PERMIT ATTACHMENT

APPENDIX IX

TANK ASSESSMENT REPORT

This appendix contains the text portion of the Tank Assessment Report. For the remainder of the Report, refer to the April 2016 Permit Application.

September 2018

APPENDIX IX

HAZARDOUS WASTE TANK SYSTEM ASSESSMENT, DESIGN DRAWINGS, AND CONTAINMENT CALCULATIONS

FOR

SIEMENS INDUSTRY, INC.

PARKER REACTIVATION FACILITY

PARKER, ARIZONA

Revision 1
April 2012

TABLE OF CONTENTS

APPENDIX IX

TAB 1

Assessment of Tank Systems
T-1, T-2, T-5, and T-6

Revision 1
April 2012

CBE CHAVOND-BARRY ENGINEERING CORP.

400 County Route 518 • P.O. Box 205
Blawenburg, New Jersey 08504-0205

Tel:(609)466-4900
Fax: (609)466-1231

Tank System Engineering Assessment

I have reviewed the information relating to the above ground tank systems identified in the document *Assessment of Tanks T-1, T-2, T-5 and T-6*, attached as Exhibit A, which are installed at the Siemens Industry, Inc. facility in Parker, Arizona, and my assessment allows me to draw the following conclusions in accordance with 40 CFR 264.192(a):

1. The tank system has sufficient structural integrity and is acceptable for the storing and treating of hazardous waste.

2. The tank system foundation, structural support, seams, connections and pressure controls (where applicable) are adequately designed.

3. The tank system has sufficient structural strength, compatibility with the wastes to be stored or treated, and corrosion protection, to ensure that it will not collapse, rupture or fail.

My assessment has been based, in part, on my review of the following information, which is provided in the attached document:

A. Results of visual inspection and ultrasonic thickness testing for the tank systems.

B. Hazardous characteristics of the wastes stored in the tank system.

C. Structural calculations and design standards for the tank systems .

In accordance with 40 CFR 264.192(a) and 40 CFR 270.11(d), I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Christopher M. Doelling, P.E.

April 23, 2012

STATE OF NEW JERSEY CHRISTOPHER M. DOELLING No. PE 43630 LICENSED PROFESSIONAL ENGINEER

Attachment: Exhibit A - Assessment of Tank Systems T-1, T-2, T-5 and T-6

CBE

CHAVOND-BARRY ENGINEERING CORP.

400 County Route 518 • P.O. Box 205
Blawenburg, New Jersey 08504-0205

Tel:(609)466-4900
Fax: (609)466-1231

EXHIBIT A

ASSESSMENT OF TANK SYSTEMS T-1, T-2, T-5 AND T-6

40 CFR 264.192

Prepared for:

Siemens Industry, Inc.
25323 Mutahar Street
Parker, Arizona 85344

Prepared by:

Karl E. Monninger
Vice President
Chavond-Barry Engineering Corp.

April 2012

ASSESSMENT OF TANK SYSTEMS T-1, T-2, T-5 AND T-6

Table of Contents

Appendices

ASSESSMENT OF TANK SYSTEMS
T-1, T-2, T-5, and T-6

In order to comply with the requirements of EPA 40 CFR, Subpart J, § 264.192, the visual inspections and ultrasonic thickness measurements were performed on the exterior of subject tank systems February 21, 2011 through February 25, 2011. Ancillary equipment including pipelines, fittings, flanges, valves, pumps and supports were also examined and visually inspected during this period. The results of the ultrasonic thickness measurements taken are shown in Appendix A. The following comments are made in conjunction with the EPA requirements:

1. <u>Tank Systems Description</u>

A. The Siemens Industry, Inc. identification numbers for the tanks are T-1, T-2, T-5, and T-6. Each tank is 10'-0" in diameter with a 16'-0" straight side wall height, 8'-0" high nominal 62° bottom cone and umbrella roof (top head). Dimensioned drawings of the tanks are provided in Appendix A.

B. All tanks are located outdoors on the east side of the control room and warehouse building. Each tank is supported by a carbon steel skirt and anchored to a common, elevated support structure. A caged ladder is installed on each tank for access to the roof.

The tanks and support structure are located within a secondary containment area that has sumps routed to the recycle water storage tank T-9 (not part of this evaluation). A portion of the tank system piping is also within this secondary containment area. The recycle water pumps, tank T-9 and the remainder of the tank system piping are located outside of the secondary containment area.

