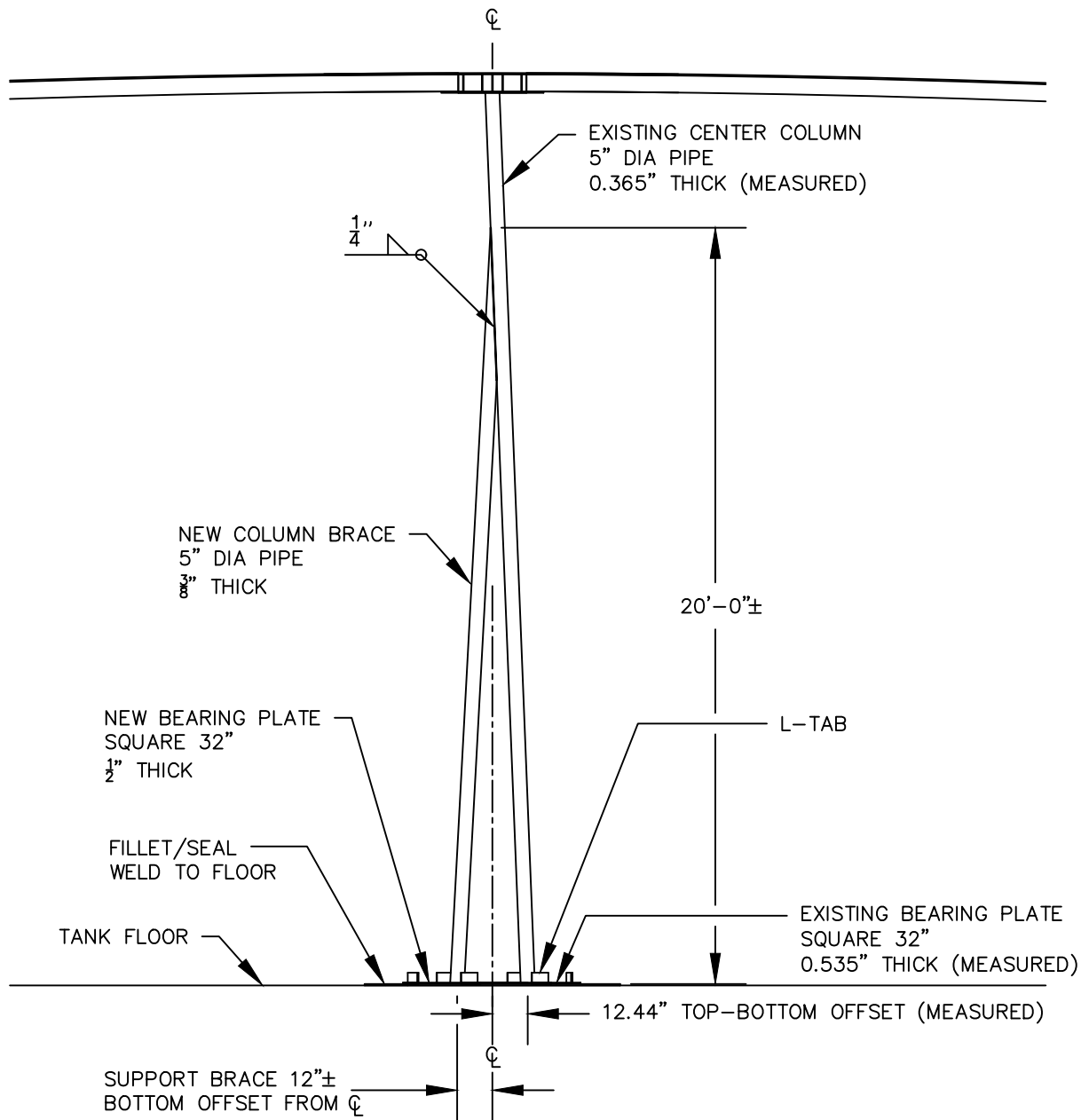
**NOTE:**

1. RELOCATE AND ADD NEW RAILINGS TO EXTEND ROOF LANDING AREA ADJACENT TO THE EXISTING ROOF MANHOLE.
2. NEW RAILINGS SHALL MATCH THE EXISTING MATERIAL AND STYLE WHILE COMPLYING WITH CURRENT ANSI/OSHA STANDARDS.
3. RAILINGS SHALL BE SCHED 40 WELDED STEEL AND PAINTED TO MATCH TANK PER SPECIFICATIONS.
4. GAP BETWEEN THE ROOF AND SAFETY RAILING TOE BAR SHALL COMPLY WITH CURRENT ANSI/OSHA STANDARDS.

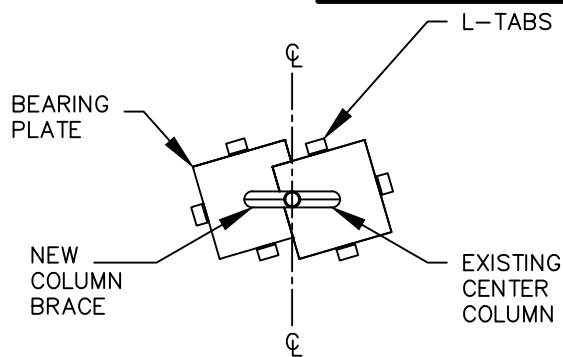
**2019 TANK REHABILITATION  
SAFETY RAILING DETAIL  
FIGURE 8**



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### COLUMN ELEVATION DETAIL



### COLUMN PLAN VIEW

#### NOTES:

1. STEEL PIPE SHALL CONFORM TO ASTM A53, GRADE B.
2. USE ONLY WELDERS QUALIFIED ACCORDING TO ANSI/AASHTO/AWS D1.5M 2010, SECTION 4.
3. HAVE ALL FILLET WELDS VISUALLY INSPECTED BY QUALIFIED PERSONNEL, ANY WELDS FOUND TO HAVE INCOMPLETE FUSION, OVERLAP, AND CRACKS WILL BE REJECTED.
4. WELDS SHALL BE CONTINUOUS.

# 2019 TANK REHABILITATION CENTER COLUMN SUPPORT FIGURE 9



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# **APPENDIX A**

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# TANK INDUSTRY CONSULTANTS



**EVALUATION OF THE  
1,000,000 GALLON STEEL GROUND STORAGE TANK  
“TANK S-1C-24”  
LAKE HAVASU CITY, ARIZONA  
FOR  
ATKINS  
HENDERSON, NEVADA**

**February 21 and 22, 2017**

17.030.S1580.011

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Houston, Texas  
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March 31, 2017, revised

**SUBJECT:**

The subject of this report is the field evaluation of the 1,000,000 gallon steel ground storage tank in Lake Havasu City, Arizona. The tank was owned by Lake Havasu City and was known as "Tank S-1C-24." The field evaluation was performed on February 21 and 22, 2017 by James A. Peyer, NACE Coating Inspector Level 3—Certified, Certificate No. 8543 of Tank Industry Consultants and Jamie L. Stewart, NACE Coating Inspector Level 1—Certified, Certificate No. 64809 of Tank Industry Consultants. The Owner's representatives on the site at the time of the field evaluation were Brent Morris, Ryan Molhoek, and Leonard Lacey. The column and rafter supported roof tank was of welded steel construction. Measurements taken at the time of the field evaluation indicated the tank was approximately 85 ft in diameter with a shell height of approximately 24 ft 2 in.

**OBJECTIVE:**

The purpose of this evaluation was to determine the condition of the tank interior, exterior, and accessories. The purpose of this report is to present the findings of the evaluation and to make recommendations for recoating, repairing, corrosion protection, and maintenance. Budget estimates for the work, anticipated life of the coating and the structure, and the replacement cost of the tank are also included.

**AUTHORIZATION:**

This evaluation and report were authorized in the Subcontract for Professional Services signed by Matthew S. Baird for Atkins Project Number 100054178.

**EXECUTIVE SUMMARY:**

The coating on the interior of the tank was in poor overall condition. It is recommended that the interior surfaces of this tank should be recoated within the next year. Furthermore, the bottom plate should be surveyed to determine if the settlement requires additional repairs.



**Potential Structural Deficiencies:** Potential structural deficiencies on this tank included:

- ◆ the center column was not plumb,
- ◆ significant corrosion and metal loss were observed in the inner ends of the rafters, on the topside of the center hub, and along several of the rafter flanges, and
- ◆ it appeared the bottom plate had settled.

**ANSI/OSHA and Safety-Related Deficiencies:** There were OSHA and safety-related deficiencies on this tank. These deficiencies included:

- ◆ the depth of the exterior ladder safety cage was too large (29 CFR Subpart D - Figure D-15),
- ◆ the exterior ladder side rails were too small (ANSI A14.3),
- ◆ the gap between the roof and safety railing toe bar exceeded the maximum allowed width (29 CFR 1910.29(k)(1)(iii)),
- ◆ the roof safety railing access opening was not equipped with a self-closing gate (29 CFR 1910.28(b)(3)(iv)),
- ◆ a rectangle had been cut out of the toe bar (29 CFR 1910.29(k)(1)(iv)),
- ◆ the interior ladder width was too small (29 CFR 1910.23(b)(4)),
- ◆ the interior ladder side rails were too small (ANSI A14.3),
- ◆ the interior ladder minimum head clearance was too small (29 CFR 1910.23(d)(13)(ii)),
- ◆ the interior ladder was not equipped with a safe-climbing device (29 CFR 1910.28(b)(9)(i)), and
- ◆ significant metal loss was located in the upper four rungs of the interior ladder.

If the Owner wishes to fully comply with OSHA and safety-related standards, it is recommended that these deficiencies be rectified.

**AWWA and Operational Deficiencies:** There were sanitary and operating deficiencies on this tank as well. These deficiencies included:

- ◆ the overflow pipe was not equipped with a visible air break above grade,
- ◆ interior overflow pipes are susceptible to accelerated rates of corrosion,
- ◆ a hole was located in the roof, and
- ◆ the roof vent was not of a clog-resistant design.

These deficiencies should be corrected.

The safety-related, sanitary, and operating deficiencies listed above are not intended to be a complete list of deficiencies on this tank. The Owner should refer to the complete report text and accompanying photographs for a complete account of all observed deficiencies.

This evaluation and the reporting of the condition of this tank do not warrant the original structural condition of the tank or any of the original design for seismic loadings. Likewise, recommendations for this tank do not include modifications which may be required for compliance with present structural codes.

## PHOTOGRAPHS:

Color photographs were taken of the visible portions of the foundation, the tank interior and exterior and are included as a part of this report. The significant photographs are keyed to the observations.

## NOMENCLATURE:

The terms used in describing the various components of water tanks are unique to the industry. In fact, the terms vary from firm to firm and from person to person. In an attempt to define the terms used in this report, a sketch of the general type of tank covered is included at the end of the narrative portion of this report. Each horizontal row of steel plates on the tank is referred to as a "shell ring" or "ring." To aid in referencing the shell rings, the bottom ring is referred to as shell ring 1 and the top ring is shell ring 3. **Warning: Some appurtenances on this tank may be referred to as erection or rigging attachments, lugs, or brackets. This does not mean that they are safe for rigging. Each attachment for each tank should be evaluated on an individual basis by a structural engineer or an experienced rigger before being used. These devices may have been intended for only the original erectors and painters to use with specialized equipment.**

## ADHESION TESTS:

All adhesion tests performed during this evaluation were done in general accordance with ASTM D3359. The results are reported herein using the ASTM scale. The ASTM scale is a relative scale to rate adhesion from 0 to 5 with 5 being the best. A table of adhesion test results classification is included with this report following the sketch of the tank.

## HEAVY METALS TESTS:

Samples of the exterior and interior coating systems were sent to a laboratory for inductively coupled plasma-atomic emission spectrometry analyses. The test results were as follows:

|          | Cadmium |             | Chromium |          | Lead   |             |
|----------|---------|-------------|----------|----------|--------|-------------|
|          | mg/kg   | percent     | mg/kg    | percent  | mg/kg  | percent     |
| Exterior | < 0.43  | < 0.000043% | 3.6      | 0.00036% | 8.8    | 0.00088%    |
| Interior | < 0.4   | < 0.00004%  | 3.2      | 0.00032% | < 0.99 | < 0.000099% |

Tank Industry Consultants performs this test only to determine if there is lead, cadmium, or chromium present in the coating samples. To limit damage to the existing coating, only small areas were tested. The small number of samples taken and the difficulty of retrieving all primer from the steel profile may cause the tests performed to not accurately represent the total coating system. Variations in thickness, types of coatings applied, and the interim cleaning and painting operations will also affect the actual readings. The reliability of the results is also dependent on the amount of primer included in the sample. Additional testing to determine the amount of leachable contaminants present in the spent cleaning debris will need to be performed following cleaning operations at the time of repainting. Results from the laboratory analysis are included following the adhesion tables.

## ULTRASONIC THICKNESS MEASUREMENTS:

(all readings were taken through coating)

Shell:

|                |                                |
|----------------|--------------------------------|
| Ring #3:       | 0.294 in. to 0.296 in.         |
| Ring #2:       | 0.336 in. to 0.338 in.         |
| Ring #1:       | 0.481 in. to 0.487 in., bottom |
| *Bottom Plate: | 0.190 in. to 0.740 in.         |

\*The full results of the ultrasonic thickness measurements performed on the floor at the time of the evaluation, as well as a grid labeling the points, can be found following the report.

## OBSERVATIONS:

### A. Foundation and Site

SITE:

Size: approx. 280 ft x 320 ft

Fence:

Type: chain link, with 3 strands of barbed wire

Height: 6 ft

Gates:

Number: 2

Location: north corner of site

Width: 19 ft 6 in. and 3 ft

Locked: yes

Nearest Structures:

Type: pumping equipment

Direction: west

Distance: approx. 17 ft

Type: ground storage tank

Direction: southwest

Distance: approx. 37 ft

Nearest Overhead Power Lines:

Direction: north

Distance: approx. 18 ft

FOUNDATION:

Type: compacted stone and gravel with steel retaining ring

Retaining Ring:

Size: 12 in. x 1/4 in., flat bar

Projection Above Grade: 2 in. to 9 in.

VALVE VAULT:

Location: approx. 18 ft northwest of tank

Size: 8 ft 6 in. x 12 ft 5 in. x 7 ft 5 in. deep

Access:

Size: 7 ft x 7 ft 4 in.

Locked: yes

Ladder:

Number of Rungs: 6

Width: 16 in.

Side Rails: 2-1/2 in. x 3/8 in., flat bar

Rung Size: 1-1/4 in. diameter

Rung Spacing: 12 in. on centers

Toe Room: 13 in.

Brackets:

Construction: welded

Size: 3 in. x 3/8 in., flat bar

Spacing: 48 in.

1. **Site Location:** The tank was located at 701 Scout Drive in Lake Havasu City, Arizona. The tank site was located in a residential neighborhood. The nearest overhead power lines were located north of the tank. The site access drive was located between two residences. (See photos 4-5)

2. **Site Conditions:** The tank site was covered with gravel and was located in a hillside. The tank site was enclosed by a chain link fence. The fence was topped with barbed wire and was equipped with two locked gates at the north corner of the site. An informational sign and a "No Trespassing" sign were posted on one of the gates. The fence was covered with privacy slats. Pumping equipment was located on the site to the west, and another ground storage tank was located to the southwest. A couple of rebar rods projected from below grade around the retaining ring. (See photos 1-3, 6-8, 11)

3. **Foundation:** The tank appeared to rest on compacted stone and gravel which was surrounded by a steel retaining ring. The side of the retaining ring facing the tank was uncoated. Corrosion, some in the form of scale and layered rust, were located in the uncoated areas. Debris had accumulated between the tank and the retaining ring. Gaps extending up to 6 ft from the perimeter of the bottom plate were located under the tank. (See photos 10-13)

4. **Valve Vault:** There was a valve vault located on the northwest side of the tank site. Access into the valve vault was locked prior to and after this field evaluation. The piping in the valve

vault was generally in good condition. The valve vault was equipped with a ladder which was welded to brackets which were embedded into the concrete. A sump was located in the valve vault floor. (See photos 8-9, 20)

## **B. Exterior Surfaces**

### DESCRIPTION:

Construction: welded steel  
Diameter: approx. 85 ft  
Shell Height: approx. 24 ft 2 in.  
Shell Rings: 3  
Roof Type: column and rafter supported

ANCHOR BOLTS: none

BOTTOM PLATE PROJECTION: 1-1/4 in. to 3 in. from shell

### SHELL MANHOLES:

Number: 2  
Type: flanged and bolted circular  
Location: west side of shell ring #1  
Size: 29-1/8 in. I.D.  
Neck: 5 in. projection from shell x 3/8 in. thick  
Flange: 4-1/8 in. projection x 5/8 in. thick  
Bolts:  
Number: 40  
Size: 3/4 in. diameter x 2 in. long  
Cover Plate:  
Size: 36 in. diameter x 1/2 in. thick  
Hinged: yes, exterior

Type: flush cleanout

Location: south side of shell ring #1  
Size: 23-3/4 in. x 23-3/4 in.  
Neck: 6 in. projection from shell x 0.528 in. thick  
Flange: 3-1/2 in. to 4-1/2 in. projection x 1/2 in. thick  
Bolts:  
Number: 36  
Size: 3/4 in. diameter x 2 in. long  
Cover Plate:  
Size: 32 in. x 32 in. x 1/2 in. thick  
Hinged: no

TARGET GAGE:

Location: west side of shell

Gage: 6 in. x 2 in., channel

Brackets:

Size: 2 in. x 1/4 in., flat bar x 6 in. long

Spacing: 8 ft 2 in. maximum

EXTERIOR LADDER:

Number of Rungs: 17

Distance From Ground to Lowest Rung: approx. 8 ft 6 in.

