

Agency: Commerce, Community and Economic Development**Grants to Municipalities (AS 37.05.315)****Grant Recipient: Kenai****Federal Tax ID: 92-6001599****Project Title:****Project Type: New Construction and Land Acquisition**

Kenai - Water Storage Reservoir Construction

State Funding Requested: \$2,500,000**House District: Kenai Areawide (28-30)**

One-Time Need

Brief Project Description:

Construct a new storage reservoir to meet existing and future water storage requirements. Provide system redundancy and provide alternative storage during major maintenance to City's existing 3-million gallon water storage reservoir.

Funding Plan:

Total Project Cost:	\$2,750,000
Funding Already Secured:	(\$250,000)
FY2014 State Funding Request:	<u>(\$2,500,000)</u>
Project Deficit:	\$0

Funding Details:

City provided funding provided by existing fund balance of the Water & Sewer Fund

Detailed Project Description and Justification:

The City of Kenai's present Water Storage requirements are met through the use of a single three million-gallon storage reservoir. The average daily demand on the City's water utility ranges from 800,000 to 1.2 million gallons per day, the existing storage is equivalent to three days average demand.

While the existing three million gallon water storage reservoir is adequate to meet present demands, having a single water storage facility does not allow for the water storage reservoir to be taken "off-line" to perform maintenance and repair activities.

The existing three million gallon reservoir was constructed in 1978, and has been in continuous service for 34 years. The reservoir has performed in an exemplary manner, providing adequate storage to meet domestic, industrial, and fire protection needs for the community.

In 2011, the City hired a consultant to perform a condition survey of the existing reservoir (attached). Not surprisingly, given the age of the coating system, the engineering consultant found:

"The interior coating system shows signs of extensive coating failure after its years of service. The roof coating has failed over 30% of the surface and shell coating has blisters on 85% of the shell surfaces. The wall blisters are beginning to crack and cause large scale underfilm corrosion and delamination. There is no serious metal loss at this time but the tank will probably need to be repainted in 1-3 years."

Re-coating the City's water storage reservoir is a highly-technical process which will require a four to six month period during which the three-million-gallon reservoir will be out of service. The process includes but is not limited to:

1. Draining the reservoir.
2. Removal of all silt and other debris inside the reservoir.
3. Installing interior scaffolding
4. Removal (sand blasting) of the existing coating system.
5. Non-destructive testing of the reservoir roof, floor, and walls to verify structural integrity.
6. Repair of any damaged surfaces and/or structural members.
7. Installing updated level control system.
8. De-humidification of reservoir interior to facilitate re-coating.
9. Preparation of interior surfaces
10. Re-coating (multiple coating layers.)

Without the construction of either a temporary or permanent alternate water storage reservoir, it is impossible to remove the existing three million gallon water storage reservoir from service. We have explored temporary water storage and found that to meet the minimum requirement of at least one day's water demand (+/-1,000,000 gallons) and found that temporary water storage is not feasible given that the water must be potable, and the volume of temporary storage results in significant costs, approaching or exceeding the cost of permanent storage.

Additionally, the City water utility experiences a 3%-5% increase in water consumption annually. In order to maintain three day water storage capacity a new one million gallon reservoir will be required within the next 10 years.

In the event there is a failure of the existing three-million-gallon water reservoir, without the construction of a second water storage reservoir the community will not have sufficient potable water during periods of heavy use, and there will be no available water to meet demands for fire-flows, therefore there would be a risk to the health and safety of Kenai residents.

Project Timeline:

July 2013-Selection of Design Consultant
 August 2013-December 2013 Design Phase Services
 January 2014-February 2014 Invitation for Bid
 March 2014 Award Contract for Construction
 April 2014-Janauary 2015 Construction
 February 2015-March 2015 Contract Close-Out
 February 2015-January 2016 Warranty Period

Entity Responsible for the Ongoing Operation and Maintenance of this Project:

City of Kenai

Grant Recipient Contact Information:

Name:	Rick Koch
Title:	City Manager
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Has this project been through a public review process at the local level and is it a community priority? Yes No

**CITY OF KENAI
 COST ESTIMATE FOR
 ADEC SFY 2014 MUNICIPAL MATCHING GRANT
 PROGRAM
 CONSTRUCTION OF A 1 MILLION GALLON WATER
 STORAGE RESERVOIR**

