PHOTO 3.4-7 Corrosion on exposed rebar around valve vault access.

PHOTO 3.4-8 Valve vault ladder.

PHOTO 3.4-9 Corrosion and metal loss on valve vault ladder.

PHOTO 3.4-10 Valve vault interior. Note standing water.

PHOTO 3.4-11 Valve vault interior. Note standing water.

PHOTO 3.4-12 Valves and piping adjacent to tank.

PHOTO 3.4-13 Valves and piping adjacent to tank.

PHOTO 3.4-14 Exterior piping.

PHOTO 3.4-15 Overflow pipe projection.

PHOTO 3.4-16 Gaps in screening and corrosion on visible surfaces of overflow.

PHOTO 3.4-17 Corrosion on overflow.

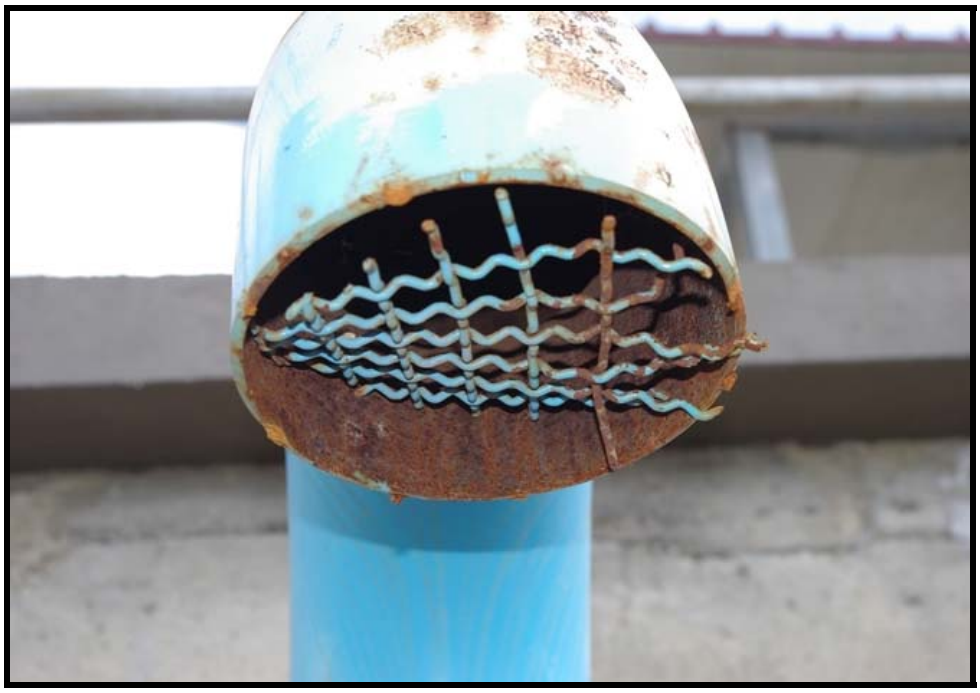


PHOTO 3.4-18 Gaps in screening and corrosion on visible surfaces of overflow.

PHOTO 3.4-19 Exterior piping.

PHOTO 3.4-20 Tank number.

PHOTO 3.4-21 Corrosion on exposed steel near top of shell.

PHOTO 3.4-22 Corrosion on exposed steel near top of shell.

PHOTO 3.4-23 Roof overhang.

PHOTO 3.4-24 Platform and roof safety railing.

PHOTO 3.4-25 Roof manhole.

PHOTO 3.4-26 Roof manhole interior.

PHOTO 3.4-27 Roof manhole interior.

PHOTO 3.4-28 Piping and pump equipment on roof.

PHOTO 3.4-29 Roof vents, pumps, and piping on roof.

PHOTO 3.4-30 Piping on roof.

PHOTO 3.4-31 Piping on roof.

PHOTO 3.4-32 Piping U-bolted to bracket on roof.

PHOTO 3.4-33 Equipment on roof.

PHOTO 3.4-34 Safety railing around roof.

PHOTO 3.4-35 Roof exterior.

PHOTO 3.4-36 Roof exterior.

PHOTO 3.4-37 Concrete projection on roof.

PHOTO 3.4-38 Roof vent.

PHOTO 3.4-39 Corrosion and rust staining around roof vent screening. Note open bolt holes in flange.

PHOTO 3.4-40 Roof vent.

PHOTO 3.4-41 Corrosion and rust staining around roof vent screening. Note open bolt holes in flange.

PHOTO 3.4-42 Roof interior.

PHOTO 3.4-43 Roof interior.

PHOTO 3.4-44 Roof and shell.

PHOTO 3.4-45 Shell interior.

PHOTO 3.4-46 Shell interior.

PHOTO 3.4-47 Shell interior.

PHOTO 3.4-48 Pipe projection from shell.

PHOTO 3.4-49 Pipe projection from shell.

PHOTO 3.4-50 Corrosion on interior piping.

PHOTO 3.4-51 Corrosion on interior ladder.

PHOTO 3.4-52 Corrosion on interior ladder bracket and bolts.

PHOTO 3.4-53 Corrosion and rust tubercles on interior piping.

PHOTO 3.4-54 Corrosion and rust tubercles on capped interior pipe.

PHOTO 3.4-55 Corrosion and rust tubercles on interior piping.

PHOTO 3.4-56 Pipe opening in sump.

PHOTO 3.4-57 Column.

PHOTO 3.4-58 Shell and floor.

PHOTO 3.4-59 Shell and floor.

PHOTO 3.4-60 Silt on floor.

3.4.3 Comparison of Previous Inspection Results

The tank was previously evaluated by Tank Industry Consultants on March 2, 2008, and evaluation report CR-6480-OCN was issued. Since the time of the 2008 evaluation, it appeared that some repairs and modifications have been made to the tank which include:

- Piping and pump equipment have been installed on the south part of the roof.
- A new pipe which extends across the roof has been installed and is U-bolted to new brackets.
- A broken hinge on one of the roof manholes has been replaced.
- The concrete roof manhole necks have been repaired.
- Unused pipe projections on the roof have been covered with fiberglass and concrete.
- The damaged roof overhang has been repaired.
- A toe bar has been installed on the roof safety railing.
- The interior roof surfaces have been resurfaced.
- The interior ladders have been replaced, and the safety cages have been removed.

3.4.4 Structural Condition Assessment

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 Navy and the Engineer.

This tank is located in a seismically active region. This evaluation and reported condition do not verify the tank's original design compliance for seismic or coastal wind loading in accordance with current design requirements, as it was outside the scope of this report. Likewise, recommendations for this tank do not include modifications that

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.

3.4.5 Recommendations

Site:

Site Maintenance: The site should be maintained so that proper drainage away from the tank continues.

Site Access and Restoration: Contractor and heavy equipment access to the site would be difficult due to the small size of the immediate tank site. Provisions should be included in the specifications for the restoration of any paving, curbing, sidewalks, or other surfaces and structures disturbed by the contractor's work. Appropriate precautions should be taken for work around the chemicals, generator, and equipment adjacent to the tank.

Valve Vault: The ladder should be replaced with a ladder which meets current requirements. The piping and valves located in the valve vault should be cleaned and painted. 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 be modified so that it can be locked at all times in order to limit liability to the Navy and to protect water system security. The sump should be repaired, and a pump should be installed to eliminate the standing water.

Exterior Surfaces:

Exterior Concrete: The concrete exterior surfaces were in generally good condition except for the corrosion observed on some exposed rebar near the top of the shell. The exterior concrete should be re-evaluated in 3 to 4 years to determine if repairs are necessary at that time, especially at the area of exposed rebar previously mentionned. When these areas are repaired, they should be prepared by wet blast cleaning to remove dust, laitance, grease, or other bond inhibiting materials and blown off with high-pressure air. The cracks in the concrete should then be repaired by routing out the crack to a minimum depth of 1 inch (25 mm, with a minimum 90° angle from the

surface) and repairing with a cement-based patching compound. The sequence and performance of these concrete repairs shall be such that the structural integrity of the tank area is not compromised.

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

Shell Manholes: It is recommended that the Navy classify this tank as a confined space, and initiate the appropriate confined space access measures whenever anyone is going to access the tank interior.

Stairs: The handrails on the safety railing should be lowered to be between 30 in. (762 mm) and 34 in. (864 mm). Toe bars should be installed on the exposed sides of the platforms.

Overflow Pipes: The overflow pipe discharges should be equipped with screened, counter-weighted flap gates or elastomeric check valves to prevent the ingress of birds, small animals, and insects into the tank. The air breaks should be adequately sized to allow the proper functioning of the new check valves. The overflow effluent should be directed away from the shell using concrete splash blocks.

Clog-Resistant Vents: The roof vents are not clog-resistant. The AWWA D100 Standard (applicable for steel tanks) recommends that all vents with screening against insects be designed to ensure "fail-safe" operation if the insect screens become occluded. However, AWWA D110 does not require a clog-resistant vent, and a concrete roof is typically capable of withstanding more pressure or vacuum than a steel roof. Until such time as the new vents are installed, the screening should be replaced with new screening which prevents the ingress of insects into the tank. Bolts should be installed in the open bolt holes on the flanges.

Interior Surfaces:

Interior Concrete: The concrete interior of the tank appeared to be in good condition as no significant areas of cracking were noted. The interior surfaces should be re-evaluated in 3 to 4 years to determine if repairs are required at that time.

Interior Piping: The piping should be cleaned to the equivalent of an SSPC-SP 10, Near-White Blast Cleaning and an epoxy coating system applied. This should be performed within the next year.

Interior Ladders: Interior ladders are susceptible to accelerated rates of corrosion. If the Navy decides to keep an interior ladder, the existing access ladders should be replaced with new ladders which meet current OSHA requirements. The existing ladders did not include slip-resistant rungs. Slip-resistant rungs are required for all ladders constructed after March 1991 by the OSHA Construction standards. However, slip-resistant rungs are not required by the OSHA General Industry standards for ladders or by the AWWA standards.

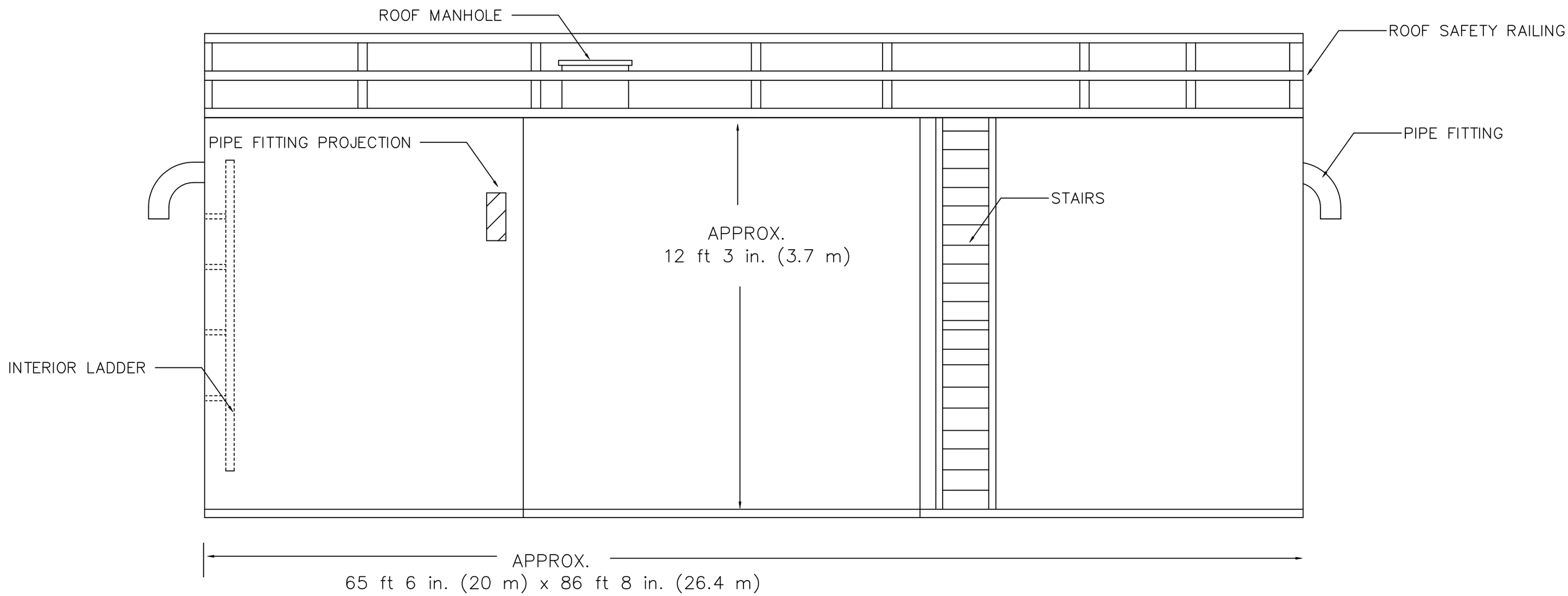
3.5 TANK 612

Tank 612 stores nonpotable water for the Naval Air Station II in Sigonella, Italy.

3.5.1 Description of the Facility

Tank 612 is a three-chamber concrete tank which is located partially below grade and provides 976,720 gallons of nonpotable water storage tank. Measurements taken at the field evaluation indicated the tank projected approximately 12 ft 6 in. (3.8 m) above grade. The exterior of the tank measured approximately 65 ft 6 in. (20 m) x 86 ft 8 in. (26.4 m), and the interior height was approximately 12 ft 3 in. (3.7 m). (See Figure 3.5-1).

TANK 612, NOMENCLATURE



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This drawing is intended only for illustration of report nomenclature and is not for design purposes.
Some features have been eliminated, simplified, relocated, etc., for the sake of clarification and, therefore, do Not reflect the actual configuration.

GRAPHIC SCALE	DATE	TIC Tank Industry Consultants	NAVAL FACILITIES ENGINEERING SERVICE CENTER EAST COAST DETACHMENT WASHINGTON, DC	
NOT TO SCALE	November 2012	Contract Number N62583–10–D–0340	NAVAL AIR STATION I SIGONELLA, ITALY NOMENCLATURE	FIG. NO. 3.5–1

3.5.2 Observed Conditions

Tank 612 is located at the Naval Air Station II in Sigonella, Italy (See photos 3.5-1 through 3.5-3 and 3.5-5). Unused electrical equipment is stored immediately adjacent to the west site of the tank and is enclosed by a chain link fence (See photo 3.5-4). Tank 492 is located east-southeast of the subject tank, and a pump house is attached to the east side of the tank. Vegetation grows through voids between the surrounding asphalt and shell projection.

The concrete shell appears to be in fair condition as there are some hairline cracks. The shell is painted beige with horizontal stripes of maroon coating located around the top and bottom of the shell. The coating has chalked, faded, and peeled in some areas (See photos 3.5-6 and 3.5-7). There is mildew on the shell (See photos 3.5-8 and 3.5-9). A label with the tank number is mounted on the shell (See photo 3.5-10).

Six fittings that function as both overflows and venting project from near the top of the shell and elbow downward before discharging (See photos 3.5-11 through 3.5-13). The fitting discharges are screened, and the screening is intact. There are a few isolated spots of corrosion on the flange and bolts surrounding the screening (See photos 3.5-12 and 3.5-13).

Stairs extend from the ground to the tank roof (See photo 3.5-14). Safety railing is located along the stairs which is constructed of welded pipe members. There is minor corrosion on the safety railing and on the closure chains at the access opening (See photos 3.5-15 and 3.5-16). The 43 in. (1092 mm) height of the handrail exceeds the maximum allowed stair handrail height of 34 in. (864 mm), which is an OSHA deficiency.

Safety railing is also located around the perimeter of the roof which is constructed of welded pipe members. There is peeled coating and corrosion on the safety railing. Toe bars had been installed on the safety railing since the previous field evaluation, however, three of the toe bars are broken (See photos 3.5-20 and 3.5-21). OSHA and safety-related deficiencies include: (1) the 40-3/4 in. (1035 mm) handrail height does not meet the required 42 in. (1067 mm) minimum height, (2) the gaps between the roof and toe bar are more than 1/4 in.

(6 mm) maximum allowed width, and (3) sections of the toe bar are broken (See photos 3.5-20 and 3.5-21).

The concrete roof is in good overall condition as there are only a few hairline cracks (See photos 3.5-22 and 3.5-23). The roof overhangs the shell, and a few minor cracks are located in the overhang which expose rebar. Several capped pipes are located within the concrete on the roof, and what appears to be sensor equipment penetrates the roof adjacent to two of the roof manholes (See photo 3.5-19).

The roof has a manhole above each of the three chambers (See photos 3.5-17 and 3.5-18). The roof manholes have hinged and locked covers. The covers are constructed of steel and are very hard to safely operate.

Most of the interior concrete surfaces are in good condition except that exposed form ties in the south wall have rusted (See photos 3.5-24, 3.5-25, and 3.5-41 through 3.5-45). There are columns in the south and north chambers (See photos 3.5-26 and 3.5-50). A layer of silt restricts the evaluation of the floor (See photos 3.5-46 and 3.5-47).