Width: 16 in.

Side Rails: 2 in. x 3/8 in., flat bar

Rung Size: 3/4 in. diameter

Spacing: 12 in. on center

Toe Room: 8 in.

Brackets:

Construction: welded

Size: 2 in. x 3/8 in., flat bar x 9 in. long

Spacing: approx. 7 ft

Safe-Climbing Device: none

Safety Cage:

Depth: 27-1/2 in.

Width: 29 in.

Vertical Bars:

Size: 2 in. x 3/16 in., flat bar

Spacing: 5-1/4 in. and 10-1/4 in.

Horizontal Bars:

Size: 2 in. x 1/4 in., flat bar

Spacing: 4 ft

Vandal Deterrent:

Type: hinged gate at base of safety cage

Size: 36 in. diameter

Construction: 3 in. x 3/16 in., flat bar

Locked: yes

PERIMETER VENTS:

Number: 8

Size: 5 in. tall x 7 in. projection

Screening: fine mesh

**ROOF SAFETY RAILING:**

Handrail:

Height: 42 in.

Size: 1-7/8 in. diameter

Uprights: 1-7/8 in. diameter

Mid-Rail: 1-7/8 in. diameter

Toe Bar: 4 in. x 1/4 in., flat bar

Access Openings:

Width: 29-1/2 in.

Closure Chain: yes

**ROOF OPENINGS:**

Manhole:

Size: 27-1/2 in. square

Type: hinged

Curb: 5 in. projection

Welded: exterior only

Overlap: 2 in.

Locked: yes

Roof Vent:

Type: removable cover

Neck Height: 6 in.

Neck Diameter: 24 in.

Screen:

Orientation: vertical

Size: 16 mesh

Cover: 36 in. diameter

**EXTERIOR COATING AND METAL CONDITION:**

|       | Coating Thickness   |          | Approx. % Failure to |      | Adhesion | Metal Loss |         |
|-------|---------------------|----------|----------------------|------|----------|------------|---------|
|       | Range               | Typical  | Underlying Coating   | Rust |          | Typical    | Deepest |
| Shell | 7 mils to 12.5 mils | -        | Neg.                 | Neg. | 5 S      | Neg.       | Neg.    |
| Roof  | 5 mils to 9.5 mils  | 6.5 mils | Neg.                 | Neg. | 5 S      | Neg.       | hole    |

Key to Table

Adhesion 5 (very good)  
 4 (good)  
 3 (fair)  
 2 (poor)  
 1 (very poor)  
 0 (very poor)

T = Topcoat to Underlying Coating

S = Primer to Steel

Neg. = negligible

1. **Exterior Coating Condition:** The coating on the exterior of the tank appeared to be in good overall condition and providing adequate corrosion protection to most of the underlying steel. The exterior coating exhibited very good adhesion to the steel.

2. **Bottom Plate:** A negligible amount of gravel was located on the bottom plate. A few large areas of corrosion and minor metal loss were observed along the edge of the bottom plate. The bottom plate had bowed downward from the shell approximately 1 in. in most areas except on the north side where it appeared to be bowed approximately 1-1/2 in. Corrosion was noted on the visible underside of the bottom plate. (See photos 11, 14-19)

3. **Shell Condition:** The contour of the tank shell was irregular with banding noted. A flat spot was located on the south side of the tank at the horizontal weld seam between rings #2 and #3 and another flat spot was located along one of the vertical seams of shell ring #2. The coating appeared to be in good overall condition with only a few isolated spots of corrosion observed. The coating had chalked, and it exhibited very good adhesion to the steel. Two 1 in. diameter couplings were located on the northwest side of shell ring #1. One of these was equipped with a pressure gage and the other a sample tap. A funnel collection pipe was located beneath the sample tap discharge. The tank name and other information had been stenciled on the shell with black coating. The black coating had faded and chalked. Five electrical cabinets, including the cathodic protection rectifier cabinet, conduits, and coaxial cables were located on the west side of shell ring #1. The cathodic protection control cabinet housed an automatically controlled potential rectifier. Cables extended up from this equipment to an antenna attached to the roof safety railing. Eight perimeter vents were located in the upper shell. The vents were angle such that the screening was oriented horizontally. The vents were equipped with fine mesh screening which appeared to be intact. Rust staining had streaked onto the shell surfaces from corrosion located on the perimeter vent frames. (See photos 20-25, 30-31, 35-38)

4. **Water Level Indicating Device:** A target gage was located on the west side of the shell adjacent to the exterior ladder. The target gage was constructed of a channel and equipped with flat bar brackets. Equipment for the device penetrated the perimeter of the roof. The device appeared to be capable of operating properly. Widespread surface rust was observed on the back side of the channel gage. (See photos 31-32, 35, 43)

5. **Shell Manholes:** The tank was equipped with one flanged and bolted circular manhole located on the west side of the tank, and one flush cleanout manhole located on the southwest side of the tank. The shell plate around each of the manholes was equipped with a reinforcing plate. The circular manhole cover was equipped with hinged support located on the exterior of the tank. The flush cleanout manhole cover had a davit arm, but the davit arm had broken. A 3 in. diameter coupling with globe valve was located in the flush cleanout manhole cover. (See photos 26-29)

6. **Exterior Shell Ladder:** **There were safety and ANSI/OSHA deficiencies noted: (1) the 2 in. x 3/8 in. ladder side rails did not meet the recommended 2-1/2 in. x 3/8 in. minimum, and (2) the 10-1/4 in. maximum spacing between vertical bars on the safety cage exceeded the maximum allowed 9 in.** A ladder provided access from near grade to the roof. The ladder was equipped with a safety cage which was constructed of welded flat bar members. The ladder was welded to brackets which were welded to the shell. The exterior ladder and brackets appeared to be in nearly their original structural condition at the time of this field evaluation although a few isolated areas of corrosion were present on the brackets and safety cage members. The ladder was equipped with a hinged gate vandal deterrent at the base of the ladder. The vandal deterrent was locked prior to and after the field evaluation. (See photos 31, 32-35)

7. **Roof Safety Railing:** **There was a safety-related and OSHA deficiency noted: the gap between the roof and toe bar exceeded the maximum allowed 1/4 in., (2) the toe bar had been**



cut out for conduit, and (3) the access opening was not equipped with a self-closing gate. The roof was equipped with a safety railing at the roof access and around the roof manhole. The safety railing was constructed from welded pipe and flat bar members. One closure chain extended across the access opening to the exterior ladder, and another closure chain extended across the access opening at the top of the railing. A rectangular area had been cut out of the toe bar for a conduit. The conduit was banded to the toe bar. There was corrosion in this area, but no other significant areas of corrosion were present on the roof safety railing at the time of the field evaluation. (See photos 35, 39-41)

8. **Roof Condition:** There was a sanitary deficiency noted: an approximately 5/16 in. diameter hole was located in the roof. The contour of the roof appeared to be adequate at the time of this evaluation. The roof coating was in good condition with no significant areas of coating failure or corrosion observed. However, an approximately 5/16 in. diameter hole was located on the southeast side of the roof. The coating exhibited very good adhesion to the steel, and it had chalked and faded. Several areas of weld spatter were located on the roof. Eighteen cathodic protection anode hand holes and cover plates were located in the roof. A significant amount of rust staining had streaked on to the roof plates from the roof vent. (See photos 44-47)

9. **Roof Manhole:** The roof was equipped with one hinged cover manhole. The roof manhole was locked prior to and after this evaluation. The manhole cover was equipped with a gasket. The roof manhole was welded on the exterior only. (See photos 41-42)

10. **Roof Vent:** There was an AWWA operational deficiency noted: the roof vent was not of a clog-resistant design. The roof was equipped with a removable cover vent attached to a flanged opening located in the approximate center of the roof. Fine mesh screening was banded to the vent, and the screening appeared intact. Corrosion was located on the vent, and a significant amount of rust staining had streaked from the vent. (See photos 47-50)

### **C. Interior Surfaces**

#### **ROOF SUPPORT SYSTEM:**

##### **Main Rafters:**

Number: 48

Size: 6 in. x 2 in., channel

##### **Secondary Rafters:**

Number: 24

Size: approx. 4 in. x 1-1/2 in., channel

##### **Attachment Clips:**

Size: 6 in. x 1/4 in., flat bar x 7-1/2 in. long

Bolt: 3/4 in. diameter x 1-1/4 in. long

Circumferential Girders: approx. 10 in. x 5 in., I-beams

Center Hub: approx. 48 in. diameter x 3/4 in. thick

##### **Center Column:**

Type: 5 in. diameter pipe x 0.365 in. thick

##### **Base Supports:**

Size: 34 in. square x 0.360 in. thick

##### **Angles:**

Number: 4

Size: 3-1/2 in. x 3-1/2 in. x 5/16 in.

##### **Outer Columns:**

Number: 6

Type: 5 in. diameter pipe x 0.337 in. thick

##### **Base Supports:**

Size: 32 in. square x 0.535 in. thick

##### **Angles:**

Number: 4 per column base

Size: 3-1/2 in. x 3-1/2 in. x 5/16 in.

#### **TOP SHELL ANGLE:**

Size: 2-1/2 in. x 2-1/2 in. x 1/4 in.

Orientation: leg in

#### **INTERIOR LADDER:**

Number of Rungs: 23

Width: 15-1/4 in.

Rung Size: 3/4 in. diameter

Spacing: 12 in. on center

Side Rails: 2 in. x 3/8 in., flat bar

Toe Room: 7 in.

Head Clearance: 25-3/4 in.

##### **Brackets:**

Construction: welded

Size: 2 in. x 3/8 in., flat bar x 6 in. long

Spacing: approx. 5 ft

Safe-Climbing Device: none

CATHODIC PROTECTION:

Anodes:

Type: suspended wire  
Number: 14  
Manufacturer: Corrpower  
Model Number: TASCA 30-8 CJ  
Serial Number: C-020717  
Reference Electrode: adjacent to interior ladder

OVERFLOW:

Inlet Type: open pipe  
Inlet Location: approx. 7 in. below rafter ends  
Size: 18 in. diameter  
Brackets:  
Size: 2-1/2 in. x 1/4 in., flat bar x 16 in. long  
Spacing: approx. 8 ft

INTERIOR PIPING:

Inlet Pipe:

Projection: 7 ft 11 in. above floor  
Size: 16 in. diameter

Outlet Pipe #1:

Projection: 2-1/2 in. above floor  
Size: 16 in. diameter  
Mud Guard:  
Diameter: 24 in.  
Size: 6 in. x 1/4 in., flat bar  
Protective Cover:  
Size: 30 in. diameter  
Brackets:  
Number: 4  
Size: 2 in. x 3/8 in., flat bar

Outlet Pipe #2:

Projection: 1 in. above floor  
Size: 18 in. diameter  
Mud Guard:  
Diameter: 24 in.  
Size: 6 in. x 1/4 in., flat bar  
Protective Cover:  
Size: 30 in. diameter  
Brackets:  
Number: 4  
Size: 2 in. x 3/8 in., flat bar

INTERIOR COATING AND METAL CONDITION:

|                       | Coating Thickness<br>Range | % Failure to |        | Adhesion | Metal Loss |          |
|-----------------------|----------------------------|--------------|--------|----------|------------|----------|
|                       |                            | Primer       | Rust   |          | Typical    | Deepest  |
| Roof                  | 9.5 mils to 15 mils        | Neg.         | < 1/2% | 2 S      | 1/16 in.   | 3/32 in. |
| Shell Ring #3         | 9 mils to 12 mils          | Neg.         | 15%    | 3 S      | 1/32 in.   | 1/16 in. |
| Shell Rings #1 and #2 | 9 mils to 12 mils          | Neg.         | 10%    | 3 S      | Neg.       | Neg.     |
| Floor                 | 10 mils to 16 mils         | Neg.         | 3%     | 2 S      | Neg.       | 1/32 in. |

Key to Table

Adhesion 5 (very good) T = Topcoat to Underlying Coating Neg. = negligible  
 4 (good)  
 3 (fair) S = Primer to Steel  
 2 (poor)  
 1 (very poor)  
 0 (very poor)

1. **Interior Coating Condition:** The coating on the interior surfaces of the tank appeared to be in poor condition with extensive corrosion and metal loss present. The interior coating exhibited fair to poor adhesion to the steel.

2. **Roof Condition: There were potential structural deficiencies noted: (1) the center column was not plumb, and (2) significant corrosion and metal loss were observed in the inner ends of the rafters, on the topside of the center hub, and along several of the rafter flanges.** The coating on the roof plates appeared to be in poor overall condition with corrosion and rust staining. Much of this was located along the roof plate lapped seams. Previous metal loss was also present in the roof plates. The coating near the center of the roof had peeled in a few large areas. The interior roof support structure consisted of two sets of radial roof rafters, a center column, one circle of outer columns, and circumferential girders. The inner ends of the roof rafters rested on a center hub which was located at the top of the center column. The topside of the center hub and the inner ends of the rafters were visible when the vent cover was removed, and significant corrosion and metal loss were present in this area. Two of these rafters were equipped with shim plates to the center hub, and another included stiffener plates on either side of the rafter end. The outer columns supported the circumferential girders on which the intermediate ends of the radial roof rafters rested. There was corrosion, metal loss, and layered rust along the along the edges and tops of the roof rafter flanges as well as along the visible roof plate surfaces adjacent to the rafters. The ends of the outer rafters were bolted to steel clips which were welded to the shell. Corrosion and metal loss were observed at this connection. The column bases were equipped with welded steel rectangular plates and each had four angle guide clips. The coating on the columns had blistered, and corrosion was present. There were 3 in. flat bar brackets wrapped around four of the outer rafters at one of the circumferential girders. Corrosion was located at these. Blank nuts were located on the columns. The center column had settled and was not plumb. The column appeared to be 1/2 in. to 2 ft from plumb. Wiring for a cathodic protection system was located in the roof of the tank. The center column appeared to have settled approximately 1/2 in. **The column blank nuts and brackets wrapped around four outer rafters and the circumferential girder should not be used for rigging purposes.** (See photos 50-74, 84, 96-97)

3. **Shell Condition:** The coating on interior shell was in poor condition. Widespread areas of cracked and blistered coating were noted, and there was corrosion at these areas. The coating on the top shell ring was in worse condition than the coating on the lower two rings. Metal loss had occurred, primarily in the top shell ring. Corrosion was also located along the horizontal weld seams. A top shell angle was located around the roof-to-shell connection. Significant corrosion was located along the roof-to-shell connection, and rust staining had streaked down from the roof-to-shell connection and rafter ends onto the upper shell surfaces. A hard, stringy substance was noted on the shell. (See photos 72-74, 78-83)

4. **Water Level Indicating Device:** A float and guide wires for the water level indicating device were located on the inside of the tank. The device appeared to be capable of operating properly at the time of the field evaluation. Corrosion was located around the cable penetrations through the roof. (See photos 68, 76, 89)