C. The material of construction for the roof, cylindrical side wall and conical bottom of all tanks is 300 series stainless steel, specific grade unknown.

The material of construction for the stiffener rings and support skirt on all tanks is carbon steel. The exposed surfaces of the stiffener angle rings and both sides of the support skirt for each tank are painted.

The material of construction for pipelines and valves used for spent carbon slurry transport is stainless steel, grade 316L.

D. All four tanks were fabricated by Wyatt M&B Works, Inc. in 1956 and put into service at Parker, AZ facility during August of 1992.

E. All tanks operate at atmospheric pressure and at a maximum temperature of 150°F; therefore, the ASME code stamp is not required. A 4-inch diameter vent is provided on the roof of each tank and connected by CPVC piping to a common granular activated carbon (GAC) adsorption system (WS-1) for VOC control. A 3-inch diameter pressure relief safety valve with vacuum breaker is also installed on the roof of each tank. All of these safety valves are set at 8 ounces for pressure relief and at 6 ounces to break the vacuum.

F. Each spent carbon storage tank has a design capacity of 8,319 gallons (31.49 cubic meters). A high carbon level sensor is located 4'-6" below the top of the cylindrical wall for each tank. An automatic safety valve on each of the two spent carbon unloading hoppers cuts off feed to the eductor system when spent carbon reaches the level sensor to ensure each of the tanks cannot be filled above the high level sensor. A 4" diameter overflow nozzle is located 1'-2" below the top of the cylindrical wall for each tank and directs excess recycle water to tank T-9 by gravity piping.

G. The design standards and construction drawings for the tanks and ancillary equipment are not available.

2. <u>Characteristics of Stored Chemicals and Compatibility with Tank Materials</u>

A. The spent carbon storage tanks (T-1, T-2, T-5, and T-6) are used to store spent activated carbon and recycle water in slurry form. The material is transferred into and out of the tanks by using eductors and a recycle water pump with a discharge pressure of approximately 85 psig.

The recycle water is maintained at a neutral pH (between 6 and 8) to minimize the corrosion.

B. The spent activated carbon stored in these tanks is contaminated with various chemicals in low concentration, as listed in Appendix B. The waste contaminants on the spent carbon treated at this facility vary in the range from < 1 to 300,000 ppmwd on average.

C. The spent carbon storage tanks are constructed of 300 series stainless steel, specific grade unknown, resistant to all of the chemicals listed in Appendix B, and not susceptible to corrosion.

All four tanks were internally lined with Plasite 7122 HAR during the construction phase of this plant prior to startup during August of 1992. The Plasite lining is a cross-linked epoxy-phenolic cured with an alkaline curing agent. Although originally installed for its resistance to abrasion and a wide range of chemicals (acids, alkalis, and solvents), the Plasite lining is not required to protect the tank systems since 300 series stainless steel is compatible with all of the waste codes and hazardous constituents listed in Appendix B. Portions of the lining have likely been damaged during tank maintenance activities or worn away due to abrasion since the tanks were put into service; the existing condition and integrity of any remaining Plasite lining is unknown.

D. All pipelines, valves and fittings used for the transfer of the spent carbon and recycle water slurry are constructed of stainless steel, grade 316L, resistant to all of the chemicals listed in Appendix B, and not susceptible to corrosion.

3. Results of Ultrasonic Testing and Visual Inspection

A. To check the integrity of the tanks, ultrasonic testing (U/T) was performed on the exterior surfaces of the cylindrical wall, umbrella roof, cone bottom and support skirt for each tank to measure the shell thickness. Shell and cone bottom thickness readings were taken at a height of every two feet on each 90° quadrant. The results of the thickness readings obtained for tanks T-1, T-2, T-5, and T-6 are tabulated in Appendix A.

A Model NDT-715 ultrasonic thickness gauge (s/n 733351) and 5.0MHz dual element transducer (s/n AG766) were used for all thickness measurements; the manufacturer's calibration data for this test equipment are provided in Appendix A. Prior to each use (whenever the instrument was turned on) the sound-velocity for the material to be measured was set (0.233 in/μ-sec for carbon steel and 0.223 in/μ-sec for stainless steel) and a probe zero conducted. To ensure the accuracy of all measurements, no thickness reading was recorded unless at least 6 of 8 bars were displayed by the gauge's Stability Indicator. Paint was removed from the test areas on the support skirt of each tank prior to thickness measurements.