A ladder is located in each chamber beneath the roof manhole, and the ladders are welded to brackets which are bolted to the shell (See photos 3.5-33 through 3.5-35). The ladders have been replaced since the previous evaluation, but there is corrosion and rust tubercles on the ladders (See photos 3.5-36, 3.5-37, and 3.5-53). There is also corrosion at the abandoned ladder bracket remains in the shell (See photo 3.5-32). The ladders do not have safe-climbing devices. OSHA and safety-related deficiencies include: (1) the 15 in. (381 mm) ladder width does not precisely meet the required 16 in. (406 mm) minimum, and (2) the rust tubercles could injure the climber (See photos 3.5-36, 3.5-37, and 3.5-53).

Pipe openings are located near the top of the shell (See photo 3.5-31). A pipe extends horizontally across the upper shell in one of the chambers and is U-bolted to brackets. There is corrosion on the brackets (See photo 3.5-28). Pipes extend vertically from the roof and are U-bolted to brackets, and there is corrosion on the pipe surfaces below the water line (See photos 3.5-27 and 3.5-

38 through 3.5-40). Pipes project from near the top of the shell and then end above the water line (See photos 3.5-29 and 3.5-30). A pipe projection is located in a sump, and there is silt in the sump (See photos 3.5-48 and 3.5-49). Pipes penetrate near the middle of the shell in the outlet chamber, and there are widespread corrosion rust tubercles on them (See photos 3.5-51, 3.5-52, and 3.5-54 through 3.5-56). Another pipe is located on the floor of the outlet chamber which is covered with corrosion and appeared to be loose (See photo 3.5-57).

PHOTO 3.5-1 Tank 612 and site.

PHOTO 3.5-2 Tank 612.

PHOTO 3.5-3 Tank 612.

PHOTO 3.5-4 Tank 612 and unused electrical equipment stored adjacent to tank.

PHOTO 3.5-5 Access to site.

PHOTO 3.5-6 Peeled coating near base of shell.

PHOTO 3.5-7 Peeled coating on shell. Note vegetation.

PHOTO 3.5-8 Mildew and dirt on shell.

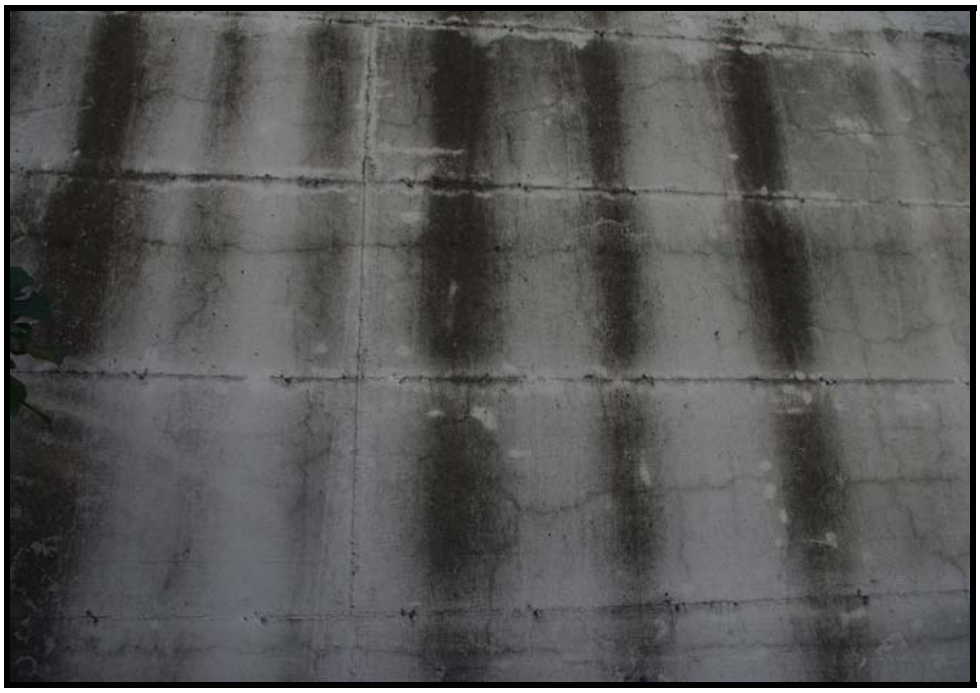


PHOTO 3.5-9 Mildew and dirt on shell.

PHOTO 3.5-10 Tank number.

PHOTO 3.5-11 Elbowed pipe fitting.

PHOTO 3.5-12 Elbowed pipe fitting. Note corrosion on bolt.

PHOTO 3.5-13 Elbowed pipe fitting. Note corrosion.

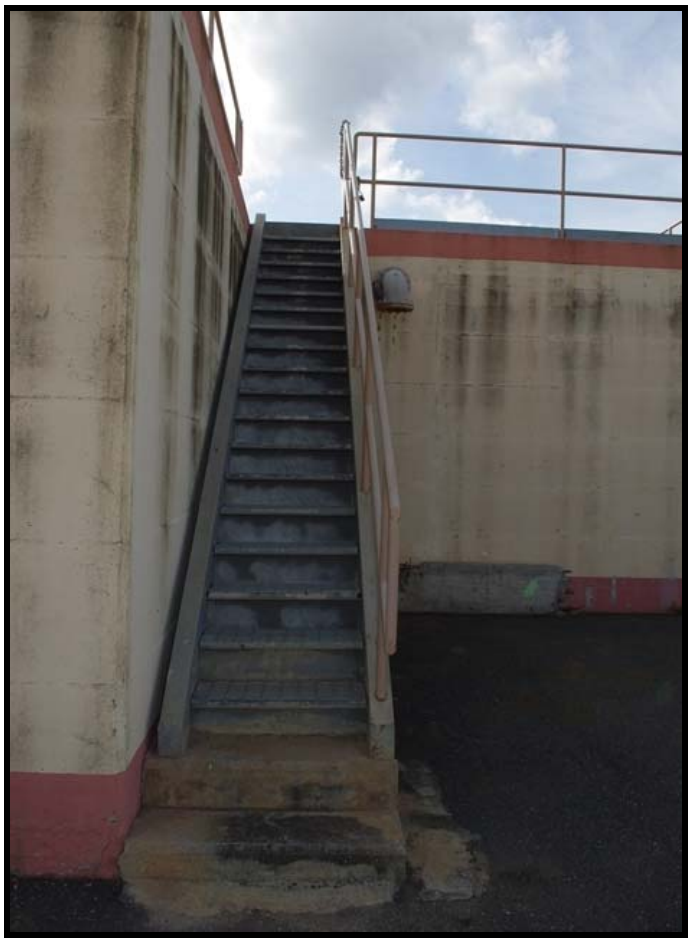


PHOTO 3.5-14 Stairs.

PHOTO 3.5-15 Corrosion on stairs.

PHOTO 3.5-16 Chain at roof access.

PHOTO 3.5-17 Roof manholes.

PHOTO 3.5-18 Roof manhole.

PHOTO 3.5-19 Equipment adjacent to roof manhole.

PHOTO 3.5-20 Missing toe bar section along roof safety railing.

PHOTO 3.5-21 Broken toe bar section.

PHOTO 3.5-22 Roof exterior.

PHOTO 3.5-23 Roof exterior.

PHOTO 3.5-24 Roof interior.

PHOTO 3.5-25 Roof interior.

PHOTO 3.5-26 Roof and columns.

PHOTO 3.5-27 Piping in tank.

PHOTO 3.5-28 Piping in tank.

PHOTO 3.5-29 Piping in tank.

PHOTO 3.5-30 Piping in tank.

PHOTO 3.5-31 Pipe opening.

PHOTO 3.5-32 Corrosion at previous bracket bolt remains in shell.

PHOTO 3.5-33 Shell and interior ladder.

PHOTO 3.5-34 Interior ladder.

PHOTO 3.5-35 Interior ladder.

PHOTO 3.5-36 Corrosion and rust tubercles on interior ladder and bracket.

PHOTO 3.5-37 Corrosion and rust tubercles on interior ladder.

PHOTO 3.5-38 Interior piping.

PHOTO 3.5-39 Interior piping.

PHOTO 3.5-40 Interior piping.

PHOTO 3.5-41 Corrosion at exposed steel on shell.

PHOTO 3.5-42 Shell interior.

PHOTO 3.5-43 Shell interior.

PHOTO 3.5-44 Corrosion at exposed steel in shell.

PHOTO 3.5-45 Shell interior.

PHOTO 3.5-46 Shell and floor.

PHOTO 3.5-47 Shell and floor.

PHOTO 3.5-48 Silt in sump.

PHOTO 3.5-49 Piping in sump.

PHOTO 3.5-50 Column.

PHOTO 3.5-51 Outlet chamber.

PHOTO 3.5-52 Corrosion and rust tubercles on piping and bracket in outlet chamber.

PHOTO 3.5-53 Corrosion on ladder in outlet chamber.

PHOTO 3.5-54 Corrosion and rust tubercles on piping in outlet chamber.

PHOTO 3.5-55 Corrosion and rust tubercles on piping in outlet chamber.

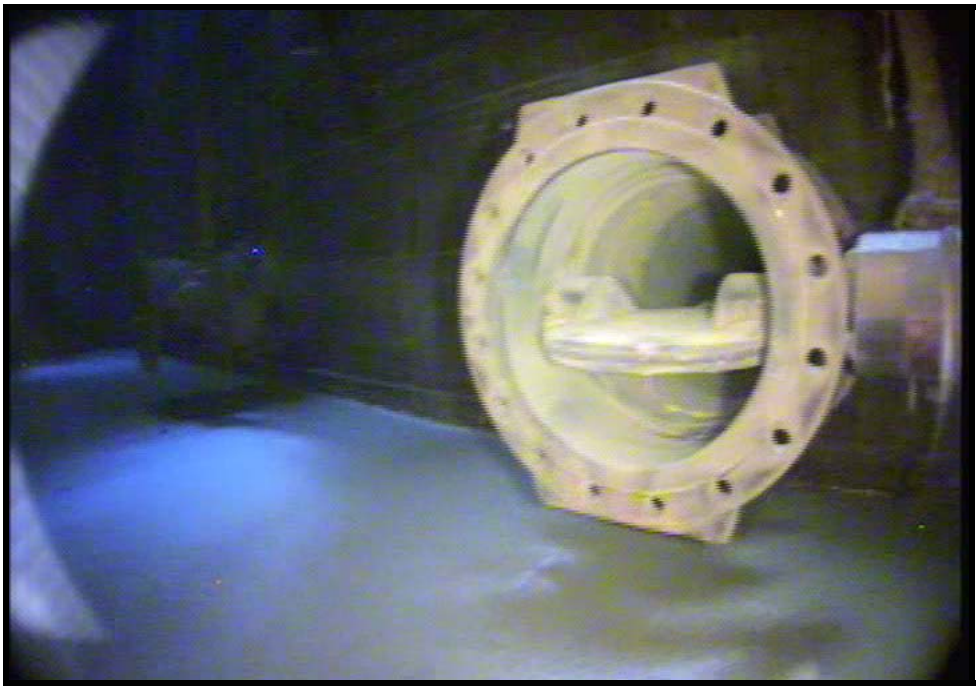


PHOTO 3.5-56 Piping in outlet chamber.

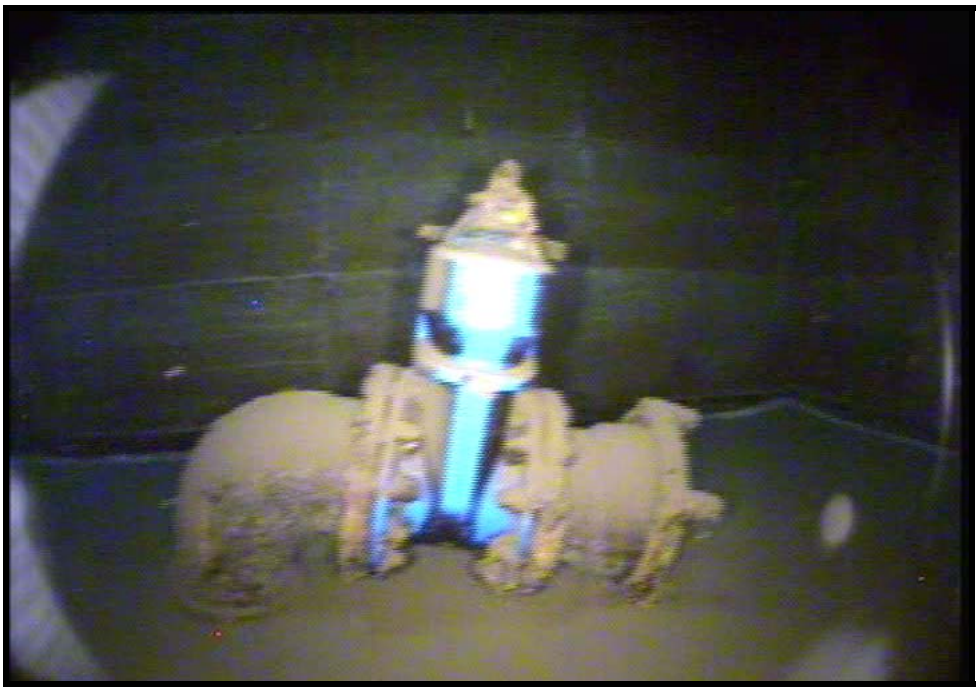


PHOTO 3.5-57 Corrosion and rust tubercles on loose piping in outlet chamber.

3.5.3 Comparison of Previous Inspection Results

The tank was previously evaluated by Tank Industry Consultants on March 6, 2008, and evaluation report CR-6480-OCN was issued. Since the time of the previous evaluation:

- The pipe fittings which function as a means of overflow and venting have been painted.
- The interior ladders have been replaced.
- Toe bars have been installed on the roof safety railing.

3.5.4 Structural Condition Assessment

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 Navy and the Engineer.

This tank is located in a seismically active region. This evaluation and reported condition do not verify the tank's original design compliance for seismic or coastal wind loading in accordance with current design requirements, as it was outside the scope of this report. Likewise, recommendations for this tank do not include modifications that 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.

3.5.5 Recommendations

Site:

Site Maintenance: The site should be maintained so that proper drainage away from the tank continues. The vegetation growing between the tank and the surrounding asphalt should be removed. The Navy may wish to consider a flexible sealant to this area to prevent vegetation from growing in this area in the future, and run-off water from accumulating in this area.

Site Access and Restoration: Contractor and heavy equipment access to the site would be difficult due to the small size of the immediate tank site. Provisions should be included in the specifications for the restoration of any paving, curbing, sidewalks, or other surfaces and structures disturbed by the contractor's work.

Exterior Surfaces:

Exterior Concrete: The exterior concrete surfaces were in generally good overall condition as no significant cracking and spalling were noted. The exterior surfaces should be re-evaluated in 4 to 5 years to determine if repairs are required at that time. When cracks develop, they should be prepared according to the specifications of the concrete crack repair material manufacturer. These areas to be repaired should be prepared by wet blast cleaning to remove dust, laitance, grease, or other bond inhibiting materials and blown off with high-pressure air. The cracks in the concrete should then be repaired by routing out the crack to a minimum depth of 1 in. (25 mm, with a minimum 90° angle from the surface) and repairing with a cement-based patching compound. The sequence and performance of these concrete repairs shall be such that the structural integrity of the tank area is not compromised.

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

Shell Manholes: It is recommended that the Navy classify this tank as a confined space, and initiate the appropriate confined space access measures whenever anyone is going to access the tank interior.

Pipe Fittings: Installing an elastomeric check valve on the discharge end of the elbowed pipe projections would prevent the ingress of birds, small animals, and insects into the tank and deter clogging. However, a new means of ventilation would need to be installed.

Clog-Resistant Vents: The tank does not have clog-resistant vents. The AWWA D100 Standard (applicable for steel tanks) recommends that all vents with screening against insects be designed to ensure "fail-safe" operation if the insect screens become occluded. However, AWWA D110 does not require a clog-resistant vent, and a concrete roof is typically capable of withstanding more pressure or vacuum than a steel roof.

Stairs: The handrail on the stair safety railing should be lowered to be between 30 in. (762 mm) and 34 in. (864 mm).

Roof Safety Railing: The broken sections of toe bar should be replaced, and the toe bars should be lowered so there is less than a 1/4 in. (6 mm) wide gap between them and the roof. The handrail should be raised to be at least 42 in. (1067 mm) above the roof.

Interior Surfaces:

Interior Concrete: The interior concrete surfaces appeared to be in adequate condition as no significant cracking and chipping were observed. The interior surfaces should be re-evaluated in 3 to 4 years to determine if repairs are required at that time.

Interior Piping: The interior piping should be cleaned to the equivalent of an SSPC-SP 10, Near-White Blast Cleaning and an epoxy coating system applied. This should be performed within the next year. The pipe in the outlet chamber should be reattached or removed.

Interior Ladders: Interior ladders are susceptible to accelerated rates of corrosion. If the Navy decides to keep an interior ladder, the existing access ladders should be replaced with new ladders which meet current OSHA requirements. The existing ladders did not include slip-resistant rungs. Slip-resistant rungs are required for all ladders constructed after March 1991 by the OSHA Construction standards.

However, slip-resistant rungs are not required by the OSHA General Industry standards for ladders or by the AWWA standards.