5. **Overflow Pipe:** There were sanitary and operational deficiencies noted: **(1) interior overflow pipes are susceptible to accelerated rates of corrosion, and (2) the overflow pipe did not include an air break to reduce the risk of a cross-connection.** The overflow was equipped with an open pipe inlet. The pipe extended down along the shell and exited the tank through a reinforced opening in the floor. The overflow pipe was equipped with welded flat bar brackets, and there was corrosion on the overflow pipe and brackets. The location of the overflow inlet was such that the top capacity level was below the shell-to-roof connection and the rafter ends. It appeared from the shell staining the tank was normally operated such that the high water line was approximately 5 ft below the roof-to-shell connection. (See photos 76-78, 88)

6. **Interior Ladder:** There were safety and ANSI/OSHA deficiencies noted: **(1) the 15-1/4 in. ladder width between side rails did not precisely meet the minimum required 16 in., (2) the 2 in. x 3/8 in. side rails did not precisely meet the required minimum of 2-1/2 in. x 3/8 in., (3) the 25-3/4 in. minimum head clearance did not meet the minimum required 30 in., (4) the ladder was not equipped with a safe-climbing device, and (5) significant metal loss was located in the upper four rungs.** A ladder extended down from the roof manhole to the floor. The ladder was not equipped with a safe-climbing device. The interior ladder was welded to brackets which were welded to the shell. Most of the interior ladder rungs and brackets appeared to be in nearly their original structural condition at the time of this field evaluation; however, significant corrosion and metal loss were located in the upper four ladder rungs and top set of brackets. **The ladder should not be used for personnel access.** (See photos 75-76)

7. **Bottom Plate Condition:** There was a potential structural deficiency noted: **it appeared part of the bottom plate had settled.** The coating on the tank bottom appeared to be in poor overall condition with widespread areas of corrosion and blistered coating noted. The contour of the floor was irregular. The perimeter of the floor appeared to have settled in locations approximately 4 in. to 24 in. from the shell. Ultrasonic thickness readings of the floor thickness were taken every 2 ft at the time of the evaluation. The minimum thickness noted was 0.190 in., the maximum thickness noted was 0.740 in., and the typical steel thickness was approximately 0.269 in. (See photos 90-95)

8. **Interior Piping:** An inlet pipe projected above the floor. The coating on the inlet pipe had blistered, and corrosion was noted. Two outlet pipes were located in the floor. Both of these pipes were both equipped with mud guards and removable protective covers. Blistered coating and corrosion were located on circular reinforcing plates in the floor around the outlet pipes. (See photos 85-87)

9. **Cathodic Protection:** The tank was equipped with a cathodic protection system which consisted of fourteen wire anodes suspended from the roof. The wiring appeared to be intact. It did not appear that the system was operating properly as corrosion and metal loss were located below the high water line. The system had one reference electrode which was adjacent to the interior ladder. (See photo 67, 79)

## **RECOMMENDATIONS:**

### **A. Foundation and Site**

1. **Site Maintenance:** The gate should continue to be locked at all times to deter unauthorized entry and limit liability for the Owner. The debris between the retaining ring and tank should be removed. The rebar rods located around the tank should be removed.

2. **Tank and Site Security:** Water tanks have been defined by some courts under certain circumstances as attractive nuisances. As such, there may be a significant potential liability to the Owner for injury to persons on the tank and tank site, even if access is not authorized. Recent events have prompted the entire water industry to consider measures that inhibit intentional acts that could threaten the water supply. A review of the security requirements for the tank and site is recommended to confirm that the existing measures are consistent with the Owner's security requirements for their water system. Primary tank and site security should be focused on eliminating, preventing, and detecting unauthorized access to the tank. Such security measures might include routinely and periodically verifying all manholes, and gates are locked, and all exterior ladders have suitable deterrents. Other security measures might include installing site lighting, motion detectors, surveillance cameras, alarms on gates and tank manholes, and arranging more frequent site visits by law enforcement agencies.

3. **Foundation and Retaining Ring:** The voids below the bottom plate should be filled with compacted gravel and stone. The gravel and stone should be regularly maintained so that voids do not develop below the bottom plate. At the time of the exterior recoating, the area around the retaining ring should be excavated and the retaining ring should be coated in accordance with the exterior recoating recommendations.

4. **Overhead Power Lines:** All overhead power lines within 40 ft of the tank should be **relocated underground in order to prevent potential electrical shock to personnel working on the tank.** The relocation of the power lines should be performed in accordance with the National Electric Code (NEC) guidelines.

5. **Valve Vault:** The piping and valves located in the valve vault should be cleaned and painted in accordance with the interior coating recommendations at the time of the tank cleaning and coating. The exterior concrete surfaces should be cleaned to the equivalent of a brush-off blast cleaning and painted with a concrete sealer. The valve vault access should continue to be locked at all times in order to limit liability to the Owner and to protect water system security.

## **B. Exterior Surfaces**

1. **Life of the Exterior Coating:** The exterior coating system appeared to be in good condition and providing adequate corrosion protection to the majority of the steel surfaces. Tank Industry Consultants believes that the exterior of the tank should not need to be repainted within the next 6 years from a corrosion standpoint. However, the exterior should be reevaluated in 3 to 5 years, in accordance with AWWA recommendations, to determine a more precise recoating schedule. Due to the very good adhesion of the existing exterior coating, spot cleaning and topcoating appears to be a viable option. The exterior coating system should be evaluated immediately prior to preparing specifications to determine if the coating adhesion is still adequate to accept a topcoat.

2. **Coating Testing:** Prior to preparation of specifications for the cleaning and coating of the exterior of the tank, samples of the exterior coating system should be subjected to laboratory analysis to test for ingredients which may at that time be subject to regulations concerning their handling and disposal.

3. **Cleaning:** When the exterior is to be cleaned, all varieties of containment should be investigated. Containment of the wind-blown debris will be required, and containment of paint droplets will be required due to the proximity of the adjacent residences.

### **4. Recommended Coating System:**

a. **Spot Clean and Topcoat:** If the exterior is to be repainted within the next few years, then spot cleaning and topcoating the tank appears to be the recommended option. The typical life of a spot cleaned and topcoated system is approximately 7 to 8 years, but is highly dependent on previous surface preparation and the condition of the underlying coating system.

b. **Coating Application:** The entire exterior surfaces of the tank should be high-pressure washed to remove chalked coating, mildew, and contaminants. After washing, the damaged and rusted areas should be spot cleaned to the equivalent of an SSPC-SP 6, Commercial Blast Cleaning, or SSPC-SP 11, Power Tool Cleaning to Bare Metal. All areas of excessive coating thickness and runs in the coating should be cleaned to the equivalent of an SSPC-SP 7, Brush-Off Blast Cleaning, to remove the excessive mils. The spot cleaned areas should receive a spot prime coat compatible with the present coating system. The entire exterior surfaces should then be intermediate coated and topcoated with a compatible coating system.

### **5. Alternative Coating System:**

a. **Complete Cleaning and Repainting:** The optimum long-life coating system presently available for this site is an epoxy-polyurethane coating system. Properly formulated and applied polyurethanes have good resistance to condensation, mildew, and chipping. The polyurethanes also have excellent color and gloss retention and the longest expected service life of any of the common exterior tank coatings. The typical life of a properly applied epoxy-polyurethane coating system is approximately 15 to 20 years. These coatings are also presently manufactured to meet current VOC requirements.

b. **Coating Application:** The entire tank exterior should be cleaned to the equivalent of an SSPC-SP 6, Commercial Blast Cleaning and have an epoxy-primed, epoxy intermediate

and polyurethane finish coating system applied. However, care must be taken during the application of this particular coating system because this coating does have poor dry-fall characteristics, and potential damage to the surrounding property must be taken into consideration. The polyurethane coatings also require close monitoring of temperature and humidity during application.

6. **Effective Service Life:** Tank Industry Consultants defines the life of a coating as the amount of time before repainting becomes necessary due to coating failure and corrosion. During the coating life the Owner should expect the coating to lose its gloss, start to chalk, show signs of weathering, and possibly some rust staining. Future touch-up may be required on isolated coating failures. If aesthetics are a concern, the Owner may have to topcoat the repainted tank prior to the end of the expected service life. However, future topcoating would be less expensive than complete cleaning and recoating and could delay the next complete cleaning and repainting for many years.

7. **Other Systems:** With air emission volatile organic compounds (VOC) restrictions being put in place around the nation, alternative coating systems may become available which would be viable options for this tank. The Owner should review the available systems prior to preparing specifications for the recoating project.

8. **Coating Curing:** It would be more economical to paint the tank exterior at the same time the interior is painted, since the tank must be drained while the exterior is painted, and the applied coatings cure. This will also reduce mobilization and observation costs.

9. **Rehabilitation Schedule:** To obtain the lowest possible prices for the work outlined in the recommendations, the Owner should have the specifications prepared and the work bid in the early fall, with the work scheduled to start in early winter.

10. **Grinding and Bracket Removal:** Any unused brackets or erection lugs should be removed prior to the exterior repainting. Any weld burrs, weld spatter, or erection scars should be ground off to provide a smooth surface for the application of the coating.

11. **Electrical Apparatus:** All unused electrical conduit, fixtures, electrical metering equipment, cathodic protection apparatus, and control cabinets should be removed from the tank and tank site. All required equipment should be repaired and maintained in accordance with the National Electric Code (NEC).

12. **Existing Shell Manholes:** At the time of recoating and repairs, the gaskets for the shell manholes should be replaced. The broken hinged support arm on the cleanout manhole should be repaired or replaced.

13. **Additional Shell Manhole:** Tank Industry Consultants interprets OSHA standards as defining a water storage tank as a confined space, and as such, a sufficient means of emergency egress and ventilation during cleaning and coating operations is required. Therefore, the tank should be equipped with another hinged shell manhole. The additional manhole and cover should be 30 in. in diameter, should be designed in accordance with current industry and safety standards, should be hinged, and should be located approximately 180 degrees from the existing circular shell manhole.



14. **Exterior Ladder:** As OSHA regulations are phasing out ladder safety cages, to reduce cleaning and painting costs and future maintenance costs, and because the existing safety cage does not meet current OSHA regulations, the cage should be removed, and a safe-climbing device installed. Since the ladder side rails did not meet the dimensions recommended by ANSI, visual evaluation of the ladders could not verify OSHA compliance. Calculations should be performed to determine whether the 2 in. x 3/8 in. side rails meet the load requirement specified by OSHA.

15. **Vandal Deterrent:** When the safety cage is removed, a new vandal deterrent should be installed.

16. **Perimeter Vents:** The perimeter vent frames should be cleaned and painted or replaced to prevent future rusting and staining.

17. **Roof Safety Railing:** The toe bar should be modified so the gap between it and the roof is less than 1/4 in. wide, and the cut-out section of the toe bar should be replaced. The access opening from the exterior ladder should be equipped with a self-closing gate.

18. **Clog-Resistant Vent:** The tank was not equipped with a clog-resistant vent. AWWA Standards recommend that all vents with screening against insects be designed to ensure "fail-safe" operation if the insect screens become occluded. Inadequate ventilation could cause a tank collapse if the tank is rapidly drained while the screen is occluded over. Therefore, a clog-resistant vent should be installed near the center of the roof. Therefore, the existing vent opening should be equipped with a large flanged opening for evaluating, cleaning, repairing, and painting the interior roof structure ends at the center. The flanged cover should be equipped with a smaller flanged opening to mount a clog-resistant vent at the center of the roof. The vent should be designed so that it is removable in order to be able to properly access the interior roof structure ends for evaluation, repairing and recoating.

19. **Cathodic Protection Hand Holes:** All cathodic protection hand holes should have the covers repositioned and new gaskets installed. If a hanging anode system will not be used in the future, then the openings should be covered with welded steel patch plates when repainting the tank.

20. **Roof Hole:** The hole in the roof should be covered with a welded steel patch plate.

### **C. Interior Surfaces**

1. **Life of the Interior Coating:** The coating on the interior surfaces of the tank appeared to be in poor condition with extensive corrosion and metal loss present. Tank Industry Consultants recommends that the interior surfaces of this tank should be recoated within next year. It is recommended that when the interior is completely cleaned and repainted, an epoxy coating system should be used

2. **Coating Testing:** Prior to preparation of specifications for the cleaning and coating of the interior of the tank, samples of the interior coating system should be subjected to laboratory analysis to test for ingredients which may at that time be subject to regulations concerning their handling and disposal.

3. **Recommended Interior Coating System:**

a. **Epoxy Coating System:** The optimum long-life coating system presently available for the interior of water tanks is a two-component epoxy coating system. A three-coat epoxy system is recommended for the interior of this tank. This coating system should meet the certification criteria of ANSI/NSF 61 and state department of health regulations.

b. **Coating Application:** When the interior is to be repainted, the entire tank interior should be cleaned to the equivalent of an SSPC-SP 10, Near-White Blast Cleaning and an epoxy coating system applied.

c. **Service Life:** The typical life of a properly formulated and applied epoxy coating system is approximately 12 to 15 years in immersion service. Tank Industry Consultants defines the life of a coating as the expected service life before repainting becomes necessary due to coating failure and corrosion. The Owner could extend the service life of the coating by installing, properly maintaining and operating a cathodic protection system to help protect the steel surfaces in areas which have experienced coating failure.

4. **Cathodic Protection:** The cathodic protection system should be evaluated and adjusted by the manufacturer so that corrosion and metal loss do not occur below the high water line.

5. **Pit Welding and Pit Filling:** After initial cleaning, all significant pitting which is found should be welded, and all pitting with rough edges that would make the pitting difficult to coat properly should be filled with a solventless epoxy seam sealer. (It was estimated that approximately 10 square inches of pits will require welding, and approximately 2 gallons of seam sealer will be required for pit repair.)

6. **Seam Sealing:** The existing roof manhole and existing roof vent intersections should be sealed with an epoxy seam sealer at the time of the interior recoating.

7. **Flexible Sealant:** The unwelded lapped roof seams should be sealed with a flexible sealant at the time of the interior recoating.

8. **Rough Edges:** All unused brackets should be removed from the interior and exterior surfaces at the time of the next recoating. Any weld burrs, spatter, scars or rough edges in the steel should be ground smooth to provide a better surface for coating. (It was estimated that approximately 20 man-hours of grinding will be required on the interior of the tank.)

9. **Bottom Plate Settling and Center Column Bowing:** A Professional Surveyor should be conduct a survey around the perimeter of the tank to compare with API 653 Annex B criteria. If the results of the survey do not indicate it meets these criteria, then a repair procedure should be determined, if feasible. The center column should be replaced.

10. **Roof Support Structure:** After abrasive blast cleaning, the roof support structure should be carefully evaluated as metal loss repairs will be necessary. It should be anticipated that all bolts and nuts will require replacement with galvanized nuts, washers, and bolts as well as several rafters.

11. **Overflow Pipe:** Overflow pipes on the interior of tanks are exposed to the potential of accelerated rates of corrosion and metal loss. This results in the potential of pipe damage and an unanticipated tank draining. Additionally, overflow pipes without visible air breaks allow for a potential cross-connection. Therefore, Tank Industry Consultants and the AWWA Standard D100

recommend relocating the pipe to the tank exterior. The overflow pipe should exit the top shell ring and extend to approximately 24 in. above grade attached to the shell by welded steel brackets. The overflow pipe discharge should be equipped with a screened, counter-weighted flap gate or elastomeric check valve to prevent the ingress of birds, small animals and insects into the tank. The air break should be adequately sized to allow the proper functioning of the new flap gate. The overflow effluent should be directed away from the foundation using a concrete splash block.

12. **Interior Ladder:** Interior ladders may be susceptible to accelerated rates of corrosion, and it is recommended they be removed. If the Owner decides to keep the interior ladder, the ladder should be replaced by a ladder which complies with current industry standards and should be equipped with a corrosion-resistant safe-climbing device. **The existing ladder should not be used for personnel access.**

13. **Shell Substance:** The hard stringy substance on the shell should be investigated to determine its content and potential source.