B. All four tanks were visually inspected from the exterior during plant operation and the following observations recorded:

1) Tank T-1

The tank's exterior surfaces and weld seams are in good condition with the exception of several small areas located adjacent to welds for carbon steel attachments where minor pitting and slight corrosion attack was evident. An area approximately 12" high x 8" wide is dented slightly inward at the 2-foot elevation on the west side of the cylindrical shell above a nozzle with a blanked off carbon steel elbow and valved city water piping connection. Two unused swirl jet nozzles located on the lower east side of the cylindrical shell are blanked off with carbon steel blind flanges. A carbon steel plate approximately 4" in diameter is welded to the cylindrical shell at the 8.5-foot elevation for closure of a nozzle that was previously removed. Four carbon steel support brackets, no longer in use have been cut off from the north side of the cylindrical shell but not completely removed by grinding. Unused nozzles and inspection/access ports on the top head of tank T-1 are sealed with stainless steel caps and carbon steel blind flanges.

As previously reported in the 1994 Tank Assessment, the two carbon steel stiffener angle rings (2-1/2" x 2-1/2" x 1/4") located at the bottom and 8-foot elevation on the cylindrical shell are corroded. In several areas, portions of the top horizontal flange on both stiffeners are disconnected from the remainder of the angle at the 90° bend. At other locations, the stiffeners are corroded at the bottom of the vertical flange of the angle. However, in all locations for both angle stiffeners at least 50% of the original material remains intact and the structural analyses performed (based upon a 2" x 1/4" flat bar) indicate they have sufficient strength. Exposed surfaces of the two stiffener angle rings and both sides of the support skirt are painted.

The minimum shell thickness for tank T-1 was determined to be 0.180 inches at the 0-foot elevation on the west side of the cylindrical shell.

2) Tank T-2

The tank's outside surfaces and weld seams are in good condition with the exception of slight corrosion attack in a few small areas located adjacent to carbon steel attachments on the shell. An area approximately 6" wide is dented slightly inward at the 10-foot elevation on the south side of the cylindrical shell. A carbon steel plate approximately 4" in diameter is welded to the cylindrical shell at the 8.5-foot elevation for closure of a nozzle that was previously removed. A carbon steel blind flange is used to blank off an unused nozzle located on the lower east side of the tank. Two swirl jet nozzles on the lower west side of the cylindrical shell are connected to the recycle water supply piping. Nozzles and inspection/access ports on the top head of tank T-2 are sealed with stainless and carbon steel blind flanges.

As previously reported in the 1994 Tank Assessment, the two carbon steel stiffener angle rings (2-1/2" x 2-1/2" x 1/4") located at the bottom and 8-foot elevation on the cylindrical shell are corroded. In several areas, portions of the top horizontal flange on both stiffeners are disconnected from the remainder of the angle at the 90° bend. At other locations, the stiffeners are corroded at the bottom of the vertical flange of the angle. However, in all locations for both angle stiffeners at least 50% of the original material remains intact and the structural analyses performed (based upon a 2" x 1/4" flat bar) indicate they have sufficient strength. Exposed surfaces of the two stiffener angle rings and both sides of the support skirt are painted.

The minimum shell thickness for tank T-2 was determined to be 0.183 inches at the 0.5-foot elevation on the north side of the cylindrical shell.

3) Tank T-5

The tank's exterior surfaces and weld seams are in good condition with the exception of several small areas located adjacent to welds for carbon steel attachments where minor pitting and slight corrosion attack was evident. A carbon steel plate approximately 4" in diameter is welded to the cylindrical shell at the 8.5-foot elevation for closure of a nozzle that was previously removed. A carbon steel blind flange is used to blank off an unused nozzle located on the lower west side of the cylindrical shell. Two swirl jet nozzles located on the lower south side of the cylindrical shell are connected to the recycle water supply piping. Nozzles and inspection/access ports on the top head of tank T-5 are sealed with stainless and carbon steel blind flanges.

As previously reported in the 1994 Tank Assessment, the two carbon steel stiffener angle rings (2-1/2" x 2-1/2" x 1/4") located at the bottom and 8-foot elevation on the cylindrical shell are corroded. In several areas, portions of the top horizontal flange on both stiffeners are disconnected from the remainder of the angle at the 90° bend. At other locations, the stiffeners are corroded at the bottom of the vertical flange of the angle. However, in all locations for both angle stiffeners at least 50% of the original material remains intact and the structural analyses performed (based upon a 2" x 1/4" flat bar) indicate they have sufficient strength. Exposed surfaces of the two stiffener angle rings and both sides of the support skirt are painted.