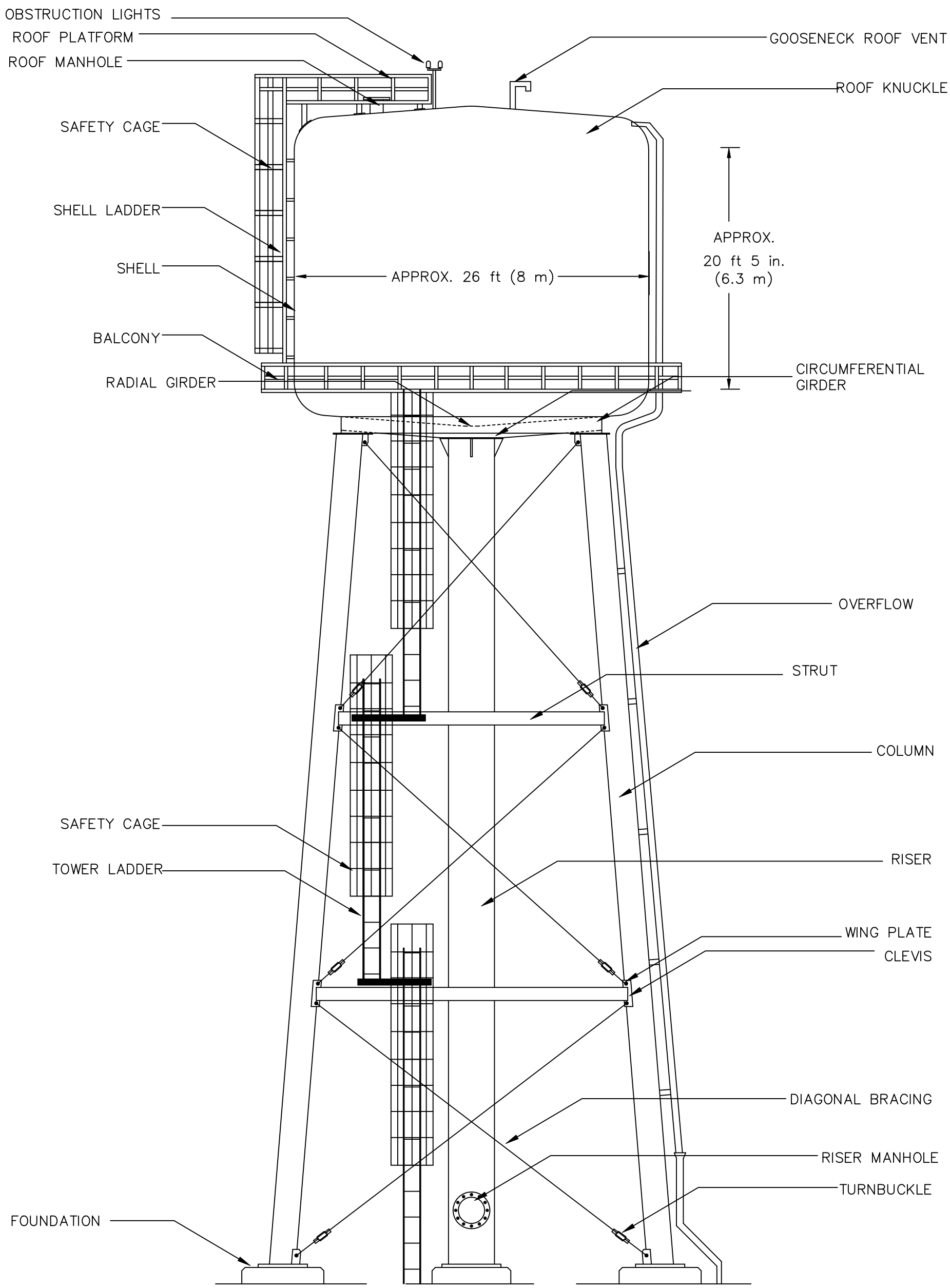
3.6 TANK 307

Tank 307 provides potable water for Naval Air Station I in Sigonella, Italy. Ongoing work operations were being performed on the tank at the time of the field evaluation which reportedly included topcoating the exterior, replacing the top of the riser, and pressure washing the interior surfaces.

3.6.1 Description of the Facility

Tank 307 is a 210,000 gallon steel elevated water storage tank. The column and stiffener supported roof, radial cone bowl tank is of welded steel construction. Measurements taken during the field evaluation indicated that the tank diameter was approximately 26 ft (8 m), and the shell height was approximately 20 ft 5 in. (6.3 m). (See Figure 3.6-1).

NOMENCLATURE, TANK 307



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GRAPHIC SCALE	DATE	TIC Tank Industry Consultants	NAVAL FACILITIES ENGINEERING SERVICE CENTER EAST COAST DETACHMENT WASHINGTON, DC	
NOT TO SCALE	November 2012	Contract Number N62583–10–D–0340	NAVAL AIR STATION SIGONELLA, ITALY NOMENCLATURE	FIG. NO. 3.6–1

3.6.2 Observed Conditions

Tank 307 is located at the Naval Air Station I in Sigonella, Italy. The tank was undergoing work operations at the time of the field evaluation which restricted its evaluation (See photo 3.6-2). The size of the site is limited as a pump house, horizontal tank, shed, and building are located in close proximity to the tank (See photo 3.6-1). Overhead power lines are attached to a strut between columns # 6 and #7. A chain link fence enclosing the site and includes two locked gates. A valve vault is located east of the tank on the site, and the access into the vault does not have a lock (See photo 3.6-3). The piping in the vault appears to be new (See photo 3.6-4).

All of the foundations have a concrete cap which do not allow for visual evaluation of the foundations, base plates, and anchor bolts. The evaluation was also restricted at the time of the field evaluation by the safety netting strung around the base of the tower because of the work operations (See photo 3.6-6). The visible concrete cap surfaces appear to have been resurfaced since the previous evaluation and are in adequate condition (See photos 3.6-7 and 3.6-8). The tops of the column foundations do not have the recommended projection of 6 in. (152 mm) to 12 in. (305 mm) above grade and are located below grade in areas under columns #1 and #2. The riser foundation exhibits the recommended projection.

It appears the exterior surfaces have been topcoated since the previous evaluation and are in good condition. The exterior coating is in the FAA checkerboard paint scheme. The coating exhibited very poor adhesion at the time of the field evaluation. The columns are numbered such that the column with the overflow pipe is column #1, and the columns are numbered clockwise.

The welded steel columns appear to be in nearly their original structural condition. The coating is in good condition as there are no significant areas of corrosion or coating failure (See photos 3.6-15 through 3.6-17 and 3.6-23). The exterior column coating exhibits very poor adhesion to the underlying coating. Each of the columns has a grounding cable. Conduits and antenna equipment are located on the columns.

The welded steel riser and most of it appears to be in nearly its original structural condition. The coating on most of the riser is in good condition as there are no significant areas of corrosion or coating failure (See photo 3.6-13). The coating exhibits

very poor adhesion to the underlying coating. The riser has a flanged and bolted manhole which has eight gussets welded to the riser and to the manhole neck. The riser manhole cover has a hinged support. A pipe penetrates the riser manhole cover (See photos 3.6-9 and 3.6-10). Significant corrosion and pack rust are located around the top of the riser just below the bowl where work operations were occurring at the time of the field evaluation (See photos 3.6-20 through 3.6-22).

The diagonal bracing coating appears to be in good condition as there are no significant areas of corrosion or coating failure noted (See photos 3.6-15 and 3.6-16). The coating exhibits very poor adhesion to the underlying coating. The diagonal bracing rods are not upset on the ends, but the rods have turnbuckles, clevises, and wing plates. The diagonal bracing rods are pinned to the column wing plates but not welded.

The tower has four sets of struts which are constructed of pipe members. The struts are welded to clevises that are bolted to the column wing plates. The struts are in nearly their original condition at the time of this field evaluation. The strut coating exhibits very poor adhesion to the steel. An antenna cable extends along one of the struts between the columns (See photos 3.6-15 and 3.6-16)

The overflow pipe exits through the roof knuckle and extends down the shell, through the balcony, and down a column before discharging within a funnel (See photos 3.6-5 and 3.6-36). The overflow pipe is constructed of flanged and bolted pipe sections. The pipe is flat bar banded to steel brackets to the column and shell (See photo 3.6-35). There are no significant areas of corrosion on the overflow pipe.

A tower ladder extends from near grade to the balcony and has two platforms (See photos 3.6-11 and 3.6-28). The three ladder sections have safety cages which are constructed of welded flat bar members (See photo 3.6-29). The ladder sections are welded to brackets which are clamped to the struts and located between columns #3 and #4. The tower ladder and brackets appear to be in nearly their original structural condition. A hinged and locked ladder gate-type vandal deterrent is located at the base of the safety cage. However, the back side of the ladder and openings in the safety cage could allow unauthorized personnel to get around the locked gate at the bottom of the cage (See photo 3.6-14). An antenna cable is attached to sections of the safety cage with nylon straps. Safety-related and OSHA deficiencies include: (1) the 12-

3/4 in. (324 mm) width does not meet the required 16 in. (406 mm) minimum, (2) the 18 in. (457 mm) head clearance does not meet the required 30 in. (762 mm) minimum, (3) the length of ladder sections between the offset platforms exceeds the 20 ft (6 m) maximum, (4) the safety cage width of 23 in. (584 mm) does not meet the required 27 in. (686 mm) minimum, (5) the safety cage depth of 21-5/8 in. (549 mm) does not meet the required 27 in. (686 mm) minimum, (6) the 1 in. (25 mm) minimum toe room at the bottom platform support channel does not meet the required 7 in. (178 mm) minimum, (7) the 2 in. (50 mm) x 1-3/16 in. (30 mm) x 1/4 in. (6 mm) side rails do not meet the required minimum of 2-1/2 in. (64 mm) x 3/8 in. (9 mm), and (8) the vandal deterrent is not adequate prevent unauthorized personnel from accessing the ladder.

The tower ladder has two offset platforms which are located at the second and fourth strut levels. The platform floors are constructed from a galvanized steel grating resting in a steel angle frame with safety railing which is constructed of welded angle members. Safety-related and OSHA deficiencies include: (1) the 39-1/4 in. (997 mm) handrail height does not meet the required 42 in. (1067 mm) minimum, (2) the 2 in. (50 mm) x 2 in. (50 mm) x 3/16 in. (5 mm) handrail does not precisely meet the required 2 in. (50 mm) x 2 in. (50 mm) x 3/8 in. (9 mm) minimum, (3) the 2 in. (50 mm) x 2 in. (50 mm) x 3/16 in. (5 mm) uprights do not precisely meet the required 2 in. (50 mm) x 2 in. (50 mm) x 3/8 in. (9 mm) minimum, (4) the 1-1/2 in. (40 mm) x 1-1/2 in. (40 mm) x 3/16 in. (5 mm) mid-rail does not meet the required 2 in. (50 mm) x 2 in. (50 mm) x 3/8 in. (9 mm) minimum, (5) the toe bar height of 2-1/4 in. (57 mm) does not meet the required 4 in. (102 mm) minimum, and (6) the access openings do not have closure chains.

The container bottom support structure consists of radial girders, an outer circumferential girder, and three inner rings of circumferential girders. Work operations to repair the riser projection through the bowl were being performed on the bowl at the time of the field evaluation (See photos 3.6-17 through 3.6-22). Prior repairs appear to have been made to the ends of the radial girders near the center of the tank since the last evaluation. Some of the welds for these repairs are quite rough. There are corrosion and pack rust on the bowl and girders, and at the top of the riser. The bowl coating exhibits very poor adhesion to the steel. The coating on the bowl knuckle and outer girder surfaces is in good condition as there is no significant corrosion (See photos 3.6-23 and 3.6-24).

The balcony is accessed from the tower ladder by an opening in the balcony floor (See photo 3.6-30). The balcony floor is constructed from a galvanized steel grating resting on radial channel supports between an inner circumferential angle support and an outer circumferential channel support (See photos 3.6-25 and 3.6-33). There is corrosion on the topside of the channel supports (See photo 3.6-32). The balcony safety railing is constructed of welded and bolted angles and flat bars. There is corrosion on some of the support angles under the balcony floor. No significant corrosion is located on the safety railing, and the coating exhibits very poor adhesion to the underlying coating. Safety-related and OSHA deficiencies include: (1) the 39-3/4 in. (1010 mm) handrail height does not meet the required 42 in. (1067 mm) minimum, (2) the 2 in. (50 mm) x 2 in. (50 mm) x 1/4 in. (6 mm) handrail does not precisely meet the required 2 in. (50 mm) x 2 in. (50 mm) x 3/8 in. (9 mm) minimum, (3) the 2 in. (50 mm) x 2 in. (50 mm) x 1/4 in. (6 mm) uprights do not precisely meet the required 2 in. (50 mm) x 2 in. (50 mm) x 3/8 in. (9 mm) minimum, (4) the 1-1/2 in. (40 mm) x 1-1/2 in. (40 mm) x 3/16 in. (5 mm) mid-rail does not precisely meet the required 2 in. (50 mm) x 2 in. (50 mm) x 3/8 in. (9 mm) minimum, (5) the safety railing toe bar height of 3-1/4 in. (83 mm) does not meet the required 4 in. (102 mm) minimum, (6) the access opening through the floor does not have a closable cover (See photo 3.6-30), and (7) the access opening does not have a 4 in. (102 mm) high curb (See photo 3.6-30).

The remains of a target gage are located on the east side of the shell, and the broken cable for the target gage is lying on the balcony (See photos 3.6-31 and 3.6-37). The target gage is not capable of operating properly due to the broken cable.

The evaluation of the shell was restricted by the work operations occurring on the container at the time of the field evaluation (See photo 3.6-27). The contour of the shell is good as there are no significant irregularities. Except for a few isolated spots of corrosion, the shell coating is in good condition (See photos 3.6-26 and 3.6-39 through 3.6-41). The shell coating exhibits poor adhesion to the shell. Three conduits extend up the shell (See photo 3.6-38).

The shell ladder is bolted to brackets which are welded to the container, and the shell ladder and brackets appear to be in nearly their original structural condition. The ladder has a safety cage which is constructed of welded members (See photo 3.6-34). An antenna cable is attached to the ladder safety cage with nylon straps. The shell

ladder side rails extend into terminals at the roof platform. Safety-related and OSHA deficiencies include: (1) the width between side rails of 11-5/8 in. (295 mm) does not meet the required 16 in. (406 mm) minimum, (2) the 6-1/2 in. (165 mm) toe room does not precisely meet the required 7 in. (178 mm) minimum, (3) the 1-1/2 in. (40 mm) x 1-1/2 in. (40 mm) x 3/16 in. (5 mm) side rails do not meet the required 2-1/2 in. (64 mm) x 3/8 in. (9 mm) minimum, (4) the 23-1/2 in. (597 mm) safety cage width does not meet the required 27 in. (686 mm) minimum, and (5) the 20-5/8 in. (524 mm) safety cage depth does not meet the required 27 in. (686 mm) minimum.

The contour of the roof appears to be adequate as there are no significant irregularities noted. No significant areas of corrosion or coating failure are located on the roof. The roof coating exhibits fair adhesion to the underlying coating. There are three cabinets, one broken pressure gage box, two sensor cabinets, and one level indicating gage mounted on the roof (See photos 3.6-46, 3.6-48, 3.6-49, and 3.6-55). Cathodic protection anode hand holes and cover plates are located in the roof, and most of the cover plates are misaligned which allows water run-off or insects to enter the tank. Wiring for the cathodic protection system is also lying on the roof. An antenna and an unused antenna bracket are also located on the roof (See photos 3.6-45 and 4.6-54). Four unused bolted cover plates are also located on the roof (See photo 3.6-43). Three erection brackets are located on the roof just below the roof cap, and several unused brackets and lugs are located on the roof (See photos 3.6-42, 3.6-44, and 3.6-47). The erection brackets, unused brackets, and lugs should not be used for rigging purposes or personnel access. The uncovered openings in the roof create a sanitary deficiency.

A platform extends from the top of the shell ladder to near the center of the roof. The platform floor is constructed from a galvanized steel grating resting in a steel angle frame, and the platform has safety railing which is constructed of welded angle members. The railing also extends around the roof manhole. Four antennas and associated equipment are mounted to the platform safety railing (See photos 3.6-51 and 3.6-53). Safety-related and OSHA deficiencies include: (1) the 39-3/4 in. (1010 mm) handrail height does not meet the required 42 in. (1067 mm) minimum, (2) the 2 in. (50 mm) x 2 in. (50 mm) x 1/4 in. (6 mm) handrail does not precisely meet the required 2 in. (50 mm) x 2 in. (50 mm) x 3/8 in. (9 mm) minimum, (3) the 2 in. (50 mm) x 2 in. (50 mm) x 1/4 in. (6 mm) uprights do not precisely meet the required 2 in. (50 mm) x

2 in. (50 mm) x 3/8 in. (9 mm) minimum, (4) the 1-1/2 in. (40 mm) x 1-1/2 in. (40 mm) x 3/16 in. (5 mm) mid-rail does not precisely meet the required 2 in. (50 mm) x 2 in. (50 mm) x 3/8 in. (9 mm) minimum, (5) the safety railing toe bar height of 3-1/4 in. (85 mm) does not meet the required 4 in. (102 mm) minimum, and (6) the access opening does not have closure chains.

The roof has one flanged manhole which has a bolted cover. The manhole is welded on the interior and exterior. The roof manhole does not have lock. Corrosion and scale rust are located in the manhole surfaces (See photo 3.6-52). Safety-related, OSHA, sanitary, and AWWA deficiencies include: (1) the roof has only one manhole, (2) the manhole cover does not have a gasket, and (3) the manhole cover was not locked.

