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CONSULTING ENGINEERS

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ENGINEER'S REPORT

CORROSION ENGINEERING EVALUATION

OF A

BURIED WELDED STEEL WATER STORAGE RESERVOIR
(7,500 Gallon Reservoir)

WHEELER CREST, CALIFORNIA

AUGUST 2016

PREPARED FOR:

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Wheeler Crest Community Service District
129 Willow Road
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CORROSION REPORT

PROJECT:	Corrosion Engineering Evaluation of a Buried Welded Steel Water Storage Reservoir
STRUCTURE:	7,500 Gallon Welded Steel Water Storage Reservoir
OWNER:	Wheeler Crest Community Service District
LOCATION:	Wheeler Crest, California
INVESTIGATED BY:	Andre Harper, Project Engineer
DATE:	August 2016

I. GENERAL INFORMATION

A. Construction and Maintenance Details

Structure is a buried welded steel water storage reservoir located in Wheeler Crest, California and is designated as the 7,500 Gallon Reservoir. The date of construction and contractor are unknown. The reservoir is a cylinder with dished heads with dimensions of approximately 8' in diameter by 25' in length. The roof access hatch is approximately 24" in diameter with an inlet pipe that can be removed for easier access.

B. Site Conditions

The reservoir is on a dirt site with no fencing or other restrictions for accessing the site. Access to the site is off a paved residential street. There is adequate space for large equipment on the adjacent street or possibly on the lot above the reservoir. No difficulty is anticipated for Contractor mobilization, assuming use of normal portable air compressor and related equipment.

There are homes nearby which could be adversely affected by dust and contamination associated with abrasive blast cleaning and painting operations. Accordingly, extreme caution must be exercised during all cleaning and painting operations.

C. Existing Coating and Paint Systems

1. The field investigation indicates the paint and coating systems to be the following:

a. Exterior Surfaces: The exterior surfaces were not evaluated due to the buried condition.

b. Interior Surfaces: An epoxy coating system is present on all interior surfaces.

D. Cathodic Protection System

No cathodic protection system is present in this reservoir. There does not appear to be a subgrade system for the underside of the bottom of the reservoir or the piping.

E. Title 22 Heavy Metal Analyses

A sample of the interior coating was removed during the evaluation for analysis for the presence of heavy metals and the result is included in this report.

F. Contract Information

Harper & Associates Engineering, Inc. was retained by the District to accomplish field investigation of two reservoirs to observe interior and exterior surfaces and conditions, with photographs taken to record conditions. This report has been prepared with remedial repair/recoating/repainting recommendations and cost estimates for accomplishing the work.

This Corrosion Report is prepared solely on the basis of noted field investigation. Conclusions and recommendations are strictly those determined by Consultant to be consistent with the best and most experienced practice within the corrosion engineering profession.

II. INVESTIGATION

A. Investigation was accomplished as follows:

1. Exterior Surfaces

a. Exterior surfaces were not investigated due to the buried condition.

2. Interior Surfaces

a. Interior surfaces were investigated by climbing into the reservoir via an extension ladder and traversing all surfaces from the bottom of the reservoir.

b. Light was supplied from the roof hatch and a portable high intensity handheld light.

c. Various chipping tools were employed to examine typical areas of defective coating and corrosion within reach.

d. Photographs were taken of typical and specific areas to illustrate condition of surfaces.

III. OBSERVATIONS

A. Based upon the above reported investigation, the following observations were noted:

1. The interior surfaces are in overall fair to poor condition with the surfaces below the high waterline being in overall fair to good and the surfaces above the high waterline exhibiting moderate to severe corrosion. (Photos I-1 through I-20)

2. Moderate to severe corrosion is present on the upper surfaces and perimeter of the roof access hatch curb. (Photos I-1 through I-7)