The minimum shell thickness for tank T-5 was determined to be 0.167 inches on the south side of the cone bottom at location 1, approximately 1-foot below the cone/cylinder intersection.

4) <u>Tank T-6</u>

The tank's outside surfaces and weld seams are in good condition with the exception of slight corrosion attack in a few small areas located adjacent to carbon steel attachments on the shell. A stainless steel plate approximately 4" in diameter is welded to the cylindrical shell at the 8.5-foot elevation for closure of a nozzle that was previously removed. A stainless steel blind flange is used to blank off an unused nozzle located on the lower east side of the cylindrical shell. Two swirl jet nozzles located on the lower south side of the cylindrical shell are connected to the recycle water supply piping. Two small rectangular stainless steel patches are welded to the cylindrical shell at 1.3 and 2.5-foot elevations on both the northeast and southwest sides of the tank. The patches range in size from 5" x 5" to 9" x 9" and were used to close holes previously created to aid in raising and supporting the tank during the repair of the bottom cone. Nozzles and inspection/access ports on the top head of tank T-6 are sealed with stainless and carbon steel blind flanges.

The original bottom cone section of tank T-6 has been replaced with a new cone fabricated from 1/4" thick type 304 stainless steel. The bottom three quarters of the old cone was removed and the new cone continuously seal welded to the remaining upper portion of the original cone from the inside of the tank.

As previously reported in the 1994 Tank Assessment, the two carbon steel stiffener angle rings (2-1/2" x 2-1/2" x 1/4") located at the bottom and 8-foot elevation on the cylindrical shell are corroded. In several areas, portions of the top horizontal flange on both stiffeners are disconnected from the remainder of the angle at the 90° bend. At other locations, the stiffeners are corroded at the bottom of the vertical flange of the angle. However, in all locations for both angle stiffeners at least 50% of the original material remains intact and the structural analyses performed (based upon a 2" x 1/4" flat bar) indicate they have sufficient strength. Exposed surfaces of the two stiffener angle rings and both sides of the support skirt are painted.

The minimum shell thickness for tank T-6 was determined to be 0.176 inches at the 16-foot elevation on the east side of the cylindrical shell.

5) Additional Information

Each tank is supported by a carbon steel skirt and anchored to an elevated structure at eight locations using 1-inch diameter structural grade bolts and nuts. The columns of the elevated support structure for the tanks are grounded by connection to underground grounding cable grids located beneath the secondary containment pad.

No structural defects, settling or distortion of the elevated support structure or foundation for the tank systems was observed.

The bottom of each of the four T-tanks are located approximately 6'- 0" above the secondary containment pad. The bottom of each of the six support columns for elevated structure are located 1' - 4" above the secondary containment pad. None of the external tank shells or any external metal component of the tank system is in contact with soil or water.

The existing pressure/vacuum relief valves for tanks T-1, T-2, T-5, and T-6 were replaced with new valves on May 11, 2011. The new valves (same model and type) are set at 8 ounces for pressure relief and at 6 ounces to break the vacuum.

Two new carbon steel vacuum stiffener angle rings (2-1/2" x 2-1/2" x 3/16") were attached to the cylindrical shell of each tank approximately 21-1/2" above the location of the original stiffeners. Installation and painting of the new stiffeners on the four tanks was completed on June 29, 2011.

D. Ancillary Equipment

1) The nozzle connections and piping for spent carbon slurry, recycle water, city water and vent were carefully examined during the inspection of each tank system and indicated no leaks.

2) Each of the two recycle water pumps (located adjacent to tank T-9 and outside of the secondary containment area) were found to leak at the packing seal for the pump drive shaft during operation. The leaks are intentional and comprised of city water used for cooling and flushing the seal gland of each pump.

3) The exterior surfaces of stainless steel pipelines and fittings are not painted and showed no signs of corrosion.

4) Pipelines are supported throughout by hanger supports and steel bridge supports, and are guided using "U" bolts.

4. <u>Structural Calculations</u>

A. A finite element analysis (FEA) of the tanks was performed for the operating condition (1.5 specific gravity slurry to fill line) and based on the minimum shell metal thicknesses measured for each of the major components (top head, cylindrical wall and bottom cone) on any of the four tanks with wind and seismic loadings calculated from the latest edition of the International Building Code. The calculated FEA stress results are all less than allowable stresses from AWWA D100-05.