The roof has a gooseneck-type vent located in the approximate center of the roof (See photo 3.6-49). The screening on the roof vent is intact although it is not adequately sized to prevent the ingress of insects into the tank (See photo 3.6-50). There is rust staining on the screening (See photo 3.6-50). AWWA, sanitary, and operational deficiencies include: (1) the roof vent is not clog-resistant, and (2) the screening on the roof vent is not restrictive enough to prevent the ingress of insects into the tank.

The roof has two single-globe obstruction lights mounted near the vent at the end of the roof platform (See photo 3.6-56). The fixtures are approximately 6 ft (1.8 m) above the roof platform and do not appear to be equipped with a photoelectric cell. The obstruction lights were illuminated at the time of this field evaluation.

The interior roof support structure consists of radial roof stiffeners that are intermittently welded to the roof and purlins bolted to the stiffeners. The coating on the interior roof plates and on the support structure is in very poor condition as there is widespread corrosion and metal loss (See photos 3.6-57 through 3.6-68). There is significant metal loss on the purlin bolts. The inner ends of the stiffeners rest on a center hub that is located at the top of a center column. The center column is constructed of a pipe and extends down from the center hub to the top of the riser projection. Extensive corrosion is located on the column (See photos 3.6-76 and 3.6-77). Daylight is visible around the cathodic protection hand hole covers plates (See photo 3.6-62).

The interior shell and bowl coating are in poor condition. There are widespread areas of corrosion observed on the interior shell and bowl surfaces (See photos 3.6-69 through 3.6-71 and 3.6-73 through 3.6-75). The evaluation of the bowl was restricted by the work operations occurring at the time of the field evaluation (See photo 3.6-76).

The overflow pipe has an open pipe inlet. The location of the overflow inlet is such that the top capacity level is above the roof cap-to-roof knuckle connection. The location of the overflow level above the unwelded roof cap seam is an AWWA deficiency.

Due to its configuration, the riser cannot be accessed for evaluation. Openings at the top of the riser allow for the inward and outward flow of water (See photo 3.6-78). Corrosion is located on the visible part of the riser projection.

The container has a cathodic protection system which consists of cast iron anodes supported from the roof of the tank (See photos 3.6-71 and 3.6-72). The wiring appears to be intact, but the system does not appear to be operating as extensive corrosion is located below high the water line.

PHOTO 3.6-1 Tank 307 and site.

PHOTO 3.6-2 Tank 307.

PHOTO 3.6-3 Valve vault exterior.

PHOTO 3.6-4 Valve vault piping.

PHOTO 3.6-5 Overflow pipe discharge within a funnel.

PHOTO 3.6-6 Conduits extending up column.

PHOTO 3.6-7 Column foundation.

PHOTO 3.6-8 Riser foundation.

PHOTO 3.6-9 Riser piping.

PHOTO 3.6-10 Riser piping and manhole neck.

PHOTO 3.6-11 Tower ladder safety cage.

PHOTO 3.6-12 Tower and scaffold equipment.

PHOTO 3.6-13 Tower and scaffold equipment.

PHOTO 3.6-14 Tower ladder, safety cage, and vandal deterrent.

PHOTO 3.6-15 Column, strut, diagonal bracing, and antenna cable.

PHOTO 3.6-16 Column, strut, diagonal bracing, and antenna cable.

PHOTO 3.6-17 Column, riser, and underside of bowl during work operations.

PHOTO 3.6-18 Radial girders with repairs.

PHOTO 3.6-19 Rough welding on radial girders.

PHOTO 3.6-20 Underside of bowl and top of riser.

PHOTO 3.6-21 Underside of bowl and top of riser.

PHOTO 3.6-22 Underside of bowl and top of riser.

PHOTO 3.6-23 Column and underside of bowl.

PHOTO 3.6-24 Bowl.

PHOTO 3.6-25 Underside of balcony.

PHOTO 3.6-26 Exterior container.

PHOTO 3.6-27 Container during work operations.

PHOTO 3.6-28 Tower ladder.

PHOTO 3.6-29 Tower ladder and safety cage.

PHOTO 3.6-30 Balcony access.

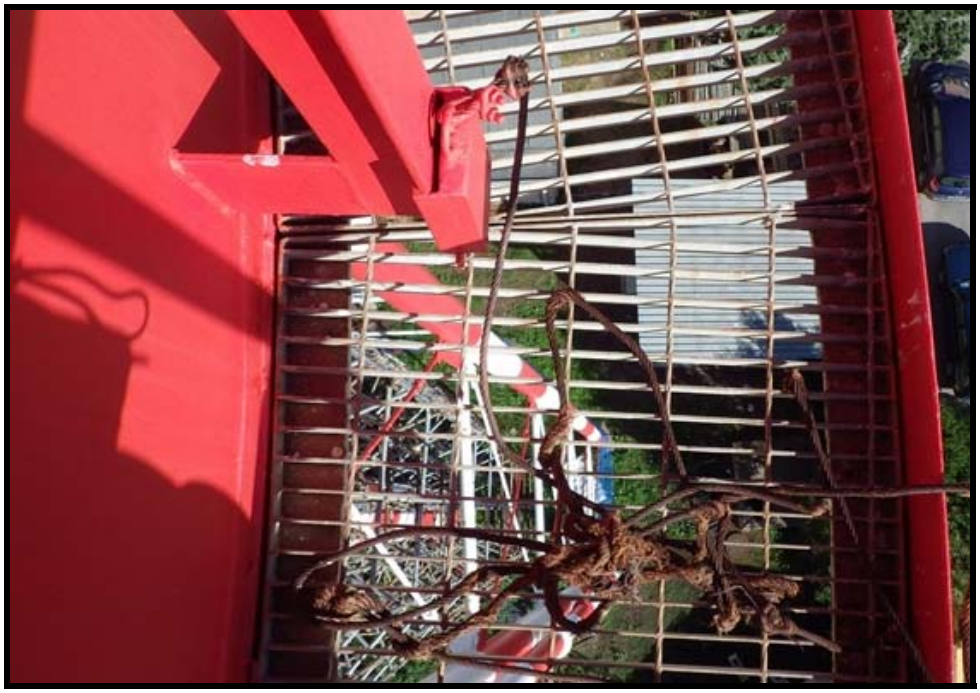


PHOTO 3.6-31 Broken target gage cable on balcony.

PHOTO 3.6-32 Corrosion on balcony support structure members.

PHOTO 3.6-33 Balcony.

PHOTO 3.6-34 Shell ladder and safety cage.

PHOTO 3.6-35 Overflow pipe and brackets.

PHOTO 3.6-36 Overflow pipe along shell.

PHOTO 3.6-37 Abandoned target gage bracket on shell.

PHOTO 3.6-38 Conduits on shell.

PHOTO 3.6-39 Shell exterior.

PHOTO 3.6-40 Shell exterior.

PHOTO 3.6-41 Spot coating failure on shell.

PHOTO 3.6-42 Roof exterior. Note unused brackets.

PHOTO 3.6-43 Covered opening in roof.

PHOTO 3.6-44 Abandoned target gage equipment, brackets, and overflow pipe on roof.

PHOTO 3.6-45 Unused antenna bracket on roof.

PHOTO 3.6-46 Rust staining around sensor equipment on roof.

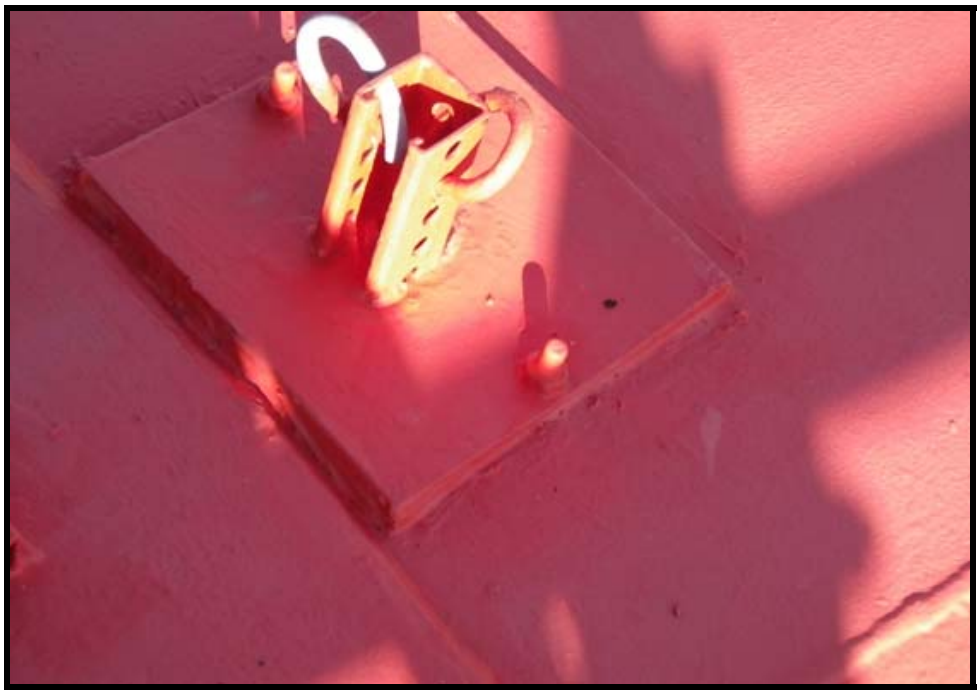


PHOTO 3.6-47 Unused bracket on roof.

PHOTO 3.6-48 Equipment on roof.

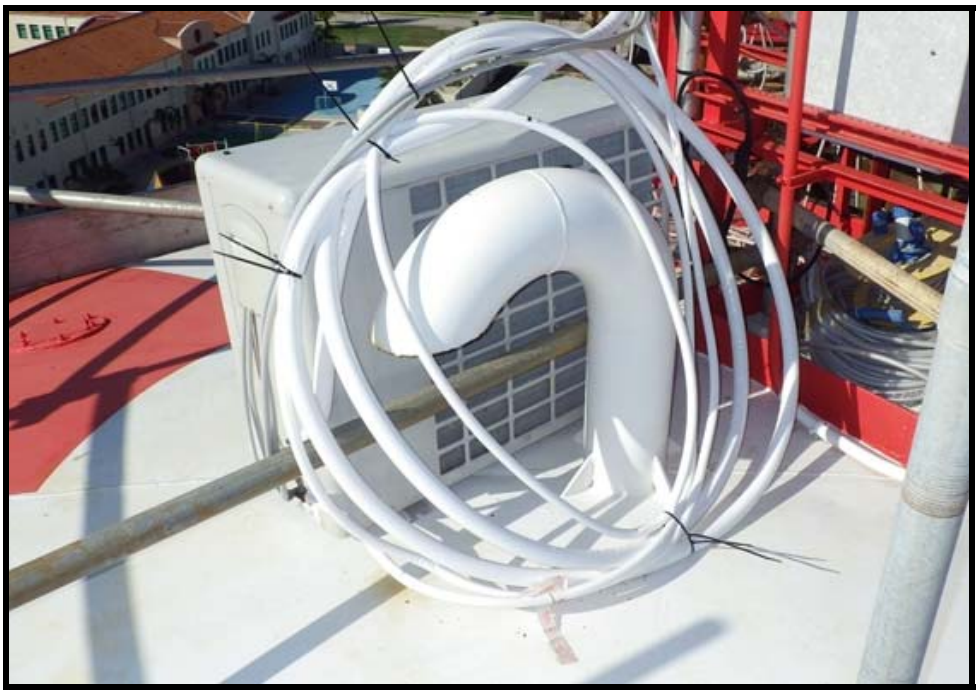


PHOTO 3.6-49 Roof vent and equipment.

PHOTO 3.6-50 Rust staining on roof vent screening.

PHOTO 3.6-51 Equipment on roof platform.

PHOTO 3.6-52 Corrosion around roof manhole opening.

PHOTO 3.6-53 Equipment on roof platform.

PHOTO 3.6-54 Antenna and equipment on roof.

PHOTO 3.6-55 Equipment on roof.

PHOTO 3.6-56 Obstruction lights on roof.

PHOTO 3.6-57 Corrosion on roof interior and support structure.

PHOTO 3.6-58 Corrosion on roof interior and support structure.

PHOTO 3.6-59 Corrosion and metal loss on roof interior and support structure.

PHOTO 3.6-60 Corrosion on roof interior and support structure.

PHOTO 3.6-61 Corrosion on roof interior and support structure.

PHOTO 3.6-62 Corrosion on roof interior and support structure. Note daylight around cathodic protection equipment.

PHOTO 3.6-63 Corrosion on roof interior and support structure.

PHOTO 3.6-64 Corrosion on roof interior and support structure.

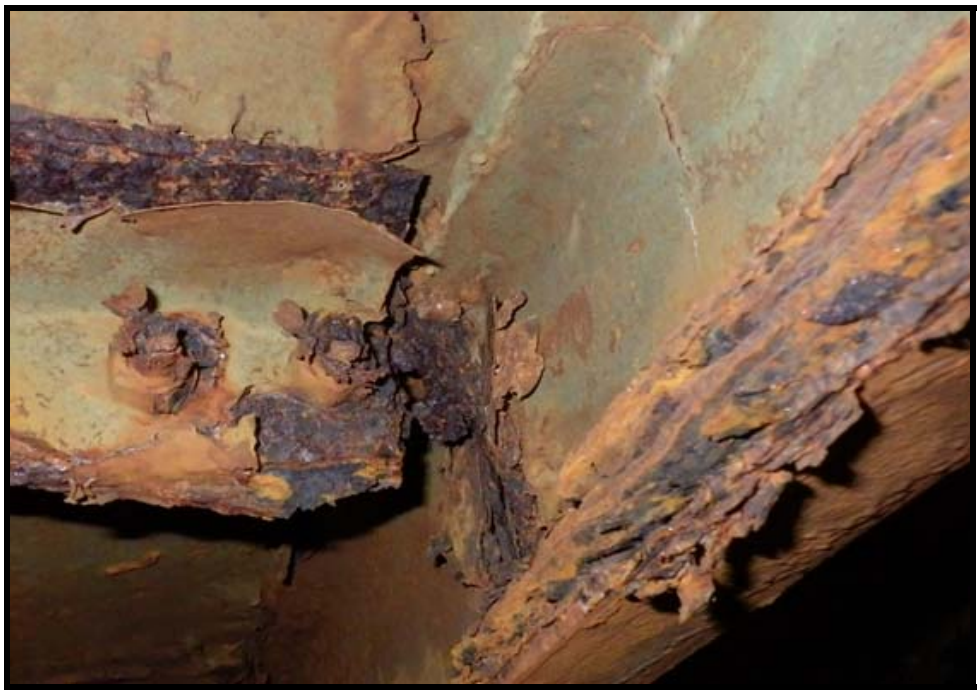


PHOTO 3.6-65 Corrosion and metal loss on roof interior and support structure.

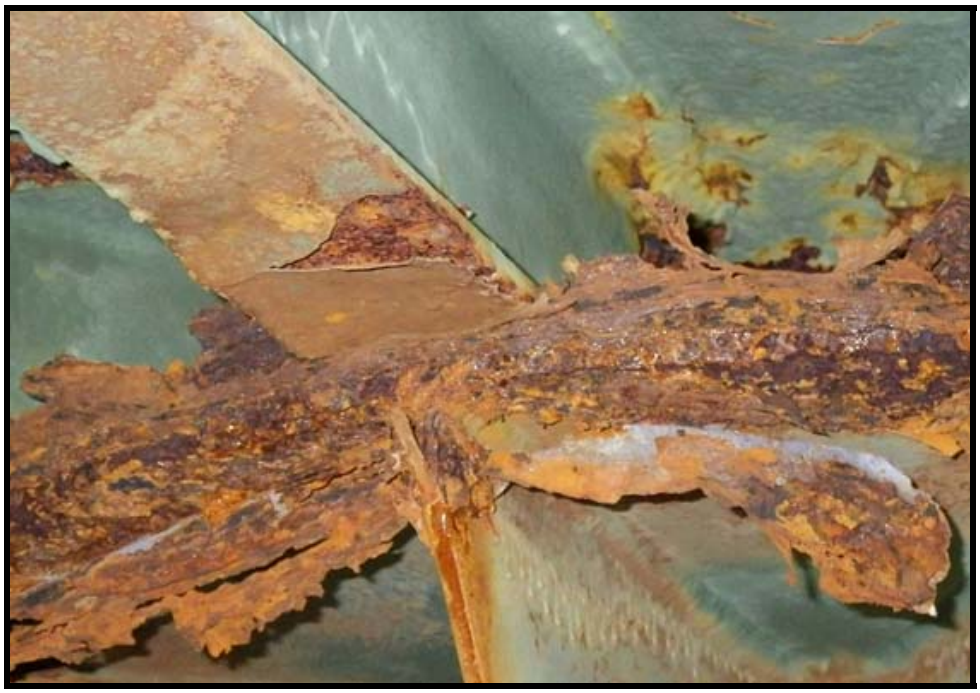


PHOTO 3.6-66 Corrosion and metal loss on roof interior and support structure.

PHOTO 3.6-67 Corrosion and metal loss on roof, stiffener, and bolts.

PHOTO 3.6-68 Corrosion and metal loss on roof, stiffener, and bolts.