3. The inlet pipe and nozzle penetration are severely corroded. (Photos I-8 through I-10)

4. The substrate exhibits moderate to severe pitting underneath the existing coating system. (Photos I-11 through I-13)

5. A rectangular patch appears to have been welded on the exterior surfaces of the reservoir. (Photo I-14)

6. A light layer of dark sediment is present randomly on the bottom surfaces. (Photos I-15 through I-18)

7. An isolated spot of corrosion on the bottom surfaces of the reservoir exhibits moderate to severe pitting. (Photos I-19 and I-20)

8. Minor corrosion is present along the upper edge of the hatch curb and on the underside of the galvanized cover. (Photos I-21 and I-22)

IV. CONCLUSIONS

A. Based on the above noted observations, the following conclusions are drawn:

1. The fair to poor condition of the interior surfaces is due to a combination of the condition of the underlying substrate, which is severely pitted, making it more difficult to properly coat, the above water portion of the reservoir being in a more corrosive environment due to the wet/dry cycle, and possibly the presence of chlorine vapor, if chlorine is being added at this location.

2. The severe corrosion on the inlet pipe and nozzle penetration appears to be due to utilizing carbon steel for these appurtenances and not coating them after installation.

3. Moderate to severe pitting of the substrate under the existing coating system is due to previous corrosion prior to applying the existing coating system.

4. It appears that a patch has been welded onto the exterior of the reservoir, but it is

not known why the patch was necessary.

5. The layer of sediment on the bottom is due to contaminants entering the reservoir with the water supply.

6. The isolated spot of corrosion on the bottom is likely due to a sharp edge of one of the pits not being properly coated and exposing the substrate to the corrosion process.

7. Minor corrosion on the hatch curb and underside of the cover is typically due to damage that occurs when opening and closing the hatch.

V. LABORATORY TESTING OF COATING

A. At the request of the District, a sample of the interior coating was removed by Consultant. The sample was forwarded to a testing laboratory for analysis. The report was prepared on the basis of lead, zinc, and chromium concentrations. The test result is as follows.

1. Interior Shell – Lead at 7.4 PPM is below the maximum allowable concentration of 1,000 PPM. Zinc at 15.9 PPM is below the maximum allowable concentration of 5,000 PPM. Chromium compounds at 42.2 PPM are below the maximum allowable concentration of 2,500 PPM.

B. Lead, zinc, and chromium compounds on the interior surfaces are below the allowable concentrations. Therefore, removal operations on the interior surfaces do not need to be classified as a hazardous materials/waste project.

C. When the levels of lead, zinc, and chromium are well below the Title 22 allowable action levels but are still present in some quantity, it should be recognized that Cal/OSHA does not specify specific action levels and similar regulatory criteria varies for mandated action levels. Accordingly, this consulting firm recommends the following be initiated for any recoating operations where heavy metal content is found to be positive.

1. At the beginning of work in a lead, zinc, or chromium laden space, air within the work space must be tested by a Certified Industrial Hygienist (CIH) to determine concentrations of heavy metals. CIH will then designate the degree of worker protection required for the work within the specific space.

2. Additionally, it is requested this report be circulated through the Owner's safety and environmental group to determine that no conflict exists between their requirements for working with heavy metals and that noted within this report. If conflict exists, it is incumbent upon the Owner to make the final decision as to the ultimate requirements for working with and disposing of hazardous wastes generated by the project.

D. The process for working with heavy metal based coatings and paints and for final determination of spent abrasive as hazardous waste is as follows.

1. All personnel working on and around site must strictly adhere to Cal/OSHA and

NIOSH regulations for working with lead paints. Regulations include personnel biological testing and monitoring of worker's air and air in vicinity of site. Inclusively, regulations outlined in 29 CFR Part 1926 must be strictly adhered to.