Cost Item Description	Amount
Site Preparation	\$ 100,000.00
Piping Systems	\$ 75,000.00
Controls	\$ 125,000.00
Foundation	\$ 300,000.00
Reservoir	\$ 850,000.00
Reservoir Coating	\$ 500,000.00
Reservoir Insulation	\$ 200,000.00
Sub-Total	\$ 2,150,000.00
Design @ 10%	\$ 215,000.00
Const. Admin./Insp. @ 12%	\$ 258,000.00
Contingency @ 5%	\$ 131,150.00
Total	\$ 2,754,150.00

Water Tank Inspection Report

For

City of Kenai, AK

Of the



3.0MG Reservoir

August 15, 2011



ACUREN

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3MG Reservoir

Kenai, Alaska

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INTRODUCTION

On August 15, 2011 Acuren representatives, Corby Robertson and Alton Drones performed corrosion analysis and structural assessment of the exterior and interior of a potable water storage tank for the City of Kenai, Alaska. The inspection was conducted to establish the current condition of the tank's coatings and steel substrate. The tank inspected included:

3.0 Million Gallon Ground Reservoir

The tank was inspected in accordance with the latest version of AWWA D101-53 (86R) standard for water tank inspections and the M42 AWWA Tank Guidance Manual.

The interior of the reservoir was inspected with the TankRover remotely operated vehicle, while full. The TankRover is the only piece of equipment of its kind in the United States and was developed by Extech, a division of Acuren. By using the TankRover the interior of the tank was inspected with no special preparation, no additional disinfection and no downtime.

The TankRover is equipped with a surface-cleaning tool used to remove loose rust or debris in order to view the potential metal loss under the coating. The unit has high-powered thrusters, which are used to maneuver throughout the tank as well as washing away bottom sediment for observations.

The TankRover was prepared for the inspection by disinfecting in accordance with AWWA C652.

The exterior portions of the tanks were inspected by walking the roof and shell portions that were accessible from the ground.

The objectives of the assessment were to:

1. Perform field inspections and tests to assess the structural and coating integrity of the tank.
2. Review the safety compliance of tank ladders and access.
3. Review sanitary conditions and protection.
4. Provide recommendations for rehabilitation.

EXECUTIVE SUMMARY

The conditions and recommendations for the tank are briefly summarized in this section. For more detailed information regarding tank conditions and the specific recommendations please refer to the designated section for each tank.

The interior coating system shows signs of extensive coating failure after its years of service. The roof coating has failed over 30% of the surfaces and the shell coating has blisters on 85% of the shell surfaces. The wall blisters are beginning to crack and cause large scale underfilm corrosion and delamination. There is no serious metal loss at this time but the tank will probably need to be repainted in 1-3 years.

The cathodic protection system is protecting the submerged surfaces from metal loss.

The floor of the tank had very thin layer of sediment ranging from 1/8 to 1/4 inches deep. The sediment was a light, fluffy material with a brownish color to it. There was some blistering along the tank floor. Sediment was removed as part of the inspection procedure.

OBSERVATIONS

Photographs provided in the report were created from a digital camera and interior pictures were captured in digital format from the interior videotape. The interior images are as clear as our printed technology will allow. The copies in the report provide a reference for our comments. Keep in mind that for underwater video snaps, the videotape provides the greatest detail and should be viewed as part of the report.

3.0 Million Gallon Ground Reservoir

The reservoir is a welded steel structure, 150 feet in diameter and 25 feet high. The tank was built in 1978. The tank roof is a low cone with a cured knuckle perimeter. The roof is supported by radial “C” channel rafters, two rows of tubular columns and “T” beams.

The exterior of the tank is insulated with spray on foam insulation.

The tank has one 36-inch square roof hatch that can be seen in DP#17 and two 36-inch round bolted ground level hatches, they’re pictured in DP#6 and DP#8. The roof hatch is equipped with the required sanitary curb which has been subject to edge corrosion, DP#17.

The following paint systems are present:

- Interior- Epoxy
- Exterior-Primer only under insulation

INTERIOR

The interior of the tank was accessed through the existing 36-inch square perimeter hatch, which was not locked at the time of the inspection. The hatch’s insulation is deteriorating which can be seen in DP#18. The water level during the inspection was consistently one foot below the overflow.

Roof (ceiling)

The roof is a flat cone structure with a central support column and radial “C” section rafters. The tank also contained numerous support beams surrounding the central support column. The roof has widespread coating failure with active surface, pinpoint, and edge corrosion. These conditions can be viewed in DP#20-27 and VS#1-4.