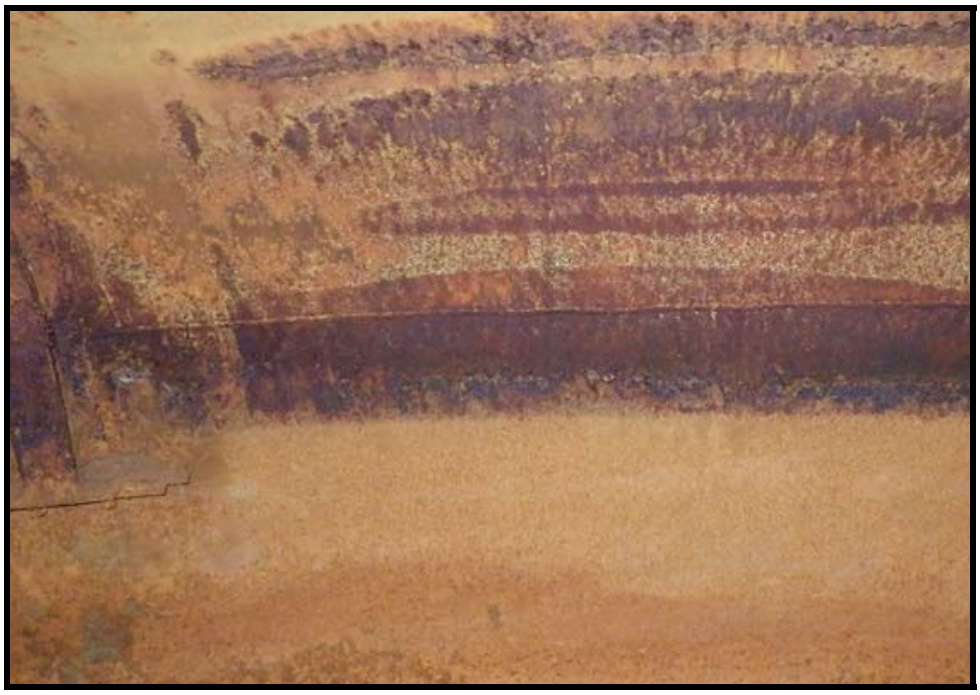


PHOTO 3.6-69 Corrosion on shell.

PHOTO 3.6-70 Corrosion on shell.

PHOTO 3.6-71 Corrosion on bowl. Note cathodic protection equipment.

PHOTO 3.6-72 Cathodic protection equipment.

PHOTO 3.6-73 Corrosion on bowl.

PHOTO 3.6-74 Corrosion on bowl.

PHOTO 3.6-75 Bowl interior.

PHOTO 3.6-76 Corrosion on column and bowl. Note photo taken during work operations.

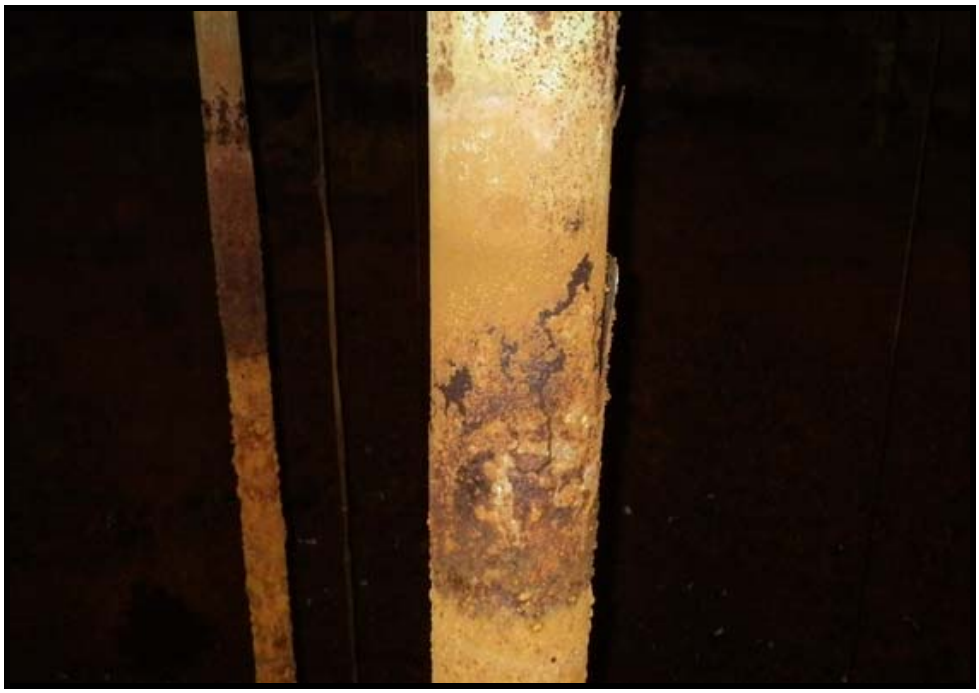


PHOTO 3.6-77 Corrosion on column.

PHOTO 3.6-78 Corrosion on riser projection around inlet/outlet pipe opening.

3.6.3 Comparison of Previous Inspection Results

The exterior of the tank was previously evaluated on March 7, 2008 and report CR-6480-OCN was issued. The exterior was also evaluated by Tank Industry Consultants on March 10, 2002, and the interior surfaces were able to be evaluated by a diver with the tank full of water at that time. Since these evaluations, the exterior surfaces have been topcoated. It was reported to Tank Industry Consultants' personnel at the site that the top of the riser was to be repaired, and the entire interior surfaces were to be pressure washed.

3.6.4 Structural Condition Assessment

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 Navy and the Engineer.

This tank is located in a seismically active region. This evaluation and reported condition do not verify the tank's original design compliance for seismic or coastal wind loading in accordance with current design requirements, as it was outside the scope of this report. Likewise, recommendations for this tank do not include modifications that 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.

3.6.5 Recommendations

Site:

Site Maintenance: The site should be regraded so that the tops of all of foundations project a minimum of 6 in. (152 mm) to a maximum of 12 in. (305 mm) above grade and so that proper drainage away from the foundations occurs. Site maintenance should be performed with the mower discharge directed away from the base of the tank to prevent rock chips in the coating.

Site Layout: Due to the tight nature of the site, consideration should be given to areas where the contractor may locate equipment near the site and how containment of the tank may affect adjacent facilities. Temporary removal of fence sections may be required to make room for equipment. Provisions for items such as replacement of removed fence sections and other site restoration should be included in specifications for the repainting project.

Foundations: If the concrete caps on the foundations should deteriorate prior to additional exterior repairs, any unsound concrete of the foundations should be chipped to sound material and the concrete should be brush-off blasted. Any deteriorated areas or voids found should have a bonding agent and a vinyl emollient modified concrete patching mortar applied to build up the surface to its original contour. The concrete should then be painted with a concrete sealer. (This repair did not appear to be necessary at the time of the field evaluation). Any gap between the steel base plates and the concrete foundations should be filled with a flexible sealant.

Overhead Power Lines: All overhead power lines within 40 ft of the tank, including those attached to 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.

Exterior Surfaces:

Life of the Exterior Coating: The exterior coating system appeared to be good overall condition and providing adequate corrosion protection. The exterior surfaces

should be re-evaluated in 4 to 5 years to determine if repainting is necessary at that time.

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.

Cleaning: As the coating samples taken during the previous evaluations indicated the exterior coatings contain lead and the exterior appears to have been topcoated with little to no surface preparation, future coating removal should be performed in accordance with local and federal regulations relative to the removal of heavy-metal based coatings. 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 buildings.

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

Other Systems: Alternative coating systems with lower volatile organic compounds (VOCs) may become available which would be viable options for this tank. The Navy should review the available systems prior to preparing specifications for the recoating project.

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.

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. This includes the unused brackets on the roof.

Riser Manholes: At the time of recoating and repairs, the gaskets for the riser manholes should be replaced.

Level Indicating Devices: The remains of the target gage on the east side of the shell should be removed along with it and all associated couplings, brackets, and components. Patch plates should be welded over the openings created by the removal of the level indicating devices. The patch plates should be completely seal welded on both the interior and exterior surfaces.

Electrical Apparatus: All unused electrical conduit, antennas, fixtures, and electrical equipment should be removed from the tank and tank site. All required equipment should be repaired in accordance with the National Electric Code (NEC).

Base Plate and Anchor Bolts: After removal of the concrete caps and an initial abrasive blast cleaning, the base plate and anchor bolts and nuts should be examined for deterioration. If deterioration is found, the base plate and anchor bolts and nuts should be repaired as necessary.

Exterior Ladders: The exterior ladders should be replaced with ladders which meet current requirements. In addition, a safety cage is not required on a ladder which has a safe-climbing device; therefore, it is recommended the safety cages be removed and safe-climbing devices be installed. The tower ladder could then be replaced with one continuous ladder as opposed to three sections separated by two platforms. The exterior ladders did not include slip-resistant rungs. Slip-resistant rungs are required for all ladders constructed after March 1991 by the OSHA Construction standards. However, slip-resistant rungs are not required by the OSHA General Industry standards for ladders or by the AWWA D100.

Tower Ladder Platforms: If the Navy decides to remove the tower ladder safety cages and replace the tower ladder with a continuous ladder to the balcony that has a safe-climbing device, the Navy could remove the platforms. If the Navy decides to keep the platforms, the safety railing should be replaced with members which meet current dimensional requirements and include handrails at least 42 in. (1067 mm) high and 4 in. (102 mm) high toe bars. A structural analysis of the tower ladder platforms should be performed to verify that the platforms' load capacity is compliant with current OSHA standards.

Vandal Deterrents: The addition of adequate vandal deterrents on both sides of the bottom tower ladder would offer the Navy further protection from unauthorized access to the ladder and tank.

Balcony: Safe access from the tower ladder should be provided for through the balcony safety railing or the existing floor opening modified to provide adequate head clearance. The access opening should also include a closable cover and a 4 in. (102 mm) high curb. The safety railing members should be replaced with members which meet current dimensional requirements and include a handrail at least 42 in. (1067 mm) high and a 4 in. (102 mm) high toe bar.

Roof Platform: The safety railing members should be replaced with members which meet current dimensional requirements and include a handrail which is at least 42 in. (1067 mm) high and a 4 in. (102 mm) high toe bar. Closure chains should be installed at the access opening.

Clog-Resistant Vent: The tank does not have 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 or frosted over. Therefore, a clog-resistant vent should be installed near 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. Until such time as the vent can be replaced, a more restrictive screen should be installed immediately.

Additional Roof Manhole: OSHA and safety-related standards require a second roof manhole for emergency egress during coating and repairing operations. Therefore, a second roof manhole should be installed in the roof. The manhole and cover should be designed in accordance with current industry and safety standards. The new roof manhole should be installed between roof structure to allow unrestricted use of the manhole. Both the new and the existing roof manholes should be locked at all times to prevent unauthorized access to the tank interior.

Roof Manhole: The flanged and bolted roof manhole should have two additional holes fitted with locks to improve water system security. Additionally, the cover should

be equipped with a chain to secure the cover to the roof or manhole neck when it is removed and a gasket should be installed.

Uncovered Roof Openings: The uncovered openings in the roof should be sealed immediately. Any abandoned openings should be sealed with welded steel cover plates.

Cathodic Protection Hand Holes: All cathodic protection hand holes should have the covers repositioned and new gaskets installed, and the missing bolts cover should be replaced. If a hanging anode system will not be used in the future, then the openings should be welded shut when repainting the tank.

Obstruction Lights: The proper operation of the photoelectric cell should be verified as the fixtures were not illuminated at the time of the field evaluation. The fixtures should then be regularly maintained

Interior Surfaces:

Life of the Interior Coating: The interior container coating was in very poor condition as widespread corrosion and metal loss were noted. It was reported that the top of the riser is to be repaired, and the interior surfaces are to be pressure washed. Care should be taken during pressure washing as the extensive metal loss located on the roof and support structure members, as well as that which may be located beneath the rust tubercles throughout the interior, may result in holes from the pressure applied during washing. It is recommended the interior surfaces be repaired and repainted as soon as feasible. If repairs and repainting are not performed, leaks could be observed at any time. However, it may be more economical to replace the tank than to repair it. The following recommendations are based on repairing and repainting the tank as opposed to replacing it.

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.

Interior Coating System:

Coating System: The standard Navy water tank interior coating system is a three-coat ANSI/NSF Standard 61 approved, polyamide epoxy system, designed in accordance with NFGS 09972.

Coating Application: The standard Navy surface preparation for interior surfaces, as described in NFGS 09972, is SSPC-SP 5, White Metal Blast Cleaning. NFGS 09972 also requires dehumidification during all surface preparation, coating application, and coating initial cure.

Service Life: The typical life of a properly formulated and applied epoxy coating system is approximately 12 to 15 years in immersion service.

Riser: The riser could not be evaluated due to its configuration. If the Navy chooses to repair and repaint the tank, the riser should be accessed and evaluated to determine the extent of repairs which are likely to be needed.

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.

Seam Welding: The existing unwelded lapped roof seam and the portions of the intermittently welded stiffeners below the top capacity level should be seal welded to comply with AWWA standards.

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 40 man-hours of grinding will be required on the interior of the container.)

Roof and Support Structure: Due to the extent of corrosion and metal loss observed on the roof and support structure as well as what might be visible on these surfaces after abrasive blast cleaning and evaluation, it is possible that extensive metal loss will require roof and support structure replacement.

Shell: After abrasive blast cleaning, the shell should be evaluated to determine if gross metal loss or structurally damaging groove pitting exists that may require extensive and potentially costly repairs.

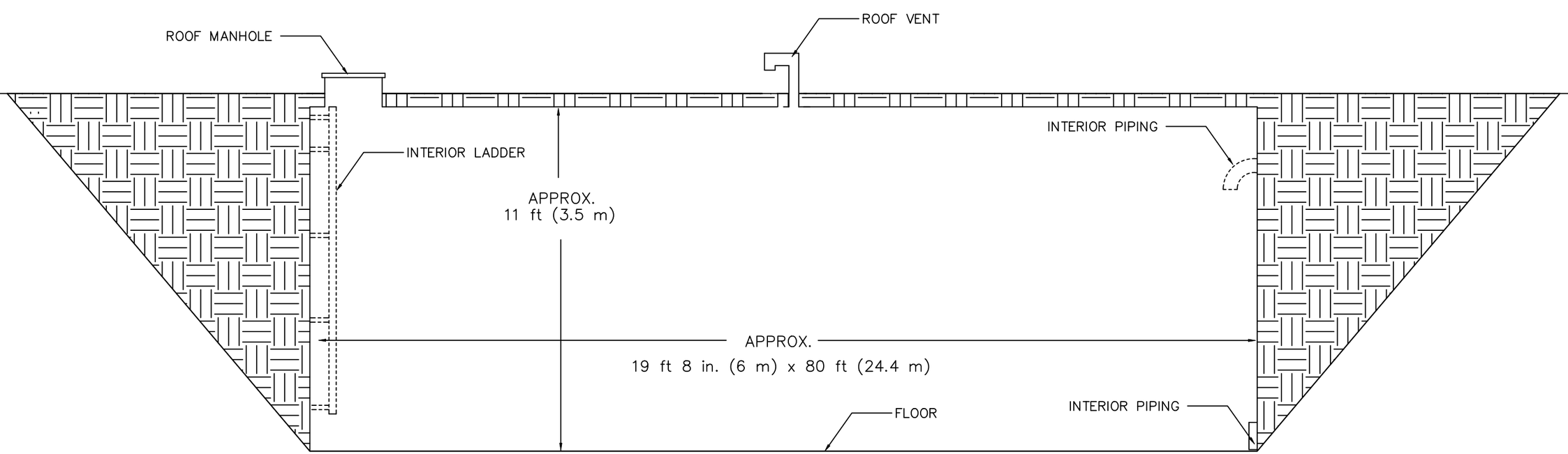
3.7 TANK 214

Tank 214 stores potable water for the Naval Air Station in Sigonella, Italy.

3.7.1 Description of the Facility

Tank 214 is a four-chamber concrete tank located below grade with a capacity of 528,344 gallons of potable water. Each chamber measured approximately 19 ft 8 in. (6 m) wide x approximately 80 ft (24.4 m) long. The interior height was approximately 11 ft (3.5 m). (See Figure 3.7-1)

TANK 214, NOMENCLATURE



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This drawing is intended only for illustration of report nomenclature and is not for design purposes.
Some features have been eliminated, simplified, relocated, etc., for the sake of clarification and, therefore, do Not reflect the actual configuration.

GRAPHIC SCALE	DATE	TIC Tank Industry Consultants	NAVAL FACILITIES ENGINEERING SERVICE CENTER EAST COAST DETACHMENT WASHINGTON, DC	
NOT TO SCALE	November 2012	Contract Number N62583–10–D–0340	NAVAL AIR STATION SIGONELLA, ITALY NOMENCLATURE	FIG. NO. 3.7–1

3.7.2 Observed Conditions

Tank 214 is located at the Naval Air Station in Sigonella, Italy. The buried tank is covered with grass and is located beneath a play area (See photos 3.7-1 and 3.7-2). Two pipes project from the wall of a pump house located east of the tank and extend below grade to the tank (See photos 3.7-3 and 3.7-4). The tank is accessed through eight roof manholes located at grade level.