## **CLOSURE:**

**Brief Summation:** Lake Havasu City owns and operates a 1,000,000 gallon ground storage tank. The coating on the exterior of the tank appeared to be in good condition at the time of the field evaluation while the coating on the interior of the tank was in poor overall condition. It is recommended that the interior surfaces of this tank should be recoated within the next year. Furthermore, the bottom plate should be surveyed to determine if the settlement requires additional repairs. Proper maintenance after completing the recommendations herein would include periodic washouts and evaluations approximately every 3 to 5 years in accordance with AWWA recommendations, and the replacement of the existing cathodic protection system with one which includes long-life anodes.

**Contractor Selection:** The work should be performed by a competent bonded contractor, chosen from competitive bids taken on complete and concise specifications. The coatings used should be furnished by an experienced water tank coating manufacturer, supplying the field service required for application of technical coatings.

**Standards for Repairs and Coatings:** All work done and coatings applied should be applied in accordance with NACE, ANSI/NSF Standard 61, the manufacturer's recommendation, AWWA D100 and AWWA D102 (latest revisions), and the SSPC: The Society for Protective Coatings.

**Observation of Work:** Observation of the work in progress by experienced personnel will offer additional assurance of quality protective coating application. Observations can be performed on a continuous basis or spot (critical phase) basis. The actual cost of observation may be less using spot as opposed to full-time resident observation; however, with spot observation it is often necessary for work to be redone to comply with the specifications. This somewhat lowers the quality of the finished product, lengthens the job, and is frequently a cause of conflict between the contractor, Owner, and field technician. Resident full-time observation minimizes the amount of "rework" required.

**Anniversary and Maintenance Evaluations:** An anniversary evaluation should be conducted prior to the end of the one year bonded guarantee. Washouts and coating, structural, sanitary, safety, and corrosion evaluations should be conducted not less than every three years.

**Time Frame:** If the work is not performed within the next 6 months, the structure should be reevaluated prior to the preparation of specifications and solicitation of bids.

**Specifications and Bidding Documents:** The recommendations in this report are not intended to be specifications on which a contractor can bid. Complete bidding documents must include general and special conditions, detailed technical specifications, and other information necessary for the competitive bidding process. To properly protect the interests of the Owner, Contractor, and Engineer; the initial evaluation, the technical specifications, legal portions of the contract documents, and the observation should be performed by the same firm or with close coordination of all parties involved.

**Limitations of Evaluation:** It is believed that the conditions reported herein reflect the condition of the tank as observed on the date of the evaluation, using reasonable care in making the observations, and safety in gaining access to the tank. Should latent defects be discovered during the cleaning of the structure, they should be brought to the attention of the Owner and the Engineer.

**Seismic and Wind Loadings:** This tank is located in or near a region of moderate seismic activity. This evaluation and the reporting of the condition of this tank do not warrant the structural condition of the tank or any of the original design for seismic loadings. Likewise, recommendations for this tank do not include modifications which may be required for compliance with present structural codes. It is possible the tank was erected in compliance with pre-existing industry standards which have since been replaced by more restrictive standards.

**Hazardous Materials in Coatings:** It should be taken into consideration that Federal, State, and local environmental agencies have placed stricter controls on the removal of lead-based and other heavy-metal based coatings from steel structures by the use of conventional abrasive blasting techniques. The paint and blast residue may be considered to be hazardous waste depending on the concentration of lead or other particles in residue.

Please contact Tank Industry Consultants if you have any questions or comments.

Respectfully submitted,

Tank Industry Consultants



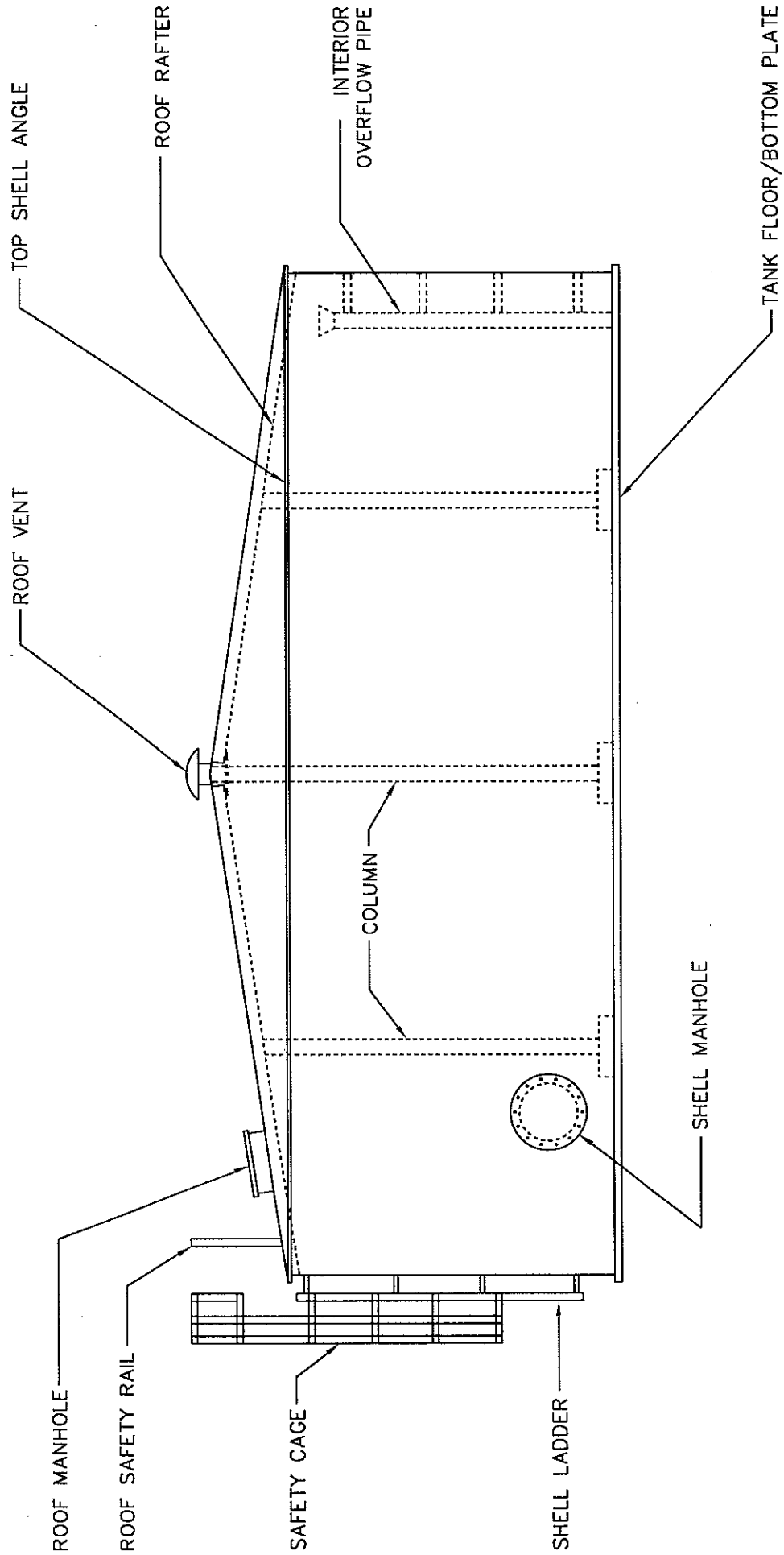
Jennifer Coon, ASP, CHMM, CET



Gregory R. "Chip" Stein, P.E.  
Managing Principal







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# GROUND STORAGE TANK



## NOMENCLATURE

## Classification of Adhesion Test Results

| Method A – X Cut Tape Test<br>Approx. 1.5 in. long cuts at 30 deg. to 45 deg. apart. | Surface  | Classification |
|--|--|----------------|
| No peeling or removal.   |  | 5              |
| Trace peeling or removal along incisions.  |  | 4              |
| Jagged removal along incisions up to 1/16 in. (1.5mm) on either side.                |  | 3              |
| Jagged removal along most of incisions up to 1/8 in. (3.2mm) on either side.         |  | 2              |
| Removal from most of the area of the X under the tape.                               |  | 1              |
| Removal beyond the area of the X.  |  | 0              |

| Method B – Lattice Cut Tape Test<br>Six parallel cuts at 2mm apart.  | Surface  | Classification |
|--|--|----------------|
| The edges of the cuts are completely smooth; none of the squares of the lattice are detached.  | No Failure   | 5              |
| Small flakes of the coating are detached at intersections; less than 5% of the lattice is affected.  |  | 4              |
| Small flakes of the coating are detached along edges and at intersections of cuts. The area affected is 5% to 15% of the lattice.                |  | 3              |
| The coating has flaked along the edges and on parts of the squares. The area affected is 15% to 35% of the lattice.                              |  | 2              |
| The coating has flaked along the edges of cuts in large ribbons and whole squares have detached. The area affected is 35% to 65% of the lattice. |  | 1              |
| Flaking and detachment worse than grade 1.   |  | 0              |

ASTM 3359 Standard Test Methods for Measuring Adhesion by Tape Test

### Tank Industry Consultants

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EMSL Analytical, Inc.

2001 East 52nd St., Indianapolis, IN 46205

Phone: (317) 803-2997 Fax: (317) 803-3047 Email: indianapolislaboratory@emsl.com

Attn:

**Bruce Hobbs**  
**Tank Industry Consultants**  
**7740 West New York Street**  
**Indianapolis, IN 46214**

3/3/2017

Phone: (317) 271-3100

Fax: (317) 271-3300

The following analytical report covers the analysis performed on samples submitted to EMSL Analytical, Inc. on 2/28/2017. The results are tabulated on the attached data pages for the following client designated project:

**17.030.51580.011**

The reference number for these samples is EMSL Order #161703604. Please use this reference when calling about these samples. If you have any questions, please do not hesitate to contact me at (317) 803-2997.

Approved By:

Doug Wiegand, Laboratory Manager

The samples associated with this report were received in good condition unless otherwise noted. This report relates only to those items tested as received by the laboratory. The QC data associated with the sample results meet the recovery and precision requirements established by the NELAP, unless specifically indicated. All results for soil samples are reported on a dry weight basis, unless otherwise noted. This report may not be reproduced except in full and without written approval by EMSL Analytical, Inc.



**EMSL Analytical, Inc.**

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EMSL Order: 161703604  
 CustomerID: TICO62  
 CustomerPO:  
 ProjectID:

Attn: **Bruce Hobbs**  
**Tank Industry Consultants**  
**7740 West New York Street**  
**Indianapolis, IN 46214**

Phone: (317) 271-3100  
 Fax: (317) 271-3300  
 Received: 02/28/17 12:04 PM  
 Collected: 2/22/2017

Project: 17.030.51580.011

**Analytical Results**

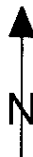
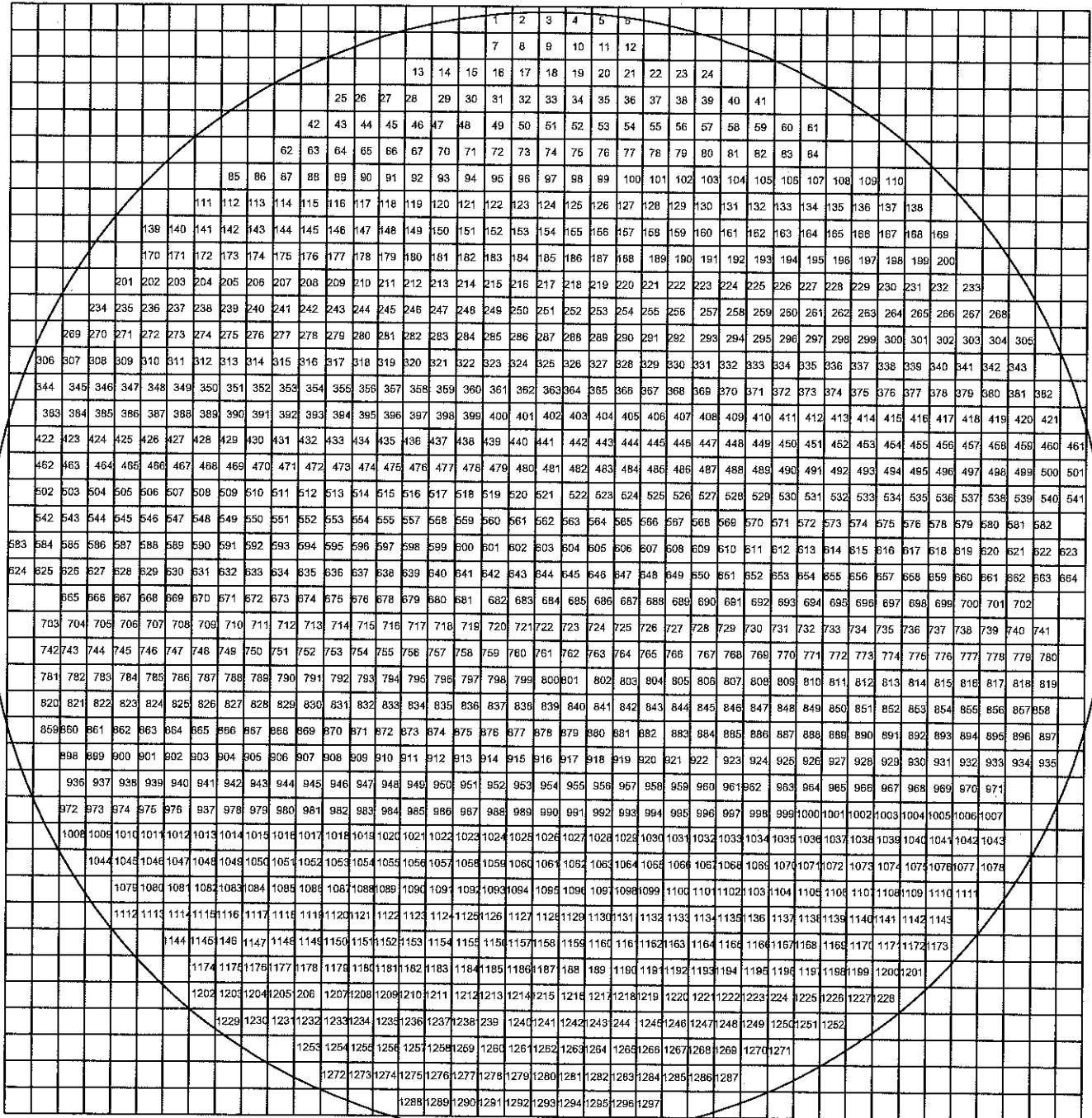
| <i>Client Sample Description</i> |                  | <i>Collected:</i> |           | <i>Lab ID:</i> |                  |                |                      |                |
|----------------------------------|------------------|-------------------|-----------|----------------|------------------|----------------|----------------------|----------------|
| 1                                | Int Floor        | 2/22/2017         | 0001      |                |                  |                |                      |                |
| <i>Method</i>                    | <i>Parameter</i> | <i>Result</i>     | <i>RL</i> | <i>Units</i>   | <i>Prep Date</i> | <i>Analyst</i> | <i>Analysis Date</i> | <i>Analyst</i> |
| 3050B/6010C                      | Cadmium          | ND                | 0.40      | mg/Kg          | 2/28/2017        | ED             | 2/28/2017            | ED             |
| 3050B/6010C                      | Chromium         | 3.2               | 0.99      | mg/Kg          | 2/28/2017        | ED             | 2/28/2017            | ED             |
| 3050B/6010C                      | Lead             | ND                | 0.99      | mg/Kg          | 2/28/2017        | ED             | 2/28/2017            | ED             |

| <i>Client Sample Description</i> |                  | <i>Collected:</i> |           | <i>Lab ID:</i> |                  |                |                      |                |
|----------------------------------|------------------|-------------------|-----------|----------------|------------------|----------------|----------------------|----------------|
| 2                                | Ext Shell        | 2/22/2017         | 0002      |                |                  |                |                      |                |
| <i>Method</i>                    | <i>Parameter</i> | <i>Result</i>     | <i>RL</i> | <i>Units</i>   | <i>Prep Date</i> | <i>Analyst</i> | <i>Analysis Date</i> | <i>Analyst</i> |
| 3050B/6010C                      | Cadmium          | ND                | 0.43      | mg/Kg          | 2/28/2017        | ED             | 2/28/2017            | ED             |
| 3050B/6010C                      | Chromium         | 3.6               | 1.1       | mg/Kg          | 2/28/2017        | ED             | 2/28/2017            | ED             |
| 3050B/6010C                      | Lead             | 8.8               | 1.1       | mg/Kg          | 2/28/2017        | ED             | 2/28/2017            | ED             |