The roof plates have widespread edge and surface corrosion developing. There is 55-60% coating failure on the surface of the plates. These conditions can be viewed in the above mentioned digital pictures and video snaps.

Ladders

There was no interior ladder present in the tank.

Shell

The shell has extensive blistering that is leading to surface cracks coating, exposing the underlying steel. These issues can be seen in VS#7-11. Coating blistering was noted on 85% of shell surfaces. The exposed steel is not rusting due to the protection offered by the impressed current cathodic protection system.

Floor

The floor of the tank is in good condition and covered by a thin film of sediment shown in VS#21 and VS#22. We did not see the same blistering in the coating on the floor. The floor was viewed before and after the removal of the sediment.

Inlet/ Outlet

The reservoir uses a combination inlet/outlet pipe with a combination diffuser and vortex breaker. The diffuser is broken, as seen in VS#14.

EXTERIOR

Roof

The roof had a layer of insulation so we were not able to view the condition of the coating. The condition of the insulation is fair with numerous areas of bird damage, see DP#18. The condition of roof insulation can be viewed in DP#13-16, where bird damage is seen but no widespread delamination.

Vent

The tank is equipped with one, 20-inch diameter vent, DP#10. There appeared to be visible damage to the vent steel shown in DP#11 and DP#12. The vent screens were in poor condition and will need to be replaced. The roof vent opening is very close to the roof and possibly susceptible to blockage by snow. Reduced air flow could create a vacuum or over pressure situation.

Ladders and Railings

The shell has a vertical ladder that is OSHA compliant, with a safety cage. The ladder is equipped with an anti climb device seen in DP#3. The bottom ladder rung is located one foot above the ground. There are handrails around the hatch on the top of the tank; this railing system can be viewed in DP#9.

Shell

The tank shell had an insulation wrapping the outer shell, which appeared to be in fair condition, seen in DP#5. Areas that have been subject to rock and bird damage can be seen in DP#4 Some slight deterioration of the shell insulation can be seen in DP#7

Overflow

The overflow pipe was a cone top with a top termination shown in DP#19. The overflow has a splash pad that discharges into an adjacent ditch. There was no screen present at the bottom of the overflow shown, however it is covered with a trash bag. DP#2.

Foundation

The reservoir's foundation consists of a concrete ring wall. DP#28. There are no anchor assemblies for this tank.

An overall view of the tank can be seen in DP#1.

RECOMMENDATIONS

3.0 Million Gallon Ground Reservoir

The tank is currently in good structural condition with no serious metal loss or deformation. The interior coating is failing above and below the water line.

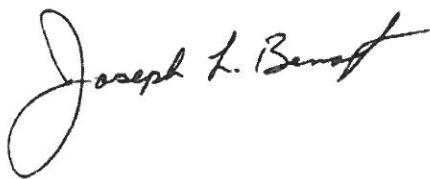
The overflow pipe will require having a screen put on the end of it immediately for sanitary reasons.

The ladder cage should be fitted with a locking gate to prevent unauthorized access. It may also be necessary to install a sheet metal cover over the ladder cage to prevent climbing.

Consideration should be given to scheduling interior repainting in 1-3 years. The interior will need to be completely blasted and painted. Although the tank shell and floor corrosion could be controlled with a cathodic protection system the roof is failing quickly and that area cannot be protected with cathodic protection.

The roof vent should be replaced with a vacuum/frost free design and a fine mesh insect screen
Estimated Cost \$5,000

Estimated Interior Painting Cost \$ 750,000.



NACE Certified Coating Inspector #1381

GLOSSARY OF TERMS

Cathodic Protection - The use of a sacrificial metal or energized substance to polarize the structures surfaces and prevents corrosion.

Chalking - The degradation of a paint system when exposed to ultra-violet light which creates a loose residue on the surface.

Corrosion Cell - A concentrated localized site of accelerated corrosion that creates pitting.

Dry Film Thickness - Total thickness of a paint film when complete cured.

Finial Vent - The central roof vent on top of a water tank.

Holiday - A hole in a protective coating that may be invisible to the unaided eye that extends to the substrate.

Lead Abatement - The removal and a lead bearing paint system.

Lead Encapsulation - The covering over of a lead based paint by applying a compatible topcoat.

Osmotic Blister- Raised coating area created by build up of fluid under the coating. Fluid moves through coating in response to water/solvent concentrations between coating and tank water.