There are four gooseneck-type vents located in the roof (See photos 3.7-5 and 3.7-6). Each of the vents has perforated plate screening which was intact at the time of the field evaluation (See photos 3.7-7 and 3.7-8). Some minor corrosion and rust staining are present on the flanged connections of the vents, and some of the bolt holes in the flanges are open (See photos 3.7-5 and 3.7-6). The tank does not appear to be equipped with an overflow. If overfilled, the only path of release is through the gooseneck-type vents. This is an operational deficiency and may be a structural deficiency if the roof cannot resist the uplift pressure development.

There are four sets of two roof manholes, and the manhole covers were locked prior to and after the field evaluation (See photos 3.7-9, 3.7-10, and 3.7-15). There are several hairline cracks in the concrete surrounding the manholes (See photos 3.7-12 through 3.7-14). Bushes are located around some of the manholes and are touching the concrete in several areas (See photo 3.7-11). Corrosion is located on the steel covers and necks of the manholes (See photos 3.7-16 through 3.7-18).

The interior concrete surfaces are in generally adequate condition as there are only a few cracks (See photos 3.7-30 through 3.7-32, 3.7-36, and 3.7-37). Form ties are exposed at a few areas in the concrete walls, and there is corrosion in these areas. The evaluation of the floor was restricted by a layer of silt, and a few pieces of miscellaneous debris were lying on the floor at the time of the field evaluation (See photos 3.7-38 through 3.7-43).

A ladder is located in each chamber beneath the roof manhole, and the ladders are welded to brackets which are welded to the shell (See photos 3.7-20, 3.7-7-26, 3.7-28, and 3.7-29). Corrosion and rust tubercles are located on the part of the ladders located below the water line (See photo 3.7-19). OSHA and safety-related deficiencies on the ladders include: (1) the 27 in. (686 mm) ladder head clearance does not

precisely meet the minimum required 30 in. (762 mm), (2) the tubercles on the ladder could injure the climber's hands (See photo 3.7-27), (3) the ladder side rails are not continuous at ladder section intersections, and (4) the ladders are not equipped with safe-climbing devices.

Sensors are located on the north wall of each chamber (See photo 3.7-21). Pipes project slightly from near the base of the south wall of the tank (See photos 3.7-33 through 3.7-35). A pipe elbows down from near the top of the wall in each of the two of the chambers (See photos 3.7-22 and 3.7-23). A significant amount of corrosion and rust tubercles were observed on all of the pipes at the time of the field evaluation.

PHOTO 3.7-1 Site above Tank 214.

PHOTO 3.7-2 Playground above Tank 214.

PHOTO 3.7-3 Piping from adjacent building to tank.

PHOTO 3.7-4 Piping from adjacent building to tank.

PHOTO 3.7-5 Gooseneck vent. Note corrosion and rust staining on flange and open bolt holes.

PHOTO 3.7-6 Gooseneck vents. Note rust staining on flanges and open bolt holes.

PHOTO 3.7-7 Corrosion around gooseneck vent screening. Note open bolt holes.

PHOTO 3.7-8 Corrosion around gooseneck vent screening. Note open bolt holes.

PHOTO 3.7-9 Roof manholes.

PHOTO 3.7-10 Roof manholes.

PHOTO 3.7-11 Roof manholes within shrubbery.

PHOTO 3.7-12 Cracks in roof manhole neck.

PHOTO 3.7-13 Hairline cracks in roof manhole exterior.

PHOTO 3.7-14 Cracks in roof manhole exterior.

PHOTO 3.7-15 Lock on roof manhole covers.

PHOTO 3.7-16 Corrosion on interior of roof manhole cover.

PHOTO 3.7-17 Roof manhole interior.

PHOTO 3.7-18 Roof manhole interior.

PHOTO 3.7-19 Interior ladders.

PHOTO 3.7-20 Interior ladder and bracket. Note corrosion on bolt.

PHOTO 3.7-21 Equipment projecting from shell.

PHOTO 3.7-22 Corrosion on interior piping.

PHOTO 3.7-23 Corrosion on interior piping.

PHOTO 3.7-24 Roof and shell.

PHOTO 3.7-25 Shell interior.

PHOTO 3.7-26 Shell and interior ladder.

PHOTO 3.7-27 Corrosion and rust tubercles on interior ladder.

PHOTO 3.7-28 Shell and interior ladder.

PHOTO 3.7-29 Interior ladder.

PHOTO 3.7-30 Shell interior.

PHOTO 3.7-31 Shell interior.

PHOTO 3.7-32 Shell interior.

PHOTO 3.7-33 Piping near base of shell.

PHOTO 3.7-34 Piping near base of shell.

PHOTO 3.7-35 Piping near base of shell.

PHOTO 3.7-36 Shell and floor.

PHOTO 3.7-37 Shell and floor.

PHOTO 3.7-38 Debris on floor.

PHOTO 3.7-39 Debris on floor.

PHOTO 3.7-40 Debris on floor.

PHOTO 3.7-41 Debris on floor.

PHOTO 3.7-42 Debris on floor.

PHOTO 3.7-43 Debris on floor.

3.7.3 Comparison of Previous Inspection Results

The tank was previously evaluated by Tank Industry Consultants on March 5, 2008, and evaluation report CR-6480-OCN was issued. Since the time of the 2008 evaluation, it did not appear the interior concrete surfaces had deteriorated significantly. It appeared the overflow/vents had been modified so the screened opening is located approximately 23 in. (584 mm) above the surrounding ground as opposed to the approximately 1/4 in. (6 mm) to 3 in. (76 mm) noted previously. The overflow/vents had also been painted blue.

3.7.4 Structural Condition Assessment

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 Navy and the Engineer.

This tank is located in a seismically active region. This evaluation and reported condition do not verify the tank's original design compliance for seismic or coastal wind loading in accordance with current design requirements, as it was outside the scope of this report. Likewise, recommendations for this tank do not include modifications that 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.

3.7.5 Recommendations

Site:

Site Maintenance: The site should be maintained so that proper drainage away from the tank continues. The grass and bushes should be regularly trimmed so they do not come into contact with the top of the concrete roof manhole accesses and the overflow/vents.

Site Access and Restoration: Contractor and heavy equipment access to the site would be difficult due to the small size of the immediate tank site and the location of the play areas. Provisions should be included in the specifications for the restoration of any paving, curbing, sidewalks, or other surfaces and structures disturbed by the contractor's work.

Exterior Surfaces:

Exterior Roof Manhole Access Concrete: The concrete on the exterior of the roof manhole access openings was in fair condition. When interior repairs are performed, these areas should also be repaired. Any cracks should be prepared according to the specifications of the concrete crack repair material manufacturer. These areas to be repaired should be prepared by wet blast cleaning to remove dust, laitance, grease, or other bond inhibiting materials and blown off with high-pressure air. The cracks in the concrete should then be repaired by routing out the crack to a minimum depth of 1 in. (25 mm, with a minimum 90° angle from the surface) and repairing with a cement-based patching compound. The sequence and performance of these concrete repairs shall be such that the structural integrity of the tank area is not compromised.

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

Shell Manholes: It is recommended that the Navy classify this tank as a confined space, and initiate the appropriate confined space access measures whenever anyone is going to access the tank interior.

Overflow: The operational system should be reviewed to determine the risk of overfilling the tank and appropriate mitigation actions identified.

Clog-Resistant Vents: The roof vents are not clog-resistant. The AWWA D100 Standard (applicable for steel tanks) recommends that all vents with screening against insects be designed to ensure "fail-safe" operation if the insect screens become occluded. However, AWWA D110 does not require a clog-resistant vent, and a concrete roof is typically capable of withstanding more pressure or vacuum than a steel roof. The existing gooseneck vents could be replaced with new clog-resistant vents but then a new means of overflow would need to be installed. Bolts should be installed in the open holes in the flanges.

Interior Surfaces:

Interior Concrete: The concrete interior of the tank appeared to be in adequate condition as no significant cracking and chipping were observed. The interior surfaces should be re-evaluated in 3 to 4 years to determine if the cracks require repair.

Interior Piping: The interior piping should be cleaned to the equivalent of an SSPC-SP 10, Near-White Blast Cleaning and an epoxy coating system applied. This should be performed within the next 2 years.

Interior Ladders: Interior ladders are susceptible to accelerated rates of corrosion. If the Navy decides to keep an interior ladder, the existing ladders should be replaced with new ladders which meet current OSHA requirements. The existing ladders did not include slip-resistant rungs. Slip-resistant rungs are required for all ladders constructed after March 1991 by the OSHA Construction standards. However, slip-resistant rungs are not required by the OSHA General Industry standards for ladders or by the AWWA standards.

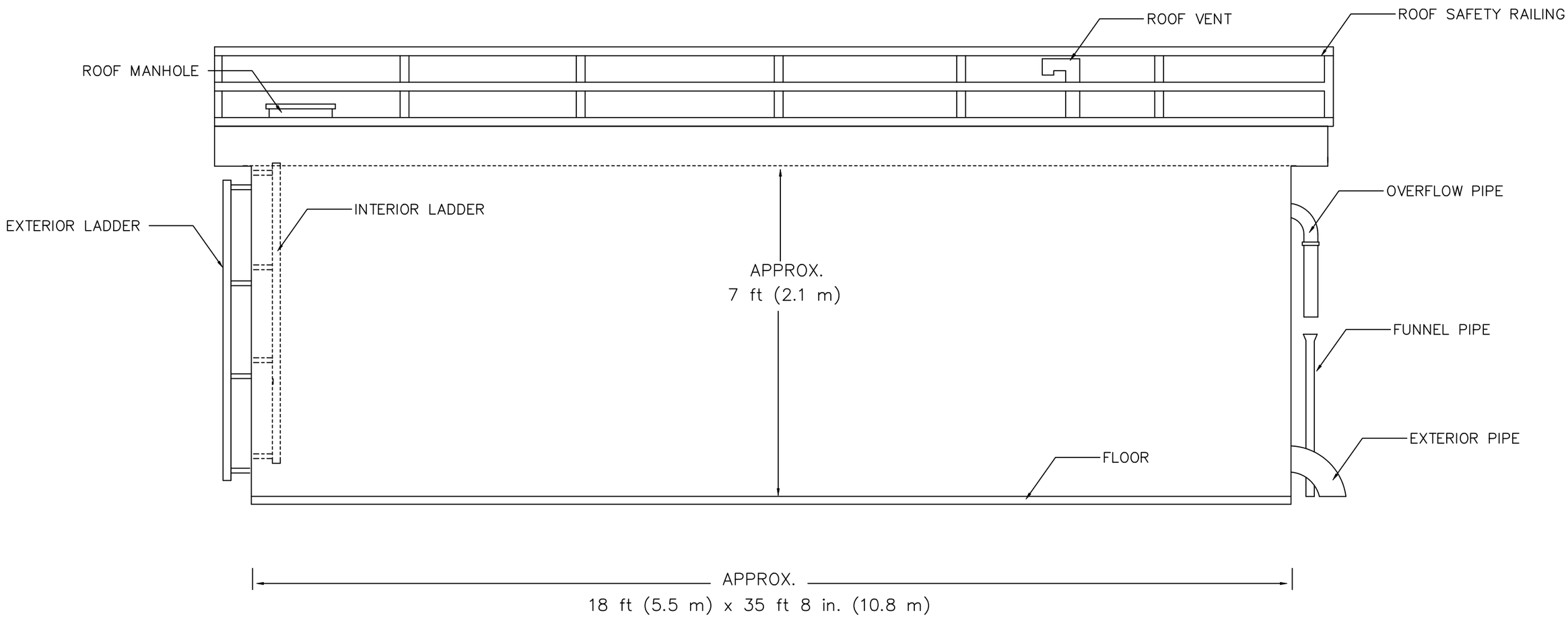
3.8 TANK 2105

Tank 2105 stores nonpotable water for the Transmitter site in Sicily, Italy.

3.8.1 Description of the Facility

Tank 2105 is a two-chamber concrete tank is located partially below grade and has a capacity of 47,500 gallons of nonpotable water. Measurements taken at the field evaluation indicated the tank projected from approximately 6 ft 5 in. (2 m) to 7 ft (2.1 m) above grade, and it measured approximately 18 ft (5.5 m) x 35 ft 6 in. (10.8 m). The interior height was approximately 12 ft 8 in. (3.8 m). (See Figure 3.8-1)

TANK 2105, NOMENCLATURE



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NOT TO SCALE	November 2012	Contract Number N62583–10–D–0340	NAVAL AIR STATION SIGONELLA, ITALY NOMENCLATURE	FIG. NO. 3.8–1

3.8.2 Observed Conditions

Tank 2105 is located at the Transmitter site in Sicily, Italy. The tank site is covered with bare soil and grass and is not entirely fenced, although there is a fence located to the north (See photo 3.8-3). Tank 2106 is located in close proximity to the south side of the subject tank, and a light pole is located to the northwest (See photo 3.8-1). A pump house is located to the south, and a blacktop driveway is located to the east. Vegetation has grown up and is touching the base of the tank in areas (See photo 3.8-2).

A valve vault is located between Tanks 2105 and 2106, and the access was not locked prior to or after the field evaluation (See photo 3.8-4). Only the valves on the pipes are visible as the remaining pipe surfaces are buried (See photo 3.8-5). The concrete walls of the vault appeared to be in adequate condition. A vertical crack and associated efflorescence measuring approximately 4 ft (1.2 m) long is located in the north interior wall (See photo 3.8-6).

The concrete on the exterior shell projection appears to be in fair overall condition. Areas of exposed rebar and tie wire ends have been spot coated and patched since the previous evaluation, and an area of the west side of the shell also appears to have been repaired (See photos 3.8-13 through 3.8-15). Two cabinets are mounted on the shell adjacent to the exterior ladder (See photo 3.8-18). There is a conduit and box near the top of the shell, and the box had broken slightly from the shell (See photo 3.8-16).

The overflow pipe projects from near the top of the shell and elbows downward before discharging above a funnel pipe which extends below grade (See photos 3.8-9 and 3.8-10). A perforated plate screen has been installed at the pipe flange, and the excess screen length is visible at the flange (See photo 3.8-11). Corrosion and rust staining are located on the overflow pipe and funnel pipe as well as the flange and bolts (See photos 3.8-9 through 3.8-12).

Two pipes project from below grade and penetrate the shell such that one of the pipes penetrates the north wall, and the other pipe penetrates the south wall. The south pipe has a sleeve, and there is corrosion on both of the pipes (See photos 3.8-7 and 3.8-8).

A ladder provides access from the ground to the roof which is bolted to brackets which are cast into the concrete shell (See photo 3.8-18). The ladder and brackets appeared to be in nearly their original structural condition at the time of the field evaluation although there is corrosion on some of the bolts (See photo 3.8-19). The ladder does not include a safe-climbing device, but there are terminals located at the access to the roof (See photo 3.8-20). OSHA and safety-related deficiencies on the ladder include: (1) the 5/8 in. (16 mm) diameter ladder rungs do not precisely meet the minimum required 3/4 in. (19 mm) diameter, (2) the 14-7/8 in. (378 mm) ladder width does not precisely meet the minimum required 16 in. (406 mm), (3) the 6-1/4 in. (159 mm) toe room does not precisely meet the minimum required 7 in. (178 mm), and (4) the 2 in. (51 mm) x 3/8 in. (9 mm) side rails do not precisely meet the minimum required 2-1/2 in. (64 mm) x 3/8 in. (9 mm) minimum.

Safety railing which is constructed of welded flat bar and pipe members has been installed around the perimeter of the roof (See photos 3.8-24 and 3.8-25). OSHA and safety-related deficiencies include: (1) the access opening does not have closure chains to deter personnel from inadvertently falling from the roof (See photo 3.8-20), (2) the 41-1/2 in. (1054 mm) height of the handrail does not precisely meet the required 42 in. (1067 mm) minimum, and (3) there are gaps greater than the maximum allowed 1/4 in. (6 mm) wide between the roof and the toe bar.

The concrete roof is in fair overall condition as there are some hairline cracks (See photo 3.8-25). Some spalling is located near the perimeter of the roof as well (See photo 3.8-17). Areas of exposed rebar which were noted in the overhang at the previous evaluation had been repaired. Water stands on the east side of the roof, and moss is located in areas (See photos 3.8-24 and 3.8-26). Ponding water may lead to infiltration through the roof which may be an operational deficiency.

The roof has two manholes both of which have hinged covers. The manholes were not locked prior to or after the field evaluation. Cracking, spalling, and exposed rebar are located in the concrete neck surfaces of the manholes (See photos 3.8-21 and 3.8-22). Equipment mounted on the interior neck of one of the manholes extends into the container of the tank (See photo 3.8-23).

Two gooseneck-type vents are located in the roof which are covered with corrosion. The vents do not include screening (See photos 3.8-27 and 3.8-28).

The interior concrete surfaces are in fair overall condition. There is corrosion and rust staining on exposed steel visible in the roof (See photos 3.8-29 and 3.8-31). Form ties are exposed at voids in the shell, and there is corrosion and rust staining on the exposed form ties (See photo 3.8-30, 3.8-33, and 3.8-36 through 3.8-40). White deposits are located on the floor adjacent to the caged pipe projections, and the presence of silt restricts the evaluation of some of the floor (See photos 3.8-46, 3.8-47, 3.8-49, and 3.8-51).