**Definitions:**

ND - indicates that the analyte was not detected at the reporting limit  
 RL - Reporting Limit (Analytical)

# GRID POINTS



Ultrasonic Thickness Readings "Tank 1-C-24" - TIC 17.030.S1580.011

| Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) |
|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|
| 1              | 0.273         | 32             | 0.291         | 63             | 0.269         | 94             | 0.263         | 125            | 0.245         | 156            | 0.264         |
| 2              | 0.255         | 33             | 0.281         | 64             | 0.255         | 95             | 0.252         | 126            | 0.279         | 157            | 0.244         |
| 3              | 0.252         | 34             | 0.295         | 65             | 0.284         | 96             | 0.300         | 127            | 0.740         | 158            | 0.256         |
| 4              | 0.228         | 35             | 0.294         | 66             | 0.314         | 97             | 0.279         | 128            | 0.275         | 159            | 0.254         |
| 5              | 0.268         | 36             | 0.280         | 67             | 0.265         | 98             | 0.262         | 129            | 0.280         | 160            | 0.250         |
| 6              | 0.285         | 37             | 0.285         | 68             | 0.261         | 99             | 0.254         | 130            | 0.252         | 161            | 0.287         |
| 7              | 0.274         | 38             | 0.285         | 69             | 0.251         | 100            | 0.291         | 131            | 0.250         | 162            | 0.297         |
| 8              | 0.263         | 39             | 0.285         | 70             | 0.247         | 101            | 0.289         | 132            | 0.298         | 163            | 0.288         |
| 9              | 0.251         | 40             | 0.271         | 71             | 0.302         | 102            | 0.284         | 133            | 0.273         | 164            | 0.288         |
| 10             | 0.220         | 41             | 0.274         | 72             | 0.282         | 103            | 0.273         | 134            | 0.283         | 165            | 0.284         |
| 11             | 0.257         | 42             | N             | 73             | 0.278         | 104            | 0.273         | 135            | 0.282         | 166            | 0.291         |
| 12             | 0.206         | 43             | N             | 74             | 0.267         | 105            | 0.289         | 136            | 0.286         | 167            | 0.272         |
| 13             | 0.230         | 44             | 0.238         | 75             | 0.277         | 106            | 0.291         | 137            | 0.258         | 168            | 0.273         |
| 14             | 0.222         | 45             | 0.280         | 76             | 0.277         | 107            | 0.306         | 138            | 0.292         | 169            | N             |
| 15             | 0.270         | 46             | 0.276         | 77             | 0.270         | 108            | 0.271         | 139            | 0.272         | 170            | 0.251         |
| 16             | 0.241         | 47             | 0.261         | 78             | 0.285         | 109            | 0.249         | 140            | 0.269         | 171            | 0.242         |
| 17             | 0.250         | 48             | 0.296         | 79             | 0.277         | 110            | 0.281         | 141            | 0.258         | 172            | 0.263         |
| 18             | 0.251         | 49             | 0.250         | 80             | 0.289         | 111            | N             | 142            | 0.302         | 173            | 0.257         |
| 19             | 0.281         | 50             | 0.255         | 81             | 0.290         | 112            | 0.249         | 143            | 0.257         | 174            | 0.283         |
| 20             | 0.257         | 51             | 0.268         | 82             | 0.291         | 113            | 0.252         | 144            | 0.252         | 175            | 0.289         |
| 21             | 0.295         | 52             | 0.255         | 83             | 0.254         | 114            | 0.293         | 145            | 0.269         | 176            | 0.262         |
| 22             | 0.283         | 53             | 0.282         | 84             | N             | 115            | 0.298         | 146            | 0.273         | 177            | 0.287         |
| 23             | 0.286         | 54             | 0.283         | 85             | N             | 116            | 0.268         | 147            | 0.284         | 178            | 0.236         |
| 24             | 0.273         | 55             | 0.281         | 86             | 0.252         | 117            | 0.272         | 148            | 0.275         | 179            | 0.287         |
| 25             | 0.241         | 56             | 0.300         | 87             | 0.268         | 118            | 0.251         | 149            | 0.259         | 180            | 0.305         |
| 26             | 0.252         | 57             | 0.287         | 88             | 0.252         | 119            | 0.284         | 150            | 0.252         | 181            | 0.262         |
| 27             | 0.256         | 58             | 0.275         | 89             | 0.275         | 120            | 0.260         | 151            | 0.245         | 182            | 0.290         |
| 28             | 0.266         | 59             | 0.287         | 90             | 0.294         | 121            | 0.267         | 152            | 0.255         | 183            | 0.259         |
| 29             | 0.275         | 60             | 0.300         | 91             | 0.281         | 122            | 0.288         | 153            | 0.293         | 184            | 0.260         |
| 30             | 0.251         | 61             | N             | 92             | 0.281         | 123            | 0.284         | 154            | 0.245         | 185            | 0.259         |
| 31             | 0.272         | 62             | 0.238         | 93             | 0.280         | 124            | 0.260         | 155            | 0.275         | 186            | 0.260         |

Ultrasonic Thickness Readings "Tank 1-C-24" - TIC 17.030.S1580.011

| Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) |
|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|
| 187            | 0.225         | 218            | 0.249         | 249            | 0.247         | 280            | 0.298         | 311            | 0.248         | 342            | 0.287         |
| 188            | 0.237         | 219            | 0.265         | 250            | 0.254         | 281            | 0.265         | 312            | 0.260         | 343            | 0.275         |
| 189            | 0.299         | 220            | 0.280         | 251            | 0.225         | 282            | 0.264         | 313            | 0.246         | 344            | 0.256         |
| 190            | 0.272         | 221            | 0.247         | 252            | 0.313         | 283            | 0.258         | 314            | 0.251         | 345            | 0.284         |
| 191            | 0.256         | 222            | 0.275         | 253            | 0.232         | 284            | 0.288         | 315            | 0.259         | 346            | 0.270         |
| 192            | 0.281         | 223            | 0.243         | 254            | 0.288         | 285            | 0.257         | 316            | 0.259         | 347            | 0.272         |
| 193            | 0.281         | 224            | 0.273         | 255            | 0.240         | 286            | 0.250         | 317            | 0.262         | 348            | 0.283         |
| 194            | 0.244         | 225            | 0.270         | 256            | 0.271         | 287            | 0.237         | 318            | 0.258         | 349            | 0.264         |
| 195            | 0.208         | 226            | 0.298         | 257            | 0.252         | 288            | 0.303         | 319            | 0.268         | 350            | 0.297         |
| 196            | 0.277         | 227            | 0.283         | 258            | 0.271         | 289            | 0.305         | 320            | 0.264         | 351            | 0.274         |
| 197            | 0.279         | 228            | 0.277         | 259            | 0.238         | 290            | 0.286         | 321            | 0.265         | 352            | 0.258         |
| 198            | 0.305         | 229            | 0.300         | 260            | 0.270         | 291            | 0.248         | 322            | 0.225         | 353            | 0.254         |
| 199            | 0.297         | 230            | 0.285         | 261            | 0.283         | 292            | 0.268         | 323            | 0.251         | 354            | 0.288         |
| 200            | 0.270         | 231            | 0.320         | 262            | 0.283         | 293            | 0.244         | 324            | 0.299         | 355            | 0.265         |
| 201            | 0.273         | 232            | 0.281         | 263            | 0.284         | 294            | 0.289         | 325            | 0.239         | 356            | 0.255         |
| 202            | 0.263         | 233            | 0.273         | 264            | 0.287         | 295            | 0.290         | 326            | 0.299         | 357            | 0.285         |
| 203            | 0.255         | 234            | 0.213         | 265            | 0.261         | 296            | 0.272         | 327            | 0.299         | 358            | 0.285         |
| 204            | 0.301         | 235            | 0.254         | 266            | 0.252         | 297            | 0.285         | 328            | 0.262         | 359            | 0.240         |
| 205            | 0.259         | 236            | 0.269         | 267            | 0.281         | 298            | 0.301         | 329            | 0.272         | 360            | 0.244         |
| 206            | 0.253         | 237            | 0.284         | 268            | 0.280         | 299            | 0.281         | 330            | 0.292         | 361            | 0.280         |
| 207            | 0.255         | 238            | 0.254         | 269            | N             | 300            | 0.281         | 331            | 0.255         | 362            | 0.260         |
| 208            | 0.271         | 239            | 0.230         | 270            | 0.238         | 301            | 0.280         | 332            | 0.292         | 363            | 0.250         |
| 209            | 0.248         | 240            | 0.299         | 271            | 0.275         | 302            | 0.288         | 333            | 0.260         | 364            | 0.269         |
| 210            | 0.269         | 241            | 0.248         | 272            | 0.264         | 303            | 0.283         | 334            | 0.278         | 365            | 0.284         |
| 211            | 0.208         | 242            | 0.298         | 273            | 0.281         | 304            | 0.281         | 335            | 0.254         | 366            | 0.258         |
| 212            | 0.229         | 243            | 0.263         | 274            | 0.266         | 305            | 0.277         | 336            | 0.277         | 367            | 0.262         |
| 213            | 0.279         | 244            | 0.291         | 275            | 0.254         | 306            | 0.228         | 337            | 0.286         | 368            | 0.294         |
| 214            | 0.286         | 245            | 0.280         | 276            | 0.248         | 307            | 0.254         | 338            | 0.282         | 369            | 0.281         |
| 215            | 0.262         | 246            | 0.293         | 277            | 0.262         | 308            | 0.258         | 339            | 0.281         | 370            | 0.271         |
| 216            | 0.275         | 247            | 0.273         | 278            | 0.261         | 309            | 0.271         | 340            | 0.268         | 371            | 0.280         |
| 217            | 0.245         | 248            | 0.253         | 279            | 0.282         | 310            | 0.273         | 341            | 0.279         | 372            | 0.290         |

Ultrasonic Thickness Readings "Tank 1-C-24" - TIC 17.030.S1580.011

| Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) |
|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|
| 373            | 0.280         | 404            | 0.292         | 435            | 0.285         | 466            | 0.278         | 497            | 0.279         | 528            | 0.220         |
| 374            | 0.280         | 405            | 0.263         | 436            | 0.252         | 467            | 0.255         | 498            | 0.281         | 529            | 0.253         |
| 375            | 0.281         | 406            | 0.277         | 437            | 0.275         | 468            | 0.267         | 499            | 0.291         | 530            | 0.292         |
| 376            | 0.281         | 407            | 0.247         | 438            | 0.272         | 469            | 0.265         | 500            | 0.262         | 531            | 0.297         |
| 377            | 0.249         | 408            | 0.246         | 439            | 0.247         | 470            | 0.272         | 501            | 0.279         | 532            | 0.307         |
| 378            | 0.261         | 409            | 0.286         | 440            | 0.270         | 471            | 0.275         | 502            | 0.239         | 533            | 0.276         |
| 379            | 0.281         | 410            | 0.290         | 441            | 0.273         | 472            | 0.302         | 503            | 0.268         | 534            | 0.288         |
| 380            | 0.286         | 411            | 0.290         | 442            | 0.305         | 473            | 0.290         | 504            | 0.255         | 535            | 0.286         |
| 381            | 0.285         | 412            | 0.289         | 443            | 0.302         | 474            | 0.268         | 505            | 0.286         | 536            | 0.291         |
| 382            | 0.266         | 413            | 0.287         | 444            | 0.281         | 475            | 0.251         | 506            | 0.286         | 537            | 0.295         |
| 383            | 0.282         | 414            | 0.301         | 445            | 0.278         | 476            | 0.258         | 507            | 0.286         | 538            | 0.235         |
| 384            | 0.281         | 415            | 0.284         | 446            | 0.269         | 477            | 0.281         | 508            | 0.266         | 539            | 0.291         |
| 385            | 0.288         | 416            | 0.264         | 447            | 0.281         | 478            | 0.251         | 509            | 0.225         | 540            | 0.249         |
| 386            | 0.294         | 417            | 0.286         | 448            | 0.274         | 479            | 0.260         | 510            | 0.250         | 541            | 0.258         |
| 387            | 0.261         | 418            | 0.268         | 449            | 0.275         | 480            | 0.246         | 511            | 0.284         | 542            | 0.264         |
| 388            | 0.286         | 419            | 0.256         | 450            | 0.278         | 481            | 0.264         | 512            | 0.261         | 543            | 0.244         |
| 389            | 0.260         | 420            | 0.274         | 451            | 0.291         | 482            | 0.273         | 513            | 0.269         | 544            | 0.269         |
| 390            | 0.264         | 421            | 0.296         | 452            | 0.288         | 483            | 0.288         | 514            | 0.279         | 545            | 0.287         |
| 391            | 0.243         | 422            | 0.273         | 453            | 0.295         | 484            | 0.286         | 515            | 0.246         | 546            | 0.271         |
| 392            | 0.233         | 423            | 0.273         | 454            | 0.284         | 485            | 0.300         | 516            | 0.271         | 547            | 0.275         |
| 393            | 0.270         | 424            | 0.296         | 455            | 0.282         | 486            | 0.269         | 517            | 0.259         | 548            | 0.267         |
| 394            | 0.265         | 425            | 0.264         | 456            | 0.239         | 487            | 0.254         | 518            | 0.243         | 549            | 0.291         |
| 395            | 0.304         | 426            | 0.252         | 457            | 0.249         | 488            | 0.289         | 519            | 0.257         | 550            | 0.287         |
| 396            | 0.245         | 427            | 0.261         | 458            | 0.284         | 489            | 0.295         | 520            | 0.250         | 551            | 0.285         |
| 397            | 0.286         | 428            | 0.250         | 459            | 0.263         | 490            | 0.277         | 521            | 0.241         | 552            | 0.271         |
| 398            | 0.264         | 429            | 0.249         | 460            | 0.240         | 491            | 0.304         | 522            | 0.286         | 553            | 0.251         |
| 399            | 0.253         | 430            | 0.252         | 461            | 0.283         | 492            | 0.294         | 523            | 0.241         | 554            | 0.291         |
| 400            | 0.249         | 431            | 0.268         | 462            | 0.263         | 493            | 0.283         | 524            | 0.244         | 555            | 0.289         |
| 401            | 0.228         | 432            | 0.293         | 463            | 0.255         | 494            | 0.277         | 525            | 0.268         | 556            | 0.255         |
| 402            | 0.301         | 433            | 0.269         | 464            | 0.281         | 495            | 0.295         | 526            | 0.241         | 557            | 0.249         |
| 403            | 0.293         | 434            | 0.294         | 465            | 0.268         | 496            | 0.278         | 527            | 0.270         | 558            | 0.257         |