2. Coatings and paints must be removed by vacuum blasting, or by conventional methods with total containment of reservoir, or by grit blasting with total containment and recovery of abrasive, or partial containment in areas where blast cleaning is being accomplished.

   a. The reservoir interior provides a containment environment for removal of interior coatings. Hence, these coatings can be removed by conventional methods. However, worker protection must be in strict compliance with the dictates of the CIH's report as noted above. Also, no coating must be allowed to fall onto the exterior soil, or dust be emitted into the outside atmosphere. Accordingly, all dust, removed coating particles, and other particulate matter from interior abrasive blast cleaning must be contained.

   b. If heavy metals are present in non-confined spaces, it is incumbent upon the contractor to utilize coating removal equipment which confines the removed coating and any abrasive used during the removal process. If the contractor covers the non-confined space to render it a confined space, all cost associated with this changed job site condition must be borne by the contractor as no additional funds will be expended by the Owner for such changed job site conditions as the cost was included in the contractor's lump sum bid.

E. Upon completion of coating and paint removal from reservoir surfaces, a representative sample of the spent abrasive, with the removed coating and paint particles within the abrasive, is taken and sent to an approved testing laboratory for testing under Land Ban requirements.

F. If tests indicate the spent abrasive with removed coating and paint particles is not hazardous, wastes can be disposed of in a local Class III or unclassified dump, regardless of the presence of heavy metal coating or paint particles. However, the local agency which has jurisdiction over the dumpsite may require further testing to ensure the waste does not violate any of their local regulations. This could result in the waste being classified as a Designated Waste, which requires disposal at a Class II dumpsite.

G. If tests still indicate excessive levels of lead or chromium compounds, spent abrasive must be placed in approved containers, removed to an approved Class I dumpsite via a licensed hazardous waste transporter, and disposed of in strict conformance to Land Ban regulations. Incineration or encapsulation in concrete or other binder-type materials are also acceptable methods of disposal and do not result in a "cradle to grave" responsibility for the generator as does the landfill disposal method.

H. PLEASE REMEMBER: THE OWNER OF THE RESERVOIR IS ALWAYS THE GENERATOR OF THE HAZARDOUS WASTE!!!!!!!!!! This liability cannot be transferred to any other party involved in the project, regardless of the contract provisions or specification requirements. The Owner can meet its responsibility to properly and

legally handle and dispose of the toxic or hazardous wastes generated by the surface preparation requirements of a project by including this work as part of the work to be accomplished by the Contractor on the project. This work includes, but is not limited to, the following.

1. Obtaining all permits and EPA numbers for Owner
2. Processing all related project paperwork
3. Blood testing of all involved personnel
4. Sampling and testing of waste as required
5. Bulking, packaging, and storing waste at job site
6. Using licensed hazardous waste transporters to deliver the hazardous wastes to their ultimate legal disposal site

VI. RECOMMENDATIONS

A. Based on the above noted observations and conclusions, the following recommendations are offered:

1. The interior surfaces are in overall fair to poor condition and beginning to exhibit moderate to severe corrosion and metal loss on the surfaces above the high waterline and a spot on the bottom. Therefore, it is recommended that all interior surfaces be abrasively blast cleaned to Near White Metal (SSPC-SP10) and a 100% solids epoxy coating system be applied to a minimum thickness of 25 mils on all surfaces.

    a. Due to the pitting from previous corrosion and severe corrosion that is now present, it may be necessary to patch plate areas that are either very thin or become holes after the abrasive blasting accomplished.

    b. The carbon steel inlet pipe and nozzle should be replaced with galvanized steel or carbon steel that is coated with the interior surfaces.

VII. COST ESTIMATES

A. Based on current and previous projects of similar scope, preliminary cost estimates for work as noted in RECOMMENDATIONS were calculated by using data from those projects.

1. Abrasive blast cleaning all interior surfaces to Near White Metal (SSPC-SP10) and applying a 100% solids epoxy coating system to a total dry film thickness of 25 mils on all surfaces would be in the cost range of $20,000 to $28,500, based on surfaces being classified as a non-hazardous materials/waste project.

2. No cost is projected for quality control inspection of any outside contract work. An estimate can be prepared when final scope of work is determined.

Respectfully submitted,

HARPER & ASSOCIATES ENGINEERING, INC.

Andre Harper
Project Engineer