A ladder is located in each chamber beneath the roof manhole, and the ladders are welded to brackets which are bolted into the shell (See photos 3.8-35, 3.8-41, and 3.8-43). The interior ladders have been replaced since the previous evaluation, and the ladders appear to be in good condition except for corrosion and rust tubercles on some of the brackets (See photo 3.8-42). The ladders are not equipped with safe-climbing devices. OSHA and safety-related deficiencies on the ladders include: (1) the 15 in. (381 mm) ladder width does not precisely meet the minimum required 16 in. (406 mm), (2) the 6-3/4 in. (165 mm) toe room does not precisely meet the minimum required 7 in. (178 mm), (3) the 2-1/4 in. (57 mm) x 3/8 in. (9 mm) side rails do not precisely meet the minimum required 2-1/2 in. (64 mm) x 3/8 in. (9 mm) minimum, and (4) the 12-1/2 in. (318 mm) spacing between rungs exceeds the maximum allowed 12 in. (305 mm) spacing intervals.

Each chamber has an open overflow pipe inlet. A pipe projects from the shell just below one of the roof manholes which is covered with corrosion (See photo 3.8-32). Another pipe projects from the shell, and corrosion and rust staining is located on it (See photos 3.8-44 and 3.8-45). A pipe projects above the floor of each chamber which has cage screening; however, the cage screens are clogged with corrosion products (See photos 3.8-47 through 3.8-50). There is another pipe in each chamber which is located within a sump in the floor (See photo 3.8-51). Significant corrosion, rust tubercles, metal loss, and holes are located in the pipes projecting above the sumps (See photos 3.8-52 through 3.8-54). The clogged screening creates an operational deficiency.

PHOTO 3.8-1 Tank 2105 and site.

PHOTO 3.8-2 Tank 2105. Note vegetation.

PHOTO 3.8-3 Tank 2105.

PHOTO 3.8-4 Valve vault access.

PHOTO 3.8-5 Valve vault interior.

PHOTO 3.8-6 Efflorescence in valve vault wall.

PHOTO 3.8-7 Corrosion on exterior piping.

PHOTO 3.8-8 Piping and equipment on shell.

PHOTO 3.8-9 Overflow pipe.
Note corrosion.

PHOTO 3.8-10 Overflow pipe discharge. Note corrosion.

PHOTO 3.8-11 Corrosion and perforated plate screen at overflow pipe flange.

PHOTO 3.8-12 Corrosion on overflow pipe.

PHOTO 3.8-13 Repaired areas in shell.

PHOTO 3.8-14 Repaired area in shell.

PHOTO 3.8-15 Shell and underside of roof overhang.

PHOTO 3.8-16 Conduit and box broken from upper shell.

PHOTO 3.8-17 Spalling in roof.

PHOTO 3.8-18 Exterior ladder, conduits, and cabinets.

PHOTO 3.8-19 Corrosion on exterior ladder bracket bolt.

PHOTO 3.8-20 Roof access and roof safety railing.

PHOTO 3.8-21 Roof manholes.

PHOTO 3.8-22 Roof manhole interior.

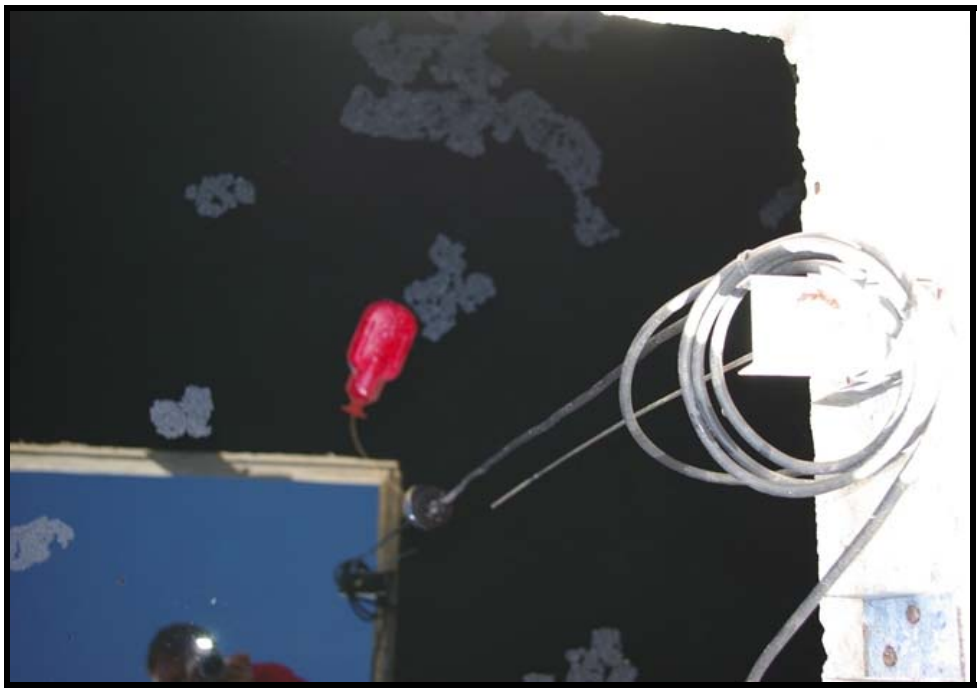


PHOTO 3.8-23 Sensor equipment in roof manhole interior.

PHOTO 3.8-24 Standing water on roof.

PHOTO 3.8-25 Roof exterior.

PHOTO 3.8-26 Moss on roof.

PHOTO 3.8-27 Corrosion on unscreened roof vent.

PHOTO 3.8-28 Corrosion on unscreened roof vent.

PHOTO 3.8-29 Rust staining and corrosion on exposed steel in roof.

PHOTO 3.8-30 Roof and shell.

PHOTO 3.8-31 Roof and shell. Note corrosion on exposed steel in roof.

PHOTO 3.8-32 Corrosion on interior piping.

PHOTO 3.8-33 Corrosion on exposed steel in shell.

PHOTO 3.8-34 Cut-out between chambers.

PHOTO 3.8-35 Interior ladder and bracket.

PHOTO 3.8-36 Concrete spalls and corrosion and rust staining on exposed steel in shell.

PHOTO 3.8-37 Corrosion and rust staining on exposed steel in shell.

PHOTO 3.8-38 Corrosion and rust staining on exposed steel in shell.

PHOTO 3.8-39 Concrete spalls and corrosion and rust staining on exposed steel in shell.

PHOTO 3.8-40 Concrete spalls and corrosion and rust staining on exposed steel in shell.

PHOTO 3.8-41 Interior ladder.

PHOTO 3.8-42 Corrosion and rust tubercles on interior ladder bracket bolts.

PHOTO 3.8-43 Interior ladder.

PHOTO 3.8-44 Corrosion and rust tubercles on pipe projection from shell.

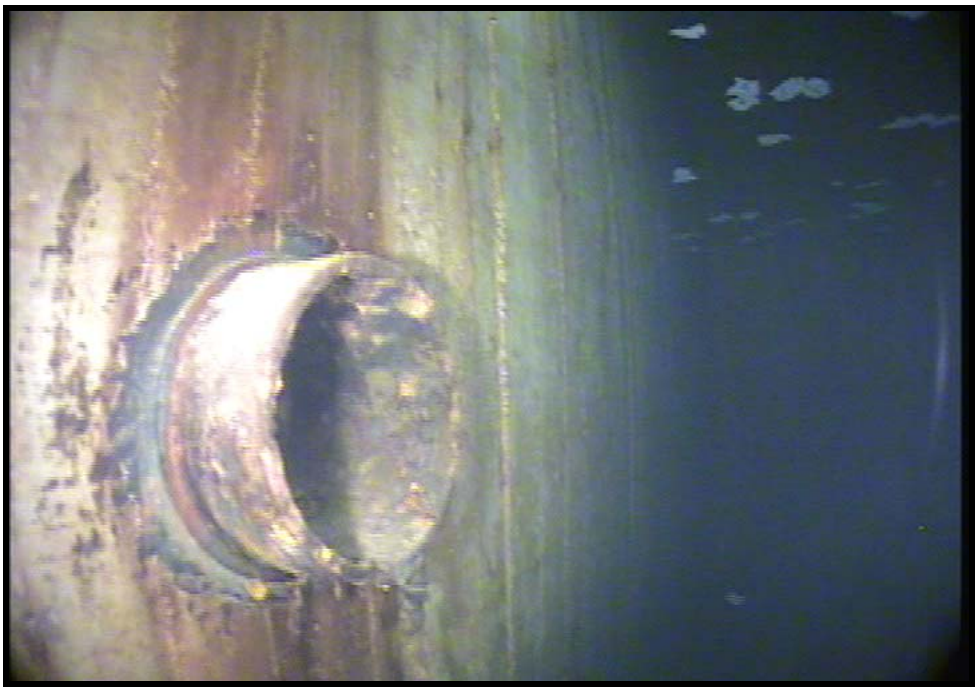


PHOTO 3.8-45 Corrosion and rust tubercles on pipe projection from shell.

PHOTO 3.8-46 Shell and floor.

PHOTO 3.8-47 Corrosion and metal loss on pipe projection, and debris and silt on floor.

PHOTO 3.8-48 Corrosion and rust tubercles on pipe projection.

PHOTO 3.8-49 Corrosion and metal loss on pipe projection, and debris and silt on floor.

PHOTO 3.8-50 Corrosion and metal loss on pipe projection.

PHOTO 3.8-51 Pipe projection above sump and silt on floor.

PHOTO 3.8-52 Corrosion and metal loss on pipe projection in sump.

PHOTO 3.8-53 Corrosion and metal loss on pipe projection in sump.

PHOTO 3.8-54 Corrosion and metal loss on pipe projection in sump.

3.8.3 Comparison of Previous Inspection Results

The tank was previously evaluated by Tank Industry Consultants on March 4, 2008, and evaluation report CR-6480-OCN was issued. Since the time of the 2008 evaluation, it appeared that some repairs and modifications had been made to the tank which include:

- Areas of exposed rebar and tie wire ends in the exterior have been spot coated and patched.
- The area of the west side of the shell which had previously sounded hollow when tapped has been repaired.
- A perforated plate screen has been installed at the overflow pipe flange.
- Safety railing has been installed around the perimeter of the roof.
- Areas of exposed rebar which were noted in the roof overhang at the previous evaluation have been repaired.
- The interior ladders have been replaced.
- Trash found in the tank previously has been removed.

3.8.4 Structural Condition Assessment

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 Navy and the Engineer.

This tank is located in a seismically active region. This evaluation and reported condition do not verify the tank's original design compliance for seismic or coastal wind loading in accordance with current design requirements, as it was outside the scope of this report. Likewise, recommendations for this tank do not include modifications that 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.

3.8.5 Recommendations

Site:

Site Maintenance: The site should be maintained so that proper drainage away from the tank continues. The vegetation should be regularly trimmed so it does not touch the tank.

Valve Vault: The piping and valves located in the valve vault should be cleaned and painted. 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 be locked at all times in order to limit liability to the Navy and to protect water system security.

Exterior Surfaces:

Exterior Concrete: The exterior concrete surfaces were in good overall condition as no significant cracking and spalling were noted. The exterior surfaces should be re-evaluated in 4 to 5 years to determine if repairs are required at that time. When cracks develop, they should be prepared according to the specifications of the concrete crack repair material manufacturer. These areas to be repaired should be prepared by wet blast cleaning to remove dust, laitance, grease, or other bond inhibiting materials and blown off with high-pressure air. The cracks in the concrete should then be repaired by routing out the crack to a minimum depth of 1 in. (25 mm, with a minimum 90° angle from the surface) and repairing with a cement-based patching compound. The sequence and performance of these concrete repairs shall be such that the structural integrity of the tank area is not compromised.

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

Shell Manholes: It is recommended that the Navy classify this tank as a confined space, and initiate the appropriate confined space access measures whenever anyone is going to access the tank interior.

Shell Box: The broken connection on the box located adjacent to the top of the shell should be repaired.

Overflow Pipe: Installing an elastomeric check valve on the discharge end of the overflow pipe would prevent the ingress of birds, small animals, and insects into the tank and deter clogging.

Clog-Resistant Vents: The roof vents are not clog-resistant. The AWWA D100 Standard (applicable for steel tanks) recommends that all vents with screening against insects be designed to ensure "fail-safe" operation if the insect screens become occluded. However, AWWA D110 does not require a clog-resistant vent, and a concrete roof is typically capable of withstanding more pressure or vacuum than a steel roof.

Exterior Ladder: The exterior ladders should be replaced with ladders which meet current dimensional requirements. The existing ladders did not include slip-resistant rungs. Slip-resistant rungs are required for all ladders constructed after March 1991 by the OSHA Construction standards. However, slip-resistant rungs are not required by the OSHA General Industry standards for ladders or by the AWWA standards.

Roof Safety Railing: The handrail should be raised to be at least 42 in. (1067 mm) above the roof, and the toe bar lowered so the gap between it and the roof is less than 1/4 in. (6 mm) wide. Closure chains should be installed at the access opening.

Interior Surfaces:

Interior Concrete: The concrete interior of the tank appeared to be in fair condition although corrosion and rust staining were visible on exposed steel in the roof and shell. The interior surfaces should be re-evaluated in 3 to 4 years to determine if these areas require repair at that time.

Interior Piping: The piping should be cleaned to the equivalent of an SSPC-SP 10, Near-White Blast Cleaning and an epoxy coating system applied. This should be

performed within the next year. The cage screening should be cleared of the corrosion products clogging them.

Interior Ladders: Interior ladders are susceptible to accelerated rates of corrosion. If the Navy decides to keep an interior ladder, the existing access ladders should be replaced with new ladders which meet current OSHA requirements. The existing ladders did not include slip-resistant rungs. Slip-resistant rungs are required for all ladders constructed after March 1991 by the OSHA Construction standards. However, slip-resistant rungs are not required by the OSHA General Industry standards for ladders or by the AWWA standards.

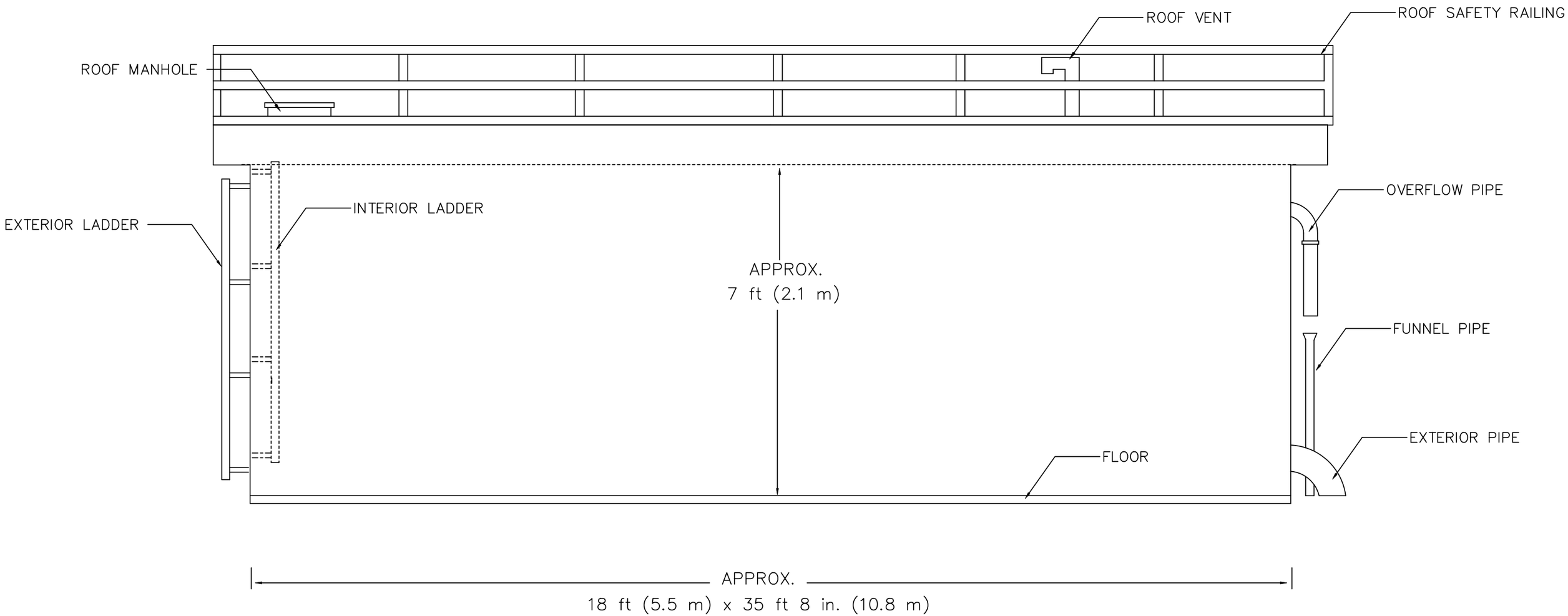
3.9 TANK 2106

Tank 2106 stores nonpotable water for the Transmitter site in Sicily, Italy.

3.9.1 Description of the Facility

Tank 2106 is a two-chamber concrete tank which is located partially below grade and has a capacity of 47,500 gallons of nonpotable water. Measurements taken at the field evaluation indicated the tank projected approximately 7 ft (2.1 m) above grade, and it measured approximately 18 ft (5.5 m) x 35 ft 8 in. (10.8 m). The interior height was approximately 12 ft 8 in. (3.8 m). (See Figure 3.9-1)

TANK 2106, NOMENCLATURE



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This drawing is intended only for illustration of report nomenclature and is not for design purposes.
Some features have been eliminated, simplified, relocated, etc., for the sake of clarification and, therefore, do Not reflect the actual configuration.