Ultrasonic Thickness Readings "Tank 1-C-24" - TIC 17.030.S1580.011

| Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) |
|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|
| 559            | 0.259         | 590            | 0.294         | 621            | 0.285         | 652            | 0.299         | 683            | 0.280         | 714            | 0.292         |
| 560            | 0.271         | 591            | 0.272         | 622            | 0.242         | 653            | 0.259         | 684            | 0.281         | 715            | 0.274         |
| 561            | 0.254         | 592            | 0.272         | 623            | 0.273         | 654            | 0.257         | 685            | 0.236         | 716            | 0.276         |
| 562            | 0.294         | 593            | 0.275         | 624            | 0.273         | 655            | 0.258         | 686            | 0.236         | 717            | 0.269         |
| 563            | 0.253         | 594            | 0.286         | 625            | 0.275         | 656            | 0.281         | 687            | 0.253         | 718            | 0.287         |
| 564            | 0.255         | 595            | 0.274         | 626            | 0.275         | 657            | 0.278         | 688            | 0.260         | 719            | 0.260         |
| 565            | 0.25          | 596            | 0.251         | 627            | 0.263         | 658            | 0.271         | 689            | 0.287         | 720            | 0.237         |
| 566            | 0.233         | 597            | 0.279         | 628            | 0.242         | 659            | 0.280         | 690            | 0.267         | 721            | 0.290         |
| 567            | 0.261         | 598            | 0.251         | 629            | 0.250         | 660            | 0.255         | 691            | 0.243         | 722            | 0.267         |
| 568            | 0.25          | 599            | 0.258         | 630            | 0.247         | 661            | 0.261         | 692            | 0.270         | 723            | 0.266         |
| 569            | 0.271         | 600            | 0.239         | 631            | 0.284         | 662            | 0.262         | 693            | 0.245         | 724            | 0.277         |
| 570            | 0.297         | 601            | 0.253         | 632            | 0.272         | 663            | 0.287         | 694            | 0.251         | 725            | 0.261         |
| 571            | 0.284         | 602            | 0.251         | 633            | 0.285         | 664            | 0.274         | 695            | 0.240         | 726            | 0.272         |
| 572            | 0.252         | 603            | 0.285         | 634            | 0.263         | 665            | 0.235         | 696            | 0.244         | 727            | 0.263         |
| 573            | 0.295         | 604            | 0.265         | 635            | 0.242         | 666            | 0.248         | 697            | 0.265         | 728            | 0.299         |
| 574            | 0.275         | 605            | 0.266         | 636            | 0.229         | 667            | 0.286         | 698            | 0.261         | 729            | 0.272         |
| 575            | 0.262         | 606            | 0.216         | 637            | 0.282         | 668            | 0.236         | 699            | 0.274         | 730            | 0.291         |
| 576            | 0.295         | 607            | 0.240         | 638            | 0.250         | 669            | 0.251         | 700            | 0.295         | 731            | 0.268         |
| 577            | 0.29          | 608            | 0.276         | 639            | 0.261         | 670            | 0.281         | 701            | 0.302         | 732            | 0.226         |
| 578            | 0.281         | 609            | 0.272         | 640            | 0.260         | 671            | 0.273         | 702            | 0.301         | 733            | 0.257         |
| 579            | 0.288         | 610            | 0.257         | 641            | 0.258         | 672            | 0.287         | 703            | 0.281         | 734            | 0.263         |
| 580            | 0.283         | 611            | 0.287         | 642            | 0.278         | 673            | 0.298         | 704            | 0.287         | 735            | 0.256         |
| 581            | 0.276         | 612            | 0.288         | 643            | 0.268         | 674            | 0.277         | 705            | 0.273         | 736            | 0.277         |
| 582            | 0.279         | 613            | 0.281         | 644            | 0.259         | 675            | 0.267         | 706            | 0.288         | 737            | 0.270         |
| 583            | 0.292         | 614            | 0.295         | 645            | 0.261         | 676            | 0.273         | 707            | 0.221         | 738            | 0.275         |
| 584            | 0.267         | 615            | 0.266         | 646            | 0.251         | 677            | 0.224         | 708            | 0.238         | 739            | 0.296         |
| 585            | 0.276         | 616            | 0.273         | 647            | 0.257         | 678            | 0.200         | 709            | 0.259         | 740            | 0.305         |
| 586            | 0.272         | 617            | 0.304         | 648            | 0.247         | 679            | 0.263         | 710            | 0.269         | 741            | 0.290         |
| 587            | 0.266         | 618            | 0.248         | 649            | 0.272         | 680            | 0.258         | 711            | 0.260         | 742            | 0.283         |
| 588            | 0.297         | 619            | 0.244         | 650            | 0.288         | 681            | 0.268         | 712            | 0.290         | 743            | 0.299         |
| 589            | 0.264         | 620            | 0.251         | 651            | 0.245         | 682            | 0.281         | 713            | 0.300         | 744            | 0.275         |

Ultrasonic Thickness Readings "Tank 1-C-24" - TIC 17.030.S1580.011

| Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) |
|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|
| 745            | 0.283         | 776            | 0.293         | 807            | 0.241         | 838            | 0.296         | 869            | 0.300         | 900            | 0.230         |
| 746            | 0.287         | 777            | 0.280         | 808            | 0.249         | 839            | 0.283         | 870            | 0.254         | 901            | 0.227         |
| 747            | 0.287         | 778            | 0.277         | 809            | 0.281         | 840            | 0.272         | 871            | 0.277         | 902            | 0.293         |
| 748            | 0.242         | 779            | 0.288         | 810            | 0.260         | 841            | 0.286         | 872            | 0.303         | 903            | 0.230         |
| 749            | 0.288         | 780            | 0.301         | 811            | 0.263         | 842            | 0.260         | 873            | 0.280         | 904            | 0.262         |
| 750            | 0.294         | 781            | 0.295         | 812            | 0.273         | 843            | 0.251         | 874            | 0.247         | 905            | 0.231         |
| 751            | 0.282         | 782            | 0.271         | 813            | 0.271         | 844            | 0.251         | 875            | 0.251         | 906            | 0.241         |
| 752            | 0.284         | 783            | 0.260         | 814            | 0.285         | 845            | 0.284         | 876            | 0.261         | 907            | 0.266         |
| 753            | 0.315         | 784            | 0.247         | 815            | 0.283         | 846            | 0.298         | 877            | 0.250         | 908            | 0.276         |
| 754            | 0.270         | 785            | 0.235         | 816            | 0.269         | 847            | 0.270         | 878            | 0.287         | 909            | 0.282         |
| 755            | 0.274         | 786            | 0.281         | 817            | 0.286         | 848            | 0.288         | 879            | 0.270         | 910            | 0.267         |
| 756            | 0.271         | 787            | 0.283         | 818            | 0.286         | 849            | 0.255         | 880            | 0.284         | 911            | 0.279         |
| 757            | 0.276         | 788            | 0.285         | 819            | 0.300         | 850            | 0.258         | 881            | 0.276         | 912            | 0.293         |
| 758            | 0.244         | 789            | 0.265         | 820            | 0.280         | 851            | 0.254         | 882            | 0.252         | 913            | 0.244         |
| 759            | 0.239         | 790            | 0.265         | 821            | 0.270         | 852            | 0.281         | 883            | 0.288         | 914            | 0.284         |
| 760            | 0.275         | 791            | 0.285         | 822            | 0.260         | 853            | 0.290         | 884            | 0.260         | 915            | 0.272         |
| 761            | 0.285         | 792            | 0.290         | 823            | 0.288         | 854            | 0.273         | 885            | 0.236         | 916            | 0.240         |
| 762            | 0.266         | 793            | 0.295         | 824            | 0.256         | 855            | 0.269         | 886            | 0.275         | 917            | 0.283         |
| 763            | 0.273         | 794            | 0.289         | 825            | 0.265         | 856            | 0.237         | 887            | 0.274         | 918            | 0.272         |
| 764            | 0.264         | 795            | 0.255         | 826            | 0.250         | 857            | 0.277         | 888            | 0.247         | 919            | 0.270         |
| 765            | 0.259         | 796            | 0.254         | 827            | 0.280         | 858            | 0.248         | 889            | 0.264         | 920            | 0.273         |
| 766            | 0.265         | 797            | 0.247         | 828            | 0.250         | 859            | 0.263         | 890            | 0.257         | 921            | 0.291         |
| 767            | 0.304         | 798            | 0.251         | 829            | 0.259         | 860            | 0.302         | 891            | 0.278         | 922            | 0.251         |
| 768            | 0.277         | 799            | 0.281         | 830            | 0.252         | 861            | 0.274         | 892            | 0.278         | 923            | 0.272         |
| 769            | 0.266         | 800            | 0.290         | 831            | 0.281         | 862            | 0.287         | 893            | 0.284         | 924            | 0.267         |
| 770            | 0.277         | 801            | 0.274         | 832            | 0.268         | 863            | 0.267         | 894            | 0.273         | 925            | 0.272         |
| 771            | 0.251         | 802            | 0.282         | 833            | 0.284         | 864            | 0.260         | 895            | 0.269         | 926            | 0.260         |
| 772            | 0.271         | 803            | 0.286         | 834            | 0.283         | 865            | 0.280         | 896            | 0.274         | 927            | 0.261         |
| 773            | 0.266         | 804            | 0.258         | 835            | 0.269         | 866            | 0.255         | 897            | 0.297         | 928            | 0.251         |
| 774            | 0.257         | 805            | 0.284         | 836            | 0.231         | 867            | 0.238         | 898            | 0.266         | 929            | 0.259         |
| 775            | 0.282         | 806            | 0.274         | 837            | 0.250         | 868            | 0.265         | 899            | 0.260         | 930            | 0.277         |

Ultrasonic Thickness Readings "Tank 1-C-24" - TIC 17.030.S1580.011

| Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) |
|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|
| 931            | 0.256         | 962            | 0.269         | 993            | 0.279         | 1024           | 0.268         | 1055           | 0.265         | 1086           | 0.263         |
| 932            | 0.267         | 963            | 0.258         | 994            | 0.227         | 1025           | 0.280         | 1056           | 0.284         | 1087           | 0.288         |
| 933            | 0.259         | 964            | 0.266         | 995            | 0.268         | 1026           | 0.270         | 1057           | 0.248         | 1088           | 0.239         |
| 934            | 0.281         | 965            | 0.255         | 996            | 0.270         | 1027           | 0.275         | 1058           | 0.234         | 1089           | 0.272         |
| 935            | 0.268         | 966            | 0.251         | 997            | 0.260         | 1028           | 0.268         | 1059           | 0.267         | 1090           | 0.230         |
| 936            | 0.287         | 967            | 0.264         | 998            | 0.280         | 1029           | 0.320         | 1060           | 0.278         | 1091           | 0.253         |
| 937            | 0.263         | 968            | 0.275         | 999            | 0.259         | 1030           | 0.254         | 1061           | 0.269         | 1092           | 0.253         |
| 938            | 0.285         | 969            | 0.287         | 1000           | 0.262         | 1031           | 0.268         | 1062           | 0.272         | 1093           | 0.254         |
| 939            | 0.287         | 970            | 0.257         | 1001           | 0.271         | 1032           | 0.291         | 1063           | 0.290         | 1094           | 0.260         |
| 940            | 0.260         | 971            | 0.289         | 1002           | 0.250         | 1033           | 0.272         | 1064           | 0.268         | 1095           | 0.260         |
| 941            | 0.233         | 972            | 0.275         | 1003           | 0.277         | 1034           | 0.279         | 1065           | 0.267         | 1096           | 0.247         |
| 942            | 0.251         | 973            | 0.281         | 1004           | 0.287         | 1035           | 0.260         | 1066           | 0.248         | 1097           | 0.296         |
| 943            | 0.280         | 974            | 0.288         | 1005           | 0.288         | 1036           | 0.284         | 1067           | 0.265         | 1098           | 0.293         |
| 944            | 0.254         | 975            | 0.288         | 1006           | 0.292         | 1037           | 0.262         | 1068           | 0.268         | 1099           | 0.276         |
| 945            | 0.256         | 976            | 0.244         | 1007           | 0.278         | 1038           | 0.262         | 1069           | 0.252         | 1100           | 0.247         |
| 946            | 0.276         | 977            | 0.256         | 1008           | 0.283         | 1039           | 0.287         | 1070           | 0.251         | 1101           | 0.271         |
| 947            | 0.273         | 978            | 0.277         | 1009           | 0.265         | 1040           | 0.263         | 1071           | 0.258         | 1102           | 0.247         |
| 948            | 0.245         | 979            | 0.258         | 1010           | 0.282         | 1041           | 0.277         | 1072           | 0.268         | 1103           | 0.245         |
| 949            | 0.253         | 980            | 0.278         | 1011           | 0.258         | 1042           | 0.255         | 1073           | 0.273         | 1104           | 0.262         |
| 950            | 0.284         | 981            | 0.290         | 1012           | 0.241         | 1043           | 0.258         | 1074           | 0.270         | 1105           | 0.257         |
| 951            | 0.275         | 982            | 0.277         | 1013           | 0.226         | 1044           | 0.292         | 1075           | 0.265         | 1106           | 0.257         |
| 952            | 0.272         | 983            | 0.253         | 1014           | 0.278         | 1045           | 0.301         | 1076           | 0.267         | 1107           | 0.258         |
| 953            | 0.259         | 984            | 0.284         | 1015           | 0.288         | 1046           | 0.280         | 1077           | 0.271         | 1108           | 0.253         |
| 954            | 0.267         | 985            | 0.265         | 1016           | 0.284         | 1047           | 0.278         | 1078           | 0.287         | 1109           | 0.244         |
| 955            | 0.246         | 986            | 0.282         | 1017           | 0.279         | 1048           | 0.280         | 1079           | 0.298         | 1110           | 0.274         |
| 956            | 0.253         | 987            | 0.279         | 1018           | 0.249         | 1049           | 0.238         | 1080           | 0.267         | 1111           | 0.244         |
| 957            | 0.288         | 988            | 0.259         | 1019           | 0.259         | 1050           | 0.263         | 1081           | N             | 1112           | 0.288         |
| 958            | 0.317         | 989            | 0.278         | 1020           | 0.272         | 1051           | 0.275         | 1082           | 0.272         | 1113           | 0.285         |
| 959            | 0.260         | 990            | 0.255         | 1021           | 0.249         | 1052           | 0.241         | 1083           | 0.230         | 1114           | 0.240         |
| 960            | 0.285         | 991            | 0.278         | 1022           | 0.251         | 1053           | 0.270         | 1084           | 0.191         | 1115           | 0.255         |
| 961            | 0.251         | 992            | 0.270         | 1023           | 0.288         | 1054           | 0.242         | 1085           | 0.296         | 1116           | 0.226         |



Ultrasonic Thickness Readings "Tank 1-C-24" - TIC 17.030.S1580.011

| Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) | Reading Number | Reading (in.) |
|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|
| 1117           | 0.272         | 1148           | 0.272         | 1179           | 0.279         | 1210           | 0.217         | 1241           | 0.270         | 1272           | 0.197         |
| 1118           | 0.269         | 1149           | 0.275         | 1180           | 0.246         | 1211           | 0.239         | 1242           | 0.263         | 1273           | 0.281         |
| 1119           | 0.260         | 1150           | 0.251         | 1181           | 0.260         | 1212           | 0.222         | 1243           | 0.290         | 1274           | 0.231         |
| 1120           | 0.285         | 1151           | 0.279         | 1182           | 0.218         | 1213           | 0.255         | 1244           | 0.287         | 1275           | 0.286         |
| 1121           | 0.264         | 1152           | 0.217         | 1183           | 0.270         | 1214           | 0.268         | 1245           | 0.287         | 1276           | 0.206         |
| 1122           | 0.245         | 1153           | 0.234         | 1184           | 0.230         | 1215           | 0.285         | 1246           | 0.271         | 1277           | 0.276         |
| 1123           | 0.265         | 1154           | 0.246         | 1185           | 0.257         | 1216           | 0.263         | 1247           | 0.278         | 1278           | 0.286         |
| 1124           | 0.240         | 1155           | 0.230         | 1186           | 0.255         | 1217           | 0.257         | 1248           | 0.277         | 1279           | 0.253         |
| 1125           | 0.240         | 1156           | 0.293         | 1187           | 0.271         | 1218           | 0.288         | 1249           | 0.268         | 1280           | 0.259         |
| 1126           | 0.288         | 1157           | 0.292         | 1188           | 0.290         | 1219           | 0.236         | 1250           | 0.228         | 1281           | 0.285         |
| 1127           | 0.289         | 1158           | 0.266         | 1189           | 0.260         | 1220           | 0.237         | 1251           | 0.270         | 1282           | 0.290         |
| 1128           | 0.288         | 1159           | 0.247         | 1190           | 0.301         | 1221           | 0.306         | 1252           | 0.257         | 1283           | 0.278         |
| 1129           | 0.288         | 1160           | 0.298         | 1191           | 0.281         | 1222           | 0.268         | 1253           | 0.260         | 1284           | 0.289         |
| 1130           | 0.261         | 1161           | 0.262         | 1192           | 0.295         | 1223           | 0.275         | 1254           | 0.300         | 1285           | 0.280         |
| 1131           | 0.266         | 1162           | 0.248         | 1193           | 0.261         | 1224           | 0.251         | 1255           | N             | 1286           | 0.280         |
| 1132           | 0.250         | 1163           | 0.257         | 1194           | 0.264         | 1225           | 0.279         | 1256           | 0.281         | 1287           | 0.254         |
| 1133           | 0.298         | 1164           | 0.247         | 1195           | 0.252         | 1226           | 0.251         | 1257           | 0.273         | 1288           | 0.274         |
| 1134           | 0.268         | 1165           | 0.288         | 1196           | 0.281         | 1227           | 0.240         | 1258           | 0.245         | 1289           | 0.274         |
| 1135           | 0.263         | 1166           | 0.257         | 1197           | 0.268         | 1228           | 0.281         | 1259           | 0.285         | 1290           | 0.274         |
| 1136           | 0.259         | 1167           | 0.278         | 1198           | 0.264         | 1229           | 0.281         | 1260           | 0.192         | 1291           | 0.270         |
| 1137           | 0.268         | 1168           | 0.276         | 1199           | 0.251         | 1230           | 0.262         | 1261           | 0.281         | 1292           | 0.301         |
| 1138           | 0.269         | 1169           | 0.257         | 1200           | 0.270         | 1231           | N             | 1262           | 0.285         | 1293           | 0.291         |
| 1139           | 0.260         | 1170           | 0.261         | 1201           | 0.258         | 1232           | 0.282         | 1263           | 0.256         | 1294           | 0.295         |
| 1140           | 0.257         | 1171           | 0.242         | 1202           | 0.273         | 1233           | 0.283         | 1264           | 0.293         | 1295           | 0.279         |
| 1141           | 0.289         | 1172           | 0.274         | 1203           | 0.280         | 1234           | 0.276         | 1265           | 0.291         | 1296           | 0.288         |
| 1142           | 0.290         | 1173           | 0.288         | 1204           | N             | 1235           | 0.289         | 1266           | 0.279         | 1297           | 0.284         |
| 1143           | 0.253         | 1174           | 0.271         | 1205           | 0.283         | 1236           | 0.247         | 1267           | 0.233         |                |               |
| 1144           | 0.275         | 1175           | 0.284         | 1206           | 0.298         | 1237           | 0.190         | 1268           | 0.242         |                |               |
| 1145           | 0.285         | 1176           | 0.275         | 1207           | 0.280         | 1238           | 0.212         | 1269           | 0.275         |                |               |
| 1146           | N             | 1177           | 0.235         | 1208           | 0.232         | 1239           | 0.240         | 1270           | 0.198         |                |               |
| 1147           | 0.279         | 1178           | 0.220         | 1209           | 0.246         | 1240           | 0.216         | 1271           | 0.259         |                |               |