In addition to the FEA/AWWA evaluation, a second analysis was performed base on the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1. The Section VIII, Division 1 analysis was conservatively based on an internal pressure of 15 psig plus the hydrostatic pressure of the spent carbon slurry and shows that the basic Code limits are satisfied.

A complete copy of the structural calculations and analyses is provided in Appendix C. Both analyses demonstrate that tanks T-1, T-2, T-5 and T-6 are acceptable for the atmospheric storage of spent carbon slurry.

Stresses due to seismic loading are higher than the stresses from wind loading, but the seismic stresses for the tanks are well below the allowable limits and relatively low when compared to those attributable to the weight/hydrostatic pressure. The structural analyses indicate that the critical component is the thickness of the cylindrical side wall of the tank at the cone/cylinder intersection where the hydrostatic loading produces a localized compressive hoop stress of 6,126 psi, which is 85% of the allowable local buckling stress of 7,209 psi (from AWWA D100-05) for a 10' - 0" diameter cylindrical wall that is 0.176" thick.

Note that the minimum actual thicknesses of the cylindrical wall for each of the four tanks at the cone/cylinder intersection is greater than the 0.176" thickness used in the FEA calculations as follows: 0.180" (T-1), 0.190" (T-2), 0.192" (T-5) and 0.208" (T-6). Since the allowable local buckling compressive stress is a function of the cylindrical wall thickness/radius ratio, the allowable stress at the cone/cylinder intersection for each tank increases such that the actual stress of 6126 psi calculated for the operating condition ranges from 73% to 80% of the allowable local buckling stress from AWWA D100-05.

For any of the four tanks, the maximum allowable stress at the cone/cylinder intersection will be equal to the calculated compressive stress if the cylindrical shell wall thickness decreases to 0.157" at that location. The maximum decrease in the tank cylindrical shell wall thicknesses since the 1993 measurements was found to be 0.028" (on the west side of T-2 at 2' elevation) and yields a maximum "thinning" rate 0.00156" per year. If the thickness of the T-1 cylindrical shell at the cone/cylinder intersection decreases at this accelerated rate, the remaining useful life of T-1 would be 15 years.

B. The corroded vacuum stiffener ring located at the bottom of the cylindrical shell of each tanks is adequate for the shell to cone junction reinforcement. The calculations are based on 2" x 1/4" flat bars in lieu of the two corroded 2-1/2" x 2-1/2" x 1/4" stiffener angles on each tank.

C. Piping drawings showing the thicknesses, layout dimensions, and the supports are not available, but based upon visual inspection, excessive stresses due to thermal expansion, settlement, and vibrations were not observed. All pipelines appeared adequately supported and guided. Therefore the piping systems do not appear to cause any threat of leakage.

D. All tanks are supported on the elevated structure, which was designed by LuMar Engineering Co. of Pasadena, California. The structural and foundation drawings are provided in Appendix D.

Each of tanks T-1, T-2, T-5, and T-6 are supported by a continuous skirt support which give uniform load distribution to the W12x26, W21x44, and W24x55 braced beams by means of eight point loads and all structural columns are supported on a mat foundation that is 2' - 6" deep per the LuMar drawings.

Based upon the absence of any observed defects, settling or distortion of the elevated support structure or foundation that have been in continuous service since 1994, the structural support and foundation for the tanks appear to be adequate.

5. Deficiencies

No deficiencies that would compromise the integrity of the tanks for the atmospheric storage of spent carbon slurry were found.

6. Recommendations

A. Continue daily monitoring and visual inspections of the spent carbon storage tanks and ancillary equipment for compliance with RCRA requirements.

B. Conduct annual ultrasonic thickness testing at the bottom of the cylindrical wall above the cone/cylinder intersection and at the previous locations of minimum shell thickness readings for each major component (top head, cylindrical wall, bottom cone and support skirt) on each of the four tanks.

C. Conduct comprehensive ultrasonic thickness testing every 5 years for each major component (top head, cylindrical wall, bottom cone and support skirt) on each of tanks T-1, T-2, T-5, and T-6.

D. Remove from service and repair or replace any tank with a cylindrical wall thickness that is less than or equal to 0.157 inches.

E. Maintain paint coating on exterior surfaces of all tank system components that are carbon steel by repainting if visual observation indicates that 20% or greater of the components paint coating is damaged.

F. Replace all carbon steel components and fittings of the tank system that are in direct contact with the spent carbon and recycle water slurry with 300 series stainless steel components and fittings prior to performing the next set of comprehensive ultrasonic thickness testing measurements.