GRAPHIC SCALE	DATE	TIC Tank Industry Consultants	NAVAL FACILITIES ENGINEERING SERVICE CENTER EAST COAST DETACHMENT WASHINGTON, DC	
NOT TO SCALE	November 2012	Contract Number N62583–10–D–0340	NAVAL AIR STATION SIGONELLA, ITALY NOMENCLATURE	FIG. NO. 3.9–1

3.9.2 Observed Conditions

Tank 2106 is located at the Transmitter site in Sicily, Italy. The tank site is covered with bare soil and grass and is not entirely fenced, although there is a fence located to the north (See photo 3.9-2). Tank 2105 is located in close proximity to the south side of the subject tank, and a light pole is located to the southwest (See photo 3.9-1). A pump house is located to the south, and a blacktop driveway is located to the east. Vegetation has grown up and is touching the base of the tank in areas (See photo 3.9-1).

A valve vault is located between Tanks 2105 and 2106, and the access was not locked prior to or after the field evaluation. Only the valves on the pipes are visible as the remaining pipe surfaces are buried (See photo 3.9-6). The concrete walls of the vault appeared to be in adequate condition. A vertical crack and associated efflorescence measuring approximately 4 ft (1.2 m) long is located in the north interior wall.

The concrete on the exterior shell projection is in fair to poor condition (See photos 3.9-16 and 3.9-17). A leak is located at an area of deterioration measuring approximately 3 ft (0.9 m) x 4 ft (1.2 m) on the south side of the shell. Efflorescence and moss is also located in this area (See photos 3.9-7 and 3.9-8). There is exposed rebar in areas, and corrosion and rust staining are located on the rebar (See photo 3.9-18). Spalling and cracks are also located in the shell, primiarly beneath the roof overhang (See photos 3.9-19 through 3.9-21). A cabinet and conduit are mounted on the shell adjacent to the ladder (See photo 3.9-23). The leak is an operational deficiency that may lead to a structural deficiency if left as is.

The overflow pipe projects from near the top of the shell and elbows downward before discharging above a funnel pipe which extends below grade (See photos 3.9-11 and 3.9-12). A perforated plate screen has been installed at the pipe flange, and the excess screen length is visible at the flange (See photo 3.9-13). Corrosion and rust staining are located on the overflow pipe and funnel pipe as well as the flange and bolts (See photos 3.9-11 through 3.9-13).

Two pipes project from below grade and penetrate the shell such that one of the pipes is located on the north side of the tank, and the other penetrates the west wall

(See photo 3.9-9 and 3.9-14). The west pipe has a sleeve. Flexible sealant is located around both of the pipe penetrations although the sealant is loose (See photos 3.9-10 and 3.9-15). There is corrosion on both of the pipes.

A ladder provides access from the ground to the roof which is bolted to brackets which are cast into the concrete shell (See photo 3.9-22). The ladder and brackets appeared to be in nearly their original structural condition at the time of the field evaluation. The ladder does not include a safe-climbing device, but there are terminals located at the access to the roof (See photo 3.9-23). OSHA and safety-related deficiencies include: (1) the 5/8 in. (16 mm) diameter ladder rungs do not precisely meet the minimum required 3/4 in. (19 mm) diameter, (2) the 15 in. (381 mm) ladder width does not precisely meet the minimum required 16 in. (406 mm), (3) the 6-1/4 in. (159 mm) toe room does not precisely meet the minimum required 7 in. (178 mm), and (4) the 2 in. (51 mm) x 3/8 in. (9 mm) side rails do not precisely meet the minimum required 2-1/2 in. (64 mm) x 3/8 in. (9 mm) minimum.

Safety railing which is constructed of welded flat bar and pipe members has been installed around the perimeter of the roof (See photo 3.9-24). OSHA and safety-related deficiencies include: (1) the access opening does not have closure chains to deter personnel from inadvertently falling from the roof (See photo 3.9-23), (2) the 41-1/2 in. (1054 mm) height of the handrail does not precisely meet the required 42 in. (1067 mm) minimum, and (3) there are gaps greater than the maximum allowed 1/4 in. (6 mm) wide between the roof and the toe bar.

The concrete roof is in generally good overall condition as there are only a few hairline cracks. Water stands on the east side of the roof, and moss is located in areas (See photos 3.9-28 through 3.9-30). Ponding water may lead to infiltration through the roof which may be an operational deficiency.

The roof has two manholes both of which have hinged covers (See photos 3.9-25 through 3.9-27). The manholes were not locked prior to or after the field evaluation. Equipment mounted on the interior neck of one of the manholes extends into the container of the tank.

Two gooseneck-type vents are located in the roof and are corrosion covered. The vents do not include screening (See photos 3.9-31 and 3.9-32).

The interior concrete surfaces are in fair to good overall condition with no significant deterioration located on the roof (See photos 3.9-33 through 3.9-36). Form ties are exposed at voids in the shell, and there is corrosion and rust staining on the exposed form ties (See photos 3.9-39, 3.9-41, and 3.9-44 through 3.9-49). Rectangular openings were located in the wall separating the chambers (See photo 3.9-37). The presence of silt restricts the evaluation of some of the floor (See photos 3.9-52 to 3.9-54 and 3.9-56).

A ladder is located in each chamber beneath the roof manhole, and the ladders are welded to brackets which are bolted into the shell (See photos 3.9-40 and 3.9-43). The interior ladders have been replaced since the previous evaluation and appear to be in good condition except for some corrosion and rust tubercles on some of the brackets (See photo 3.9-42). The ladders are not equipped with safe-climbing devices. OSHA and safety-related deficiencies include: (1) the 15 in. (381 mm) ladder width does not precisely meet the minimum required 16 in. (406 mm), (2) the 2-1/4 in. (57 mm) x 3/8 in. (9 mm) side rails do not precisely meet the minimum required 2-1/2 in. (64 mm) x 3/8 in. (9 mm) minimum, and (3) the 12-1/2 in. (318 mm) spacing between rungs exceeds the maximum allowed 12 in. (305 mm) spacing intervals.

Each chamber has an open overflow pipe inlet. A pipe projects from the shell just below one of the roof manholes which is covered with corrosion (See photo 3.9-38). Another pipe projects from the shell, and corrosion and rust staining is located on it (See photos 3.9-50 and 3.9-51). A pipe projects above the floor of each chamber which has cage screening; however, the cage screens are clogged with corrosion products (See photos 3.9-58 and 3.9-59). There is another pipe in each chamber which is located within a sump in the floor (See photos 3.9-54 and 3.9-56). Significant corrosion, rust tubercles, metal loss, and holes are located on one of the sump pipes although the other sump pipe appears to be in good condition (See photos 3.9-55 and 3.9-57). The clogged screening is an operational deficiency.

PHOTO 3.9-1 Tank 2106 and site.

PHOTO 3.9-2 Tank 2106 and site.

PHOTO 3.9-3 Tank 2106.

PHOTO 3.9-4 Tank 2106.

PHOTO 3.9-5 Tank 2106.

PHOTO 3.9-6 Valve vault.

PHOTO 3.9-7 Apparent leak located near base of shell.

PHOTO 3.9-8 Apparent leak in shell.

PHOTO 3.9-9 Corrosion on exterior piping.

PHOTO 3.9-10 Corrosion on exterior piping, and loose sealant around pipe penetration.

PHOTO 3.9-11 Overflow pipe.
Note corrosion.

PHOTO 3.9-12 Overflow pipe discharge. Note corrosion.

PHOTO 3.9-13 Corrosion and perforated plate screen at overflow pipe flange.

PHOTO 3.9-14 Exterior piping and equipment.

PHOTO 3.9-15 Deteriorated sealant around pipe projection.

PHOTO 3.9-16 Shell exterior.

PHOTO 3.9-17 Shell exterior.

PHOTO 3.9-18 Corrosion and rust staining at exposed steel in shell.

PHOTO 3.9-19 Shell and underside of roof overhang.

PHOTO 3.9-20 Deterioration in shell.

PHOTO 3.9-21 Deterioration in shell.

PHOTO 3.9-22 Exterior ladder, conduits, and cabinets.

PHOTO 3.9-23 Roof access and roof safety railing.

PHOTO 3.9-24 Roof safety railing.

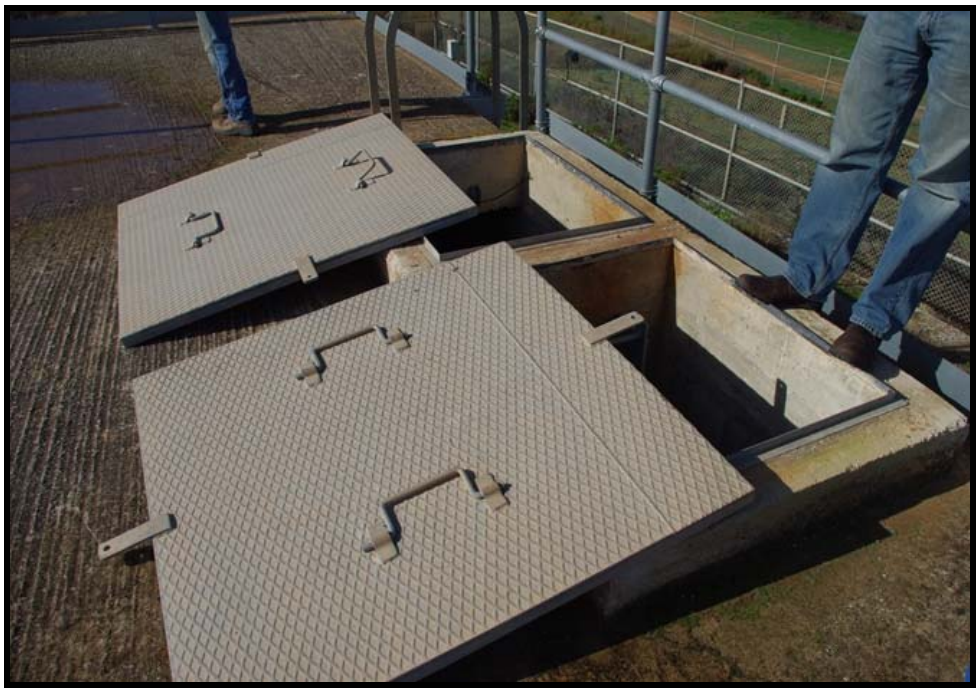

PHOTO 3.9-25 Roof manholes.

PHOTO 3.9-26 Roof manhole interior.

PHOTO 3.9-27 Roof manhole interior.

PHOTO 3.9-28 Standing water on roof.

PHOTO 3.9-29 Standing water on roof.

PHOTO 3.9-30 Moss on roof.

PHOTO 3.9-31 Corrosion on unscreened roof vent.

PHOTO 3.9-32 Corrosion on unscreened roof vent.

PHOTO 3.9-33 Corrosion around pipe opening in shell.

PHOTO 3.9-34 Roof interior.

PHOTO 3.9-35 Roof and shell.

PHOTO 3.9-36 Roof and shell.

PHOTO 3.9-37 Roof and shell.

PHOTO 3.9-38 Cut-out between chambers.

PHOTO 3.9-39 Corrosion at exposed steel in shell.

PHOTO 3.9-40 Interior ladder and bracket.

PHOTO 3.9-41 Corrosion at exposed steel in shell.

PHOTO 3.9-42 Corrosion and rust tubercles on interior ladder bracket bolts.

PHOTO 3.9-43 Interior ladder.

PHOTO 3.9-44 Corrosion and rust staining on exposed steel in shell.

PHOTO 3.9-45 Corrosion and rust staining on exposed steel in shell.

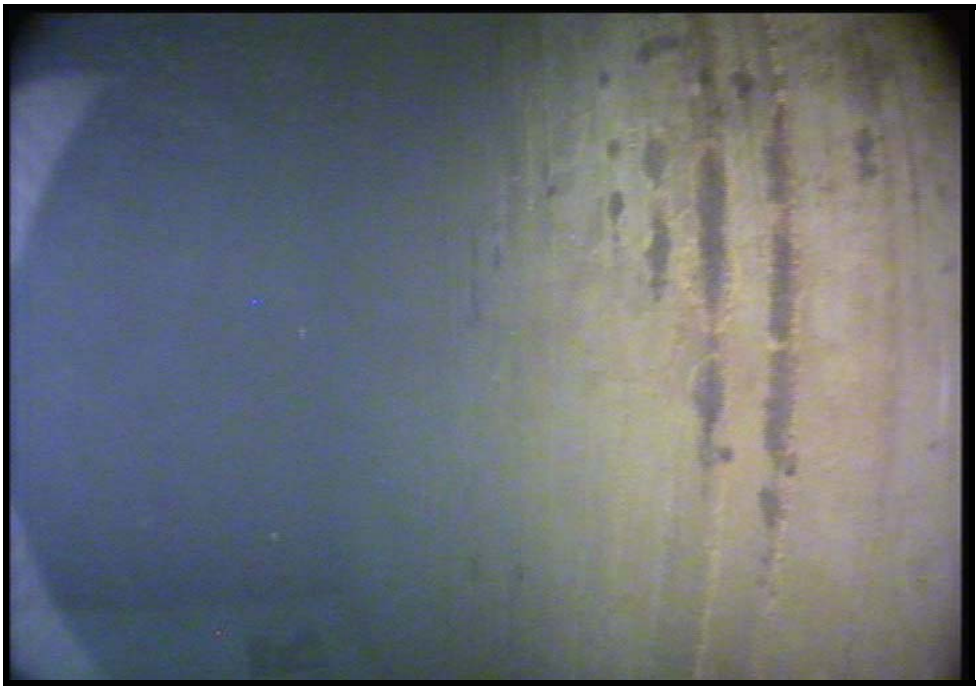

PHOTO 3.9-46 Corrosion on exposed steel in shell.

PHOTO 3.9-47 Concrete spalls and corrosion on exposed steel in shell.

PHOTO 3.9-48 Corrosion on exposed steel in shell.

PHOTO 3.9-49 Corrosion on exposed steel in shell.

PHOTO 3.9-50 Corrosion and rust tubercles on pipe projection from shell.

PHOTO 3.9-51 Corrosion and rust tubercles on pipe projection from shell.

PHOTO 3.9-52 Shell and floor.

PHOTO 3.9-53 Silt on floor.

PHOTO 3.9-54 Pipe projection above sump and silt on floor.

PHOTO 3.9-55 Corrosion and metal loss on pipe projection in sump.

PHOTO 3.9-56 Pipe projection above sump and silt on floor.

PHOTO 3.9-57 Corrosion and metal loss on pipe projection in sump.

PHOTO 3.9-58 Corrosion and rust tubercles on pipe projection.

PHOTO 3.9-59 Corrosion and rust tubercles on pipe projection.

3.9.3 Comparison of Previous Inspection Results

The tank was previously evaluated by Tank Industry Consultants on March 4, 2008, and evaluation report CR-6480-OCN was issued. Since the time of the 2008 evaluation, it appeared that some repairs and modifications had been made to the tank which include:

- A perforated plate screen has been installed at the overflow pipe flange.
- Safety railing has been installed around the perimeter of the roof.
- A new overhang has been installed on the roof.
- The interior ladders have been replaced.

3.9.4 Structural Condition Assessment

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 Navy and the Engineer.

This tank is located in a seismically active region. This evaluation and reported condition do not verify the tank's original design compliance for seismic or coastal wind loading in accordance with current design requirements, as it was outside the scope of this report. Likewise, recommendations for this tank do not include modifications that 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.

3.9.5 Recommendations

Site:

Site Maintenance: The site should be maintained so that proper drainage away from the tank continues. The vegetation should be regularly trimmed so it does not touch the tank.

Valve Vault: The piping and valves located in the valve vault should be cleaned and painted. 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 be locked at all times in order to limit liability to the Navy and to protect water system security.

Exterior Surfaces:

Exterior Concrete: It is recommended the exterior surfaces be repaired within the next year. The shell beneath the roof overhang has deteriorated and the deterioration in the south side of the shell has started to leak. The cracks in the underside of the roof overhang should be prepared according to the specifications of the concrete crack repair material manufacturer. These areas to be repaired should be prepared by wet blast cleaning to remove dust, laitance, grease, or other bond inhibiting materials and blown off with high-pressure air. The cracks in the concrete should then be repaired by routing out the crack to a minimum depth of 1 inch (25 mm, with a minimum 90° angle from the surface) and repairing with a cement-based patching compound. The sequence and performance of these concrete repairs shall be such that the structural integrity of the tank area is not compromised. In order to repair the leak, epoxy injection may be required.

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

Exterior Piping: When the tank is rehabilitated, the loose sealant around the exterior pipe penetrations should be removed, and new sealant installed.

Shell Manholes: It is recommended that the Navy classify this tank as a confined space, and initiate the appropriate confined space access measures whenever anyone is going to access the tank interior.

Overflow Pipe: Installing an elastomeric check valve on the discharge end of the overflow pipe would prevent the ingress of birds, small animals, and insects into the tank and deter clogging.

Clog-Resistant Vents: The roof vents are not clog-resistant. The AWWA D100 Standard (applicable for steel tanks) recommends that all vents with screening against insects be designed to ensure "fail-safe" operation if the insect screens become occluded. However, AWWA D110 does not require a clog-resistant vent, and a concrete roof is typically capable of withstanding more pressure or vacuum than a steel roof.

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