1. Tank and site.



2. Tank and site.



3. Tank and site.



4. Surrounding area.



5. Surrounding area.



6. Signs on site fence.



7. Site sloped toward tank.



8. Pump equipment and valve vault exterior adjacent to tank.



9. Valve vault interior.



10. Retaining ring around tank. Note debris.



11. Retaining ring around tank. Note rod.



12. Corrosion and metal loss on retaining ring.



13. Corrosion and metal loss on retaining ring.



14. Corrosion and metal loss along bottom plate projection.





15. Conduit along gap between gravel and tank bottom.



16. Gap between gravel and bottom plate.



17. Bottom plate, coaxial cable, and retaining ring. Note gaps between gravel and bottom plate.



18. Gap between bottom plate and gravel.



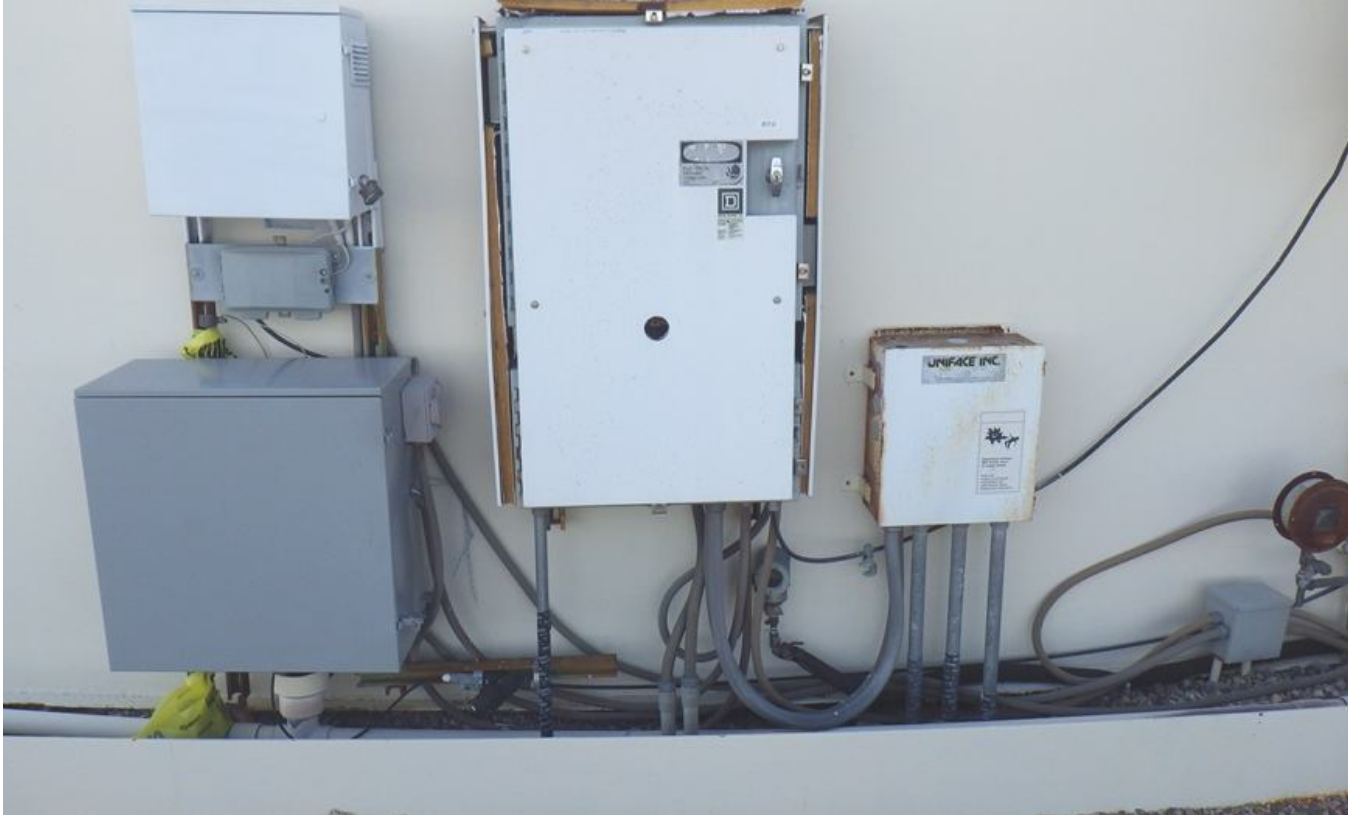
19. Corrosion on underside of bottom plate at gap.



20. Valve vault exterior, information stenciled on tank, and electrical cabinets.



21. Electrical equipment adjacent to tank.



22. Cabinets on tank.



23. Coupling penetrations and valves on shell.



24. Cathodic protection equipment, other electrical equipment, and funnel adjacent to tank.



25. Cathodic protection information.



26. Shell manhole.



27. Cleanout manhole.



28. Broken cleanout manhole davit arm.



29. Coupling and valve in cleanout manhole cover.



30. Corrosion and stencil on shell.





- 31. Cables, cathodic protection cabinet, exterior ladder, safety cage, and target gage.



- 32. Corrosion on backside of target gage.



33. Vandal deterrent at base of safety cage.



34. Corrosion at ladder bracket.



35. Antenna, roof safety railing, ladder safety cage, and target gage.



36. Upper shell.



37. Rust staining streaking from perimeter vent.



38. Corrosion on perimeter vent frame.



39. Conduits at shell-to-roof connection. Note conduit banded at cut-out in toe bar.



40. Roof access.



41. Roof safety railing and roof manhole.



42. Roof manhole.



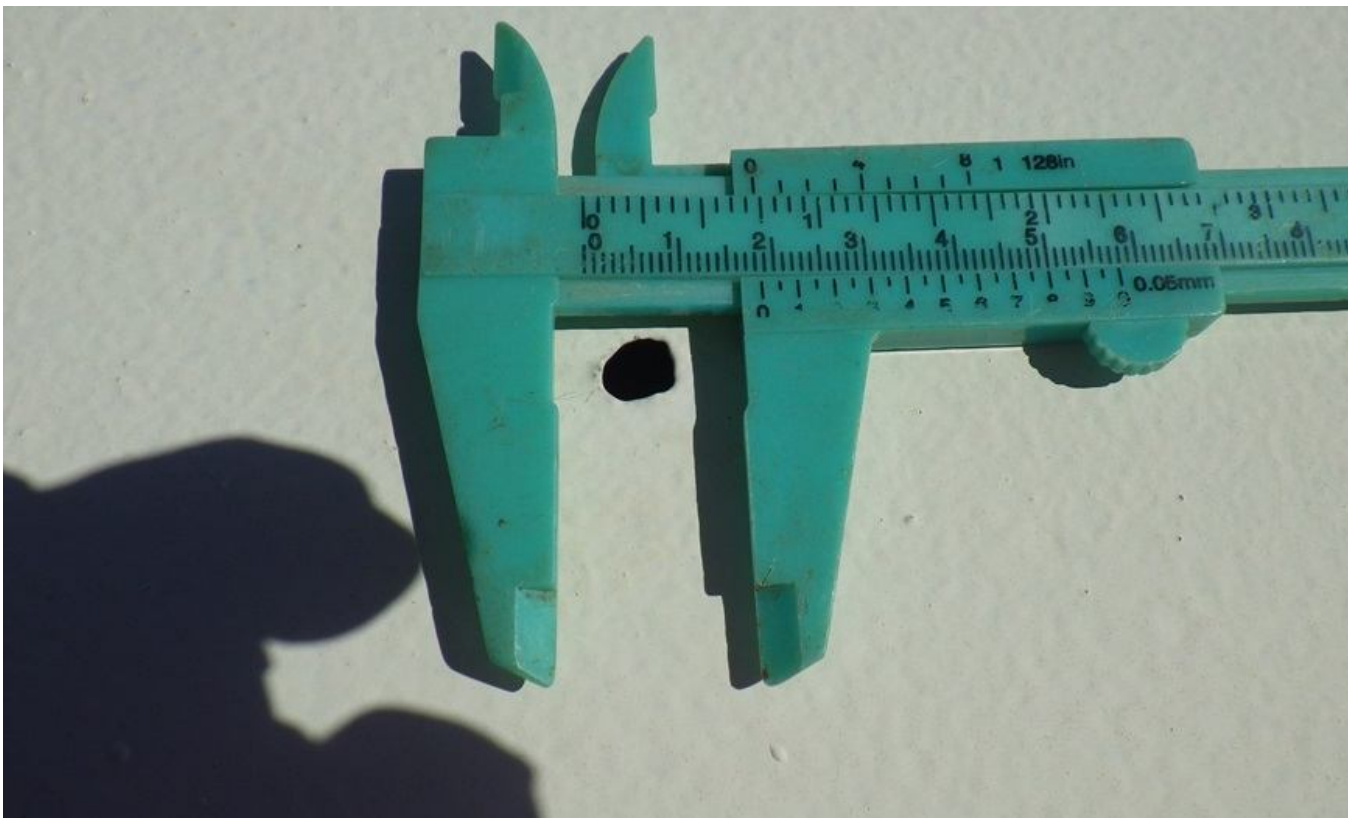
43. Target gage equipment.



44. Roof exterior.



45. Cathodic protection hand hole cover plate.



46. Hole in roof.





47. Rust staining on roof around vent.



48. Corrosion on roof vent.



49. Corrosion within removable cover vent and rust staining on roof plates.



50. Corrosion and metal loss on top side of center hub at removable cover vent.



51. Corrosion and metal loss on top side of center hub at removable cover vent.



52. Corrosion and metal loss on rafter end and top side of center hub at removable cover vent.



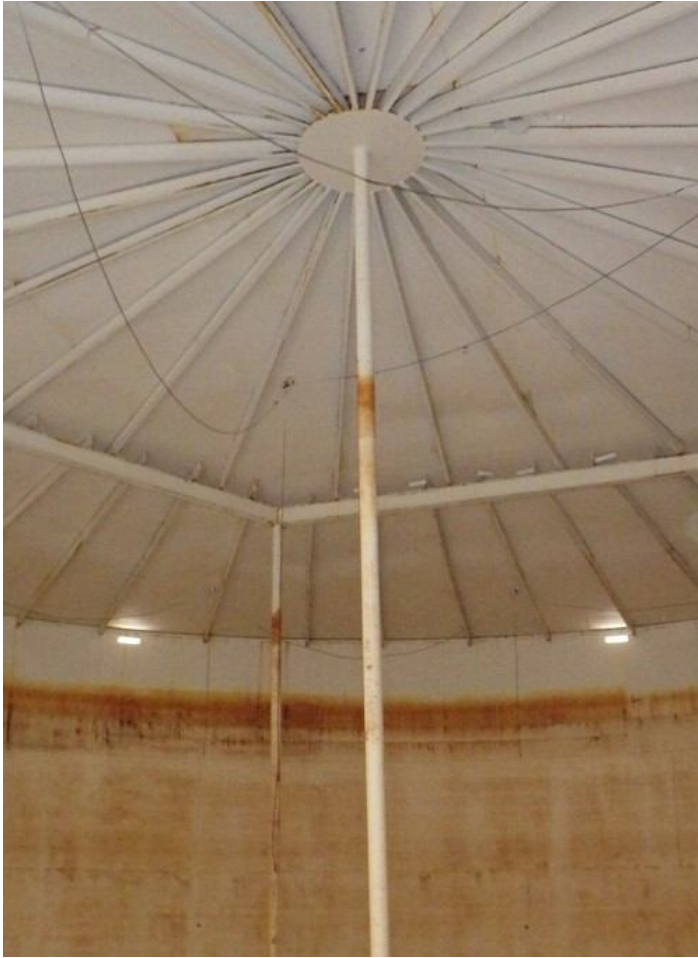
53. Corrosion and metal loss on rafter end and top side of center hub at removable cover vent.



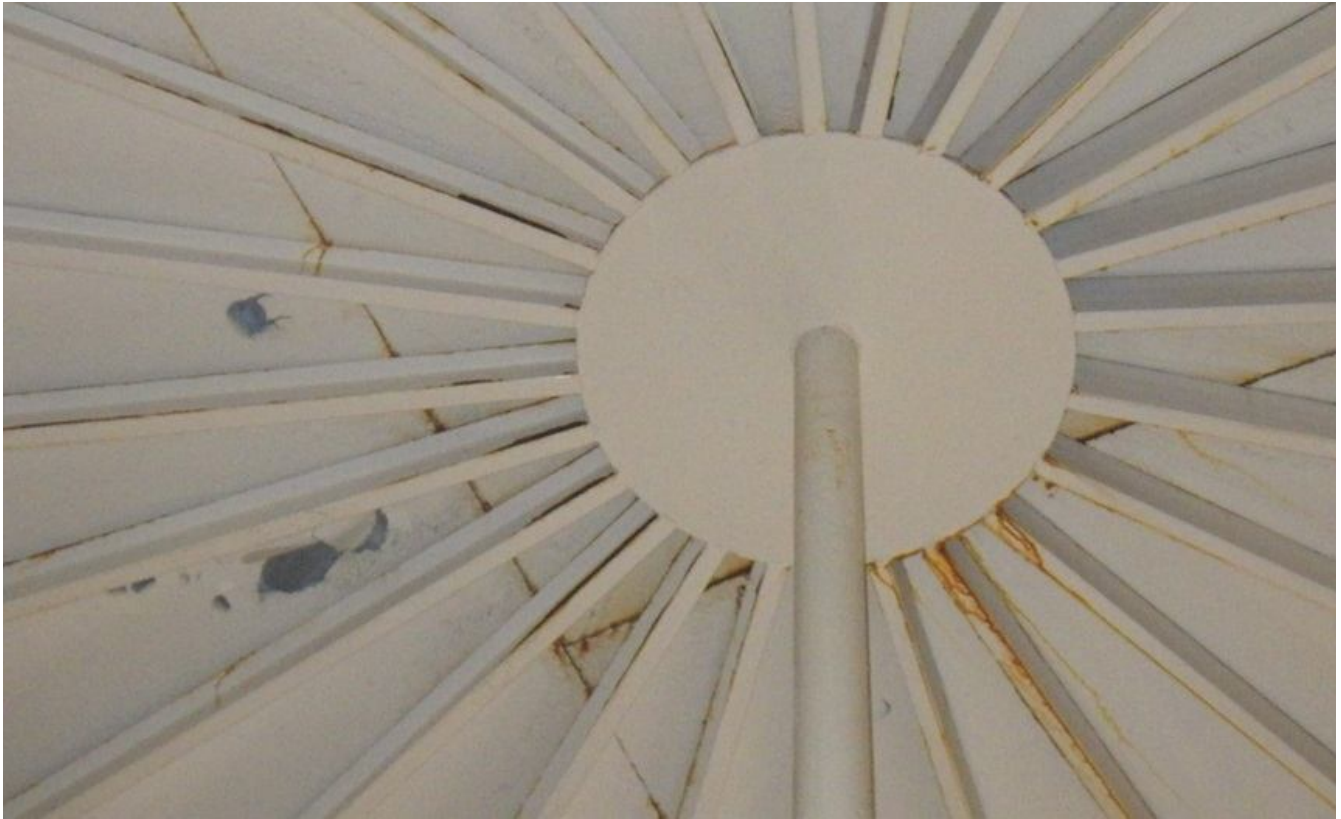
54. Corrosion and metal loss on rafter end and top side of center hub at removable cover vent.



55. Corrosion and metal loss on rafter end and top side of center hub at removable cover vent.



56. Roof interior support structure.



57. Center column, center hub, and inner rafters. Note peeled coating, corrosion, and rust staining.



58. Bowing in center column.



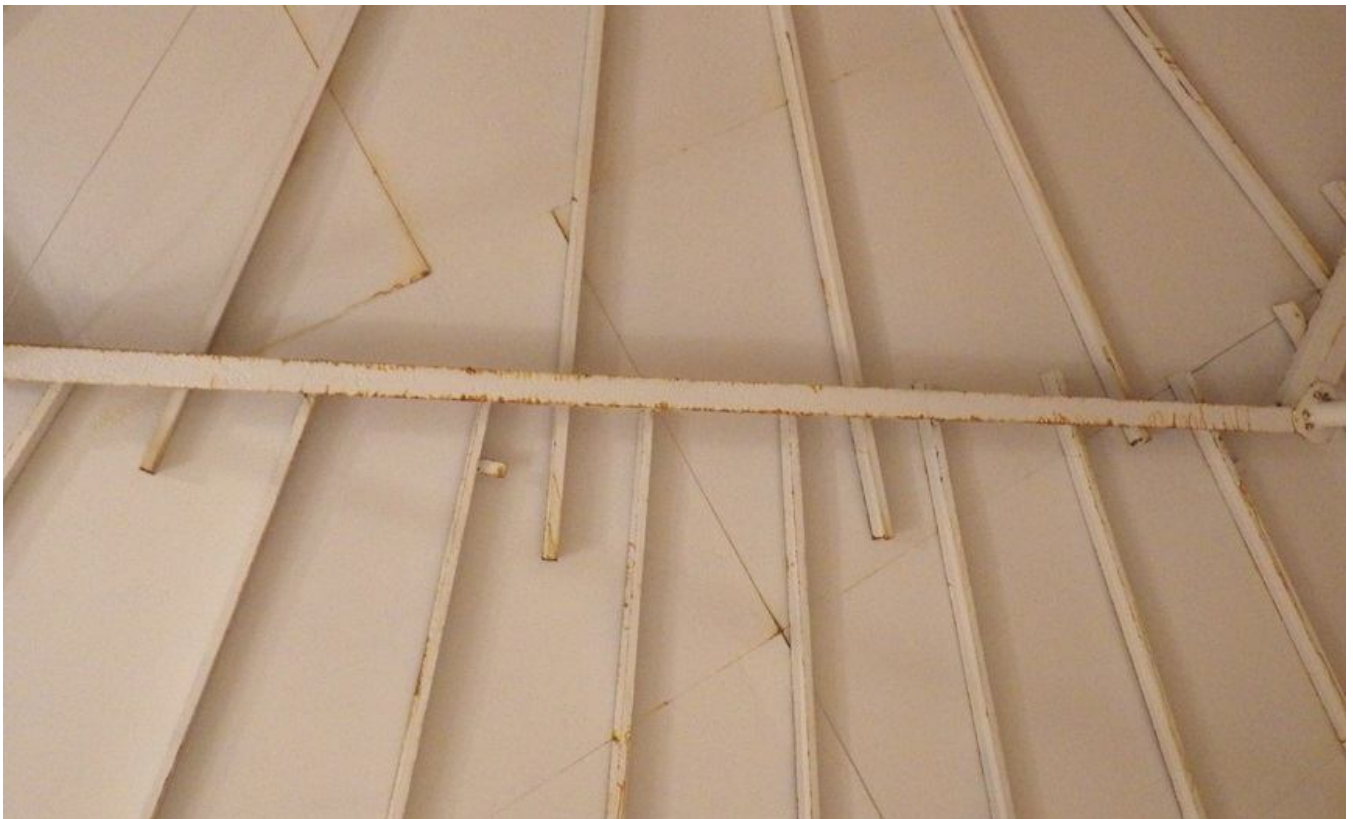
59. Center column not plumb.



60. Center column not plumb.



61. Corrosion on roof rafters.



62. Roof rafters and circumferential girder. Note corrosion and rust staining.





63. Outer column, roof rafters, and circumferential girder. Note corrosion and rust staining.



64. Outer column, roof rafters, and circumferential girder. Note corrosion and rust staining.



65. Unused brackets on rafter ends. Note corrosion and rust staining.



66. Unused bracket on rafter ends. Note corrosion and rust staining.



67. Cathodic protection wiring on roof and corrosion and rust staining along roof rafters and seam. Note hole in roof.



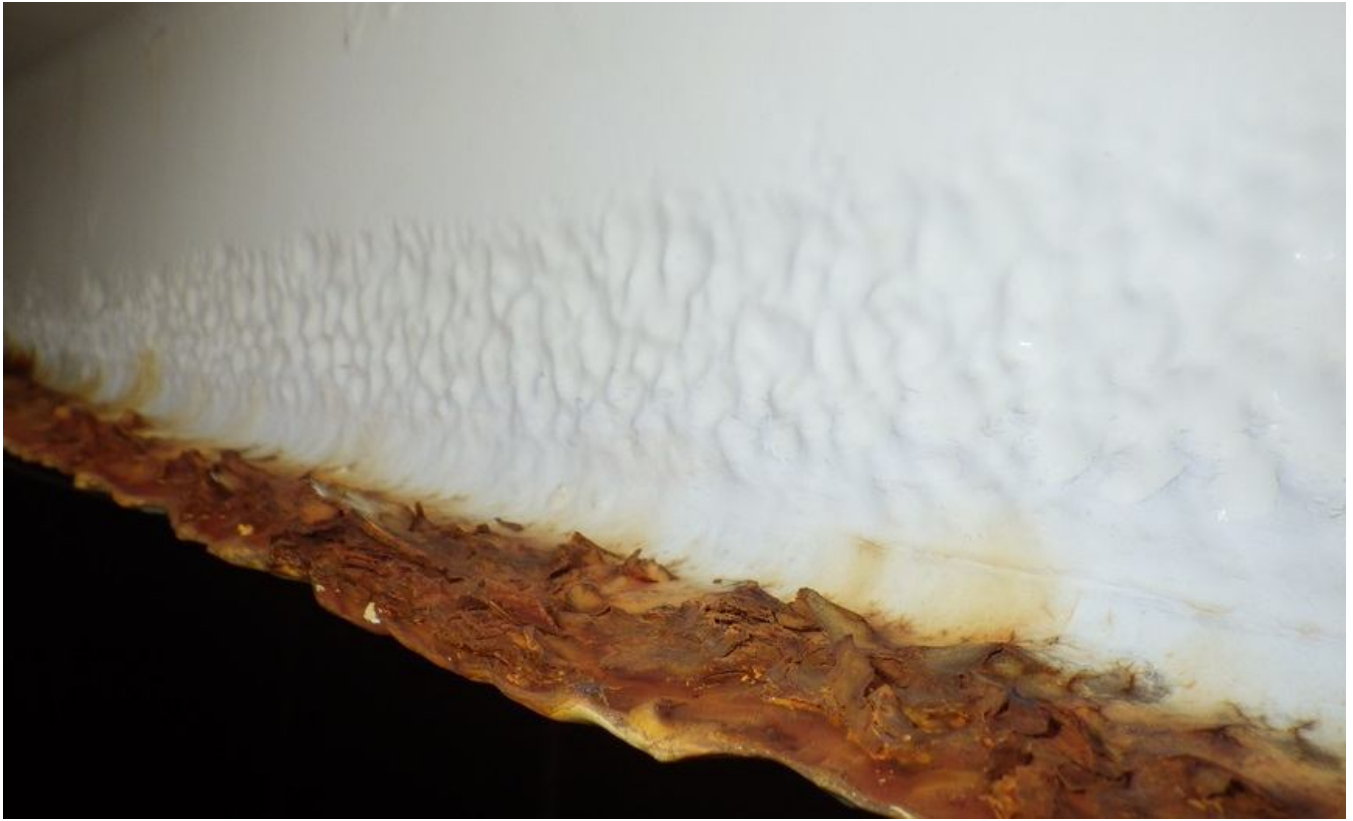
68. Corrosion around target gage equipment penetrations through roof.



69. Corrosion and rust staining along roof plate seam and previous metal loss in roof.



70. Corrosion and metal loss along rafter.



71. Corrosion and metal loss along rafter.



72. Corrosion and metal loss along roof-to-shell connection.



73. Corrosion and metal loss on rafter, attachment clip, bolt, and roof-to-shell connection.



74. Corrosion and metal loss on attachment clip and along roof-to-shell connection.



75. Corrosion and metal loss on upper interior ladder.



76. Target gage cables, interior ladder, and interior overflow pipe.



77. Corrosion and metal loss in interior overflow pipe.



78. Corrosion in shell, overflow pipe, and bracket.





79. Cathodic protection reference electrode, coupling openings, and lower shell.



80. Corrosion on upper shell.



81. Corrosion on upper shell.



82. Blistered shell coating and hard, stringy substance on shell.



83. Blistered shell coating.



84. Blank nut and blistered coating on column.



85. Outlet pipe, removable cover, and mud guard.



86. Outlet pipe, removable cover, and mud guard.



87. Inlet pipe.



88. Reinforcing plate on floor around overflow pipe penetration.



89. Target gage float and cables.



90. Corrosion and blistered coating on floor.



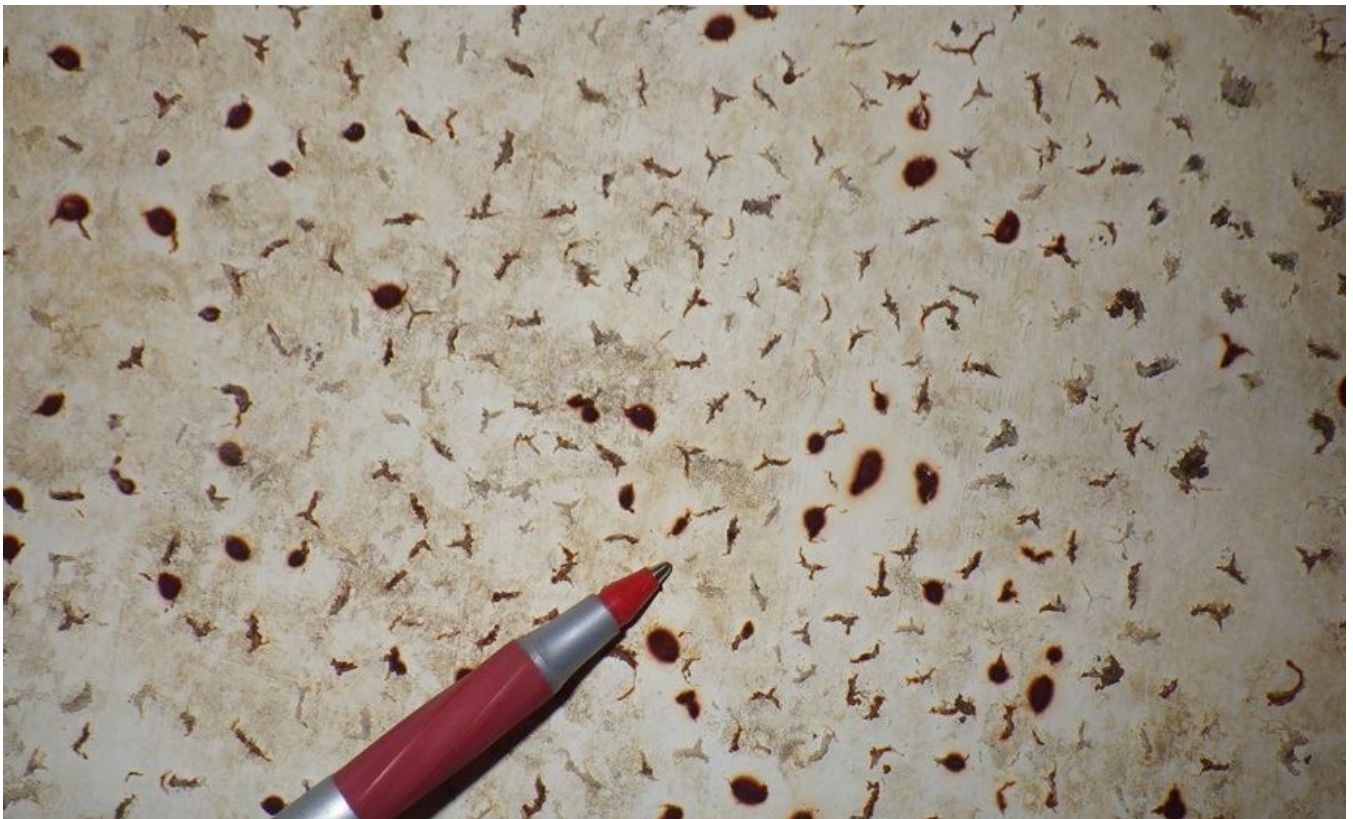
91. Shell-to-floor connection.



92. Floor.

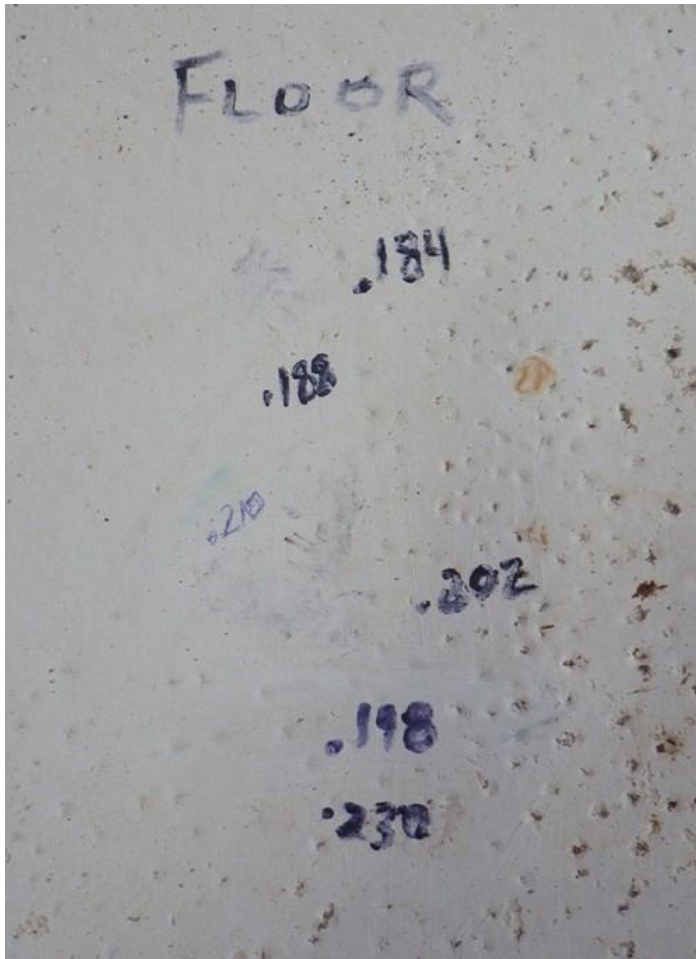


93. Irregular contour of floor. Note blistered coating and corrosion.



94. Popped coating blisters and corrosion on floor.





95. Ultrasonic thickness measurements and blistered coating on floor.



96. Outer column and angles.



97. Center column base and angles.