ROV- Remotely operated vehicle, underwater inspection device "TankRover"

Silt - Material that accumulates in the bottom of a water tank originating from treatment by products and distribution system debris.

Tubercle- Domed shaped build up of corrosion products over an active corrosion site. Promotes metal loss through pitting due to differential oxygen concentrations.

Ultrasonic Measurement - The use of high frequency sound waves passed through a material to measure the time required to return. The time required to pass through the material is correlated to the speed of sound in the substrate to yield an actual thickness at a specific location.

APPENDIX A
PHOTOGRAPHS

***Kenai
3MG
Reservoir***

3.0MG GST Kenai, AK

DP#1



Overall view of tank

DP#2



Trash bag on overflow discharge

DP#3



Exterior shell ladder with safety cage

DP#4



Upper shell insulation with rock damage

3.0MG GST Kenai, AK

DP#5



Upper shell insulation in good condition

DP#6



Concrete foundation with minor spalling

DP#7



36-inch shell manway

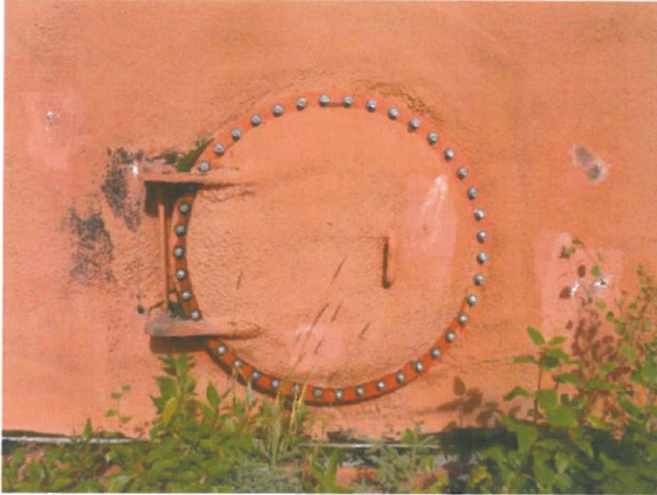
DP#8



Upper shell insulation has slight deterioration

3.0MG GST Kenai, AK

DP#9



Second shell manway 36-inch diameter

DP#10 Railing system adjacent to roof hatch



DP#11



Center roof vent cap

DP#12



Coarse and fine mesh screen on roof vent.

3.0MG GST Kenai, AK

DP#13



Hole in coarse screen

DP#14



Insulation deterioration on exterior roof

DP#15



Insulation deterioration on exterior roof plates

DP#16



Insulation deterioration on exterior roof plates

3.0MG GST Kenai, AK

DP#17



36-inch square roof hatch with edge corrosion on sanitary curb

DP#18



Insulation deterioration on roof hatch lip

DP#19



Overflow pipe with cone top

DP#20



Interior roof support beams with minor edge corrosion

3.0MG GST Kenai, AK

DP#21



Pinpoint corrosion on interior roof plate

DP#22



Pinpoint and edge corrosion on interior roof plates and beams

DP#23



Pinpoint corrosion on interior roof plate

DP#24



Corrosion and coating failure on roof support beam

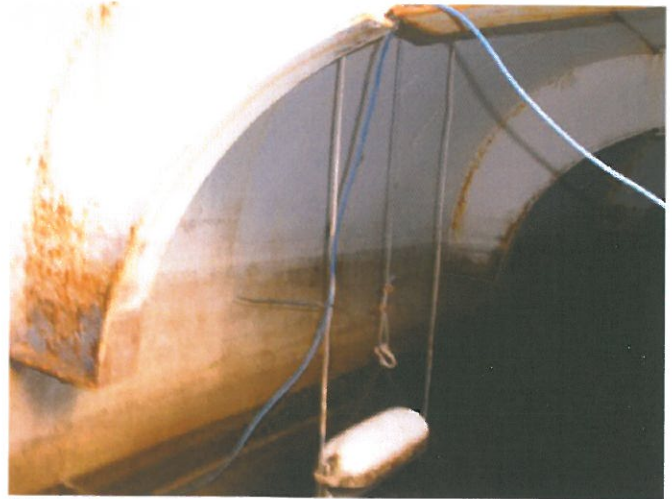
3.0MG GST Kenai, AK

DP#25



Pinpoint and edge corrosion on roof support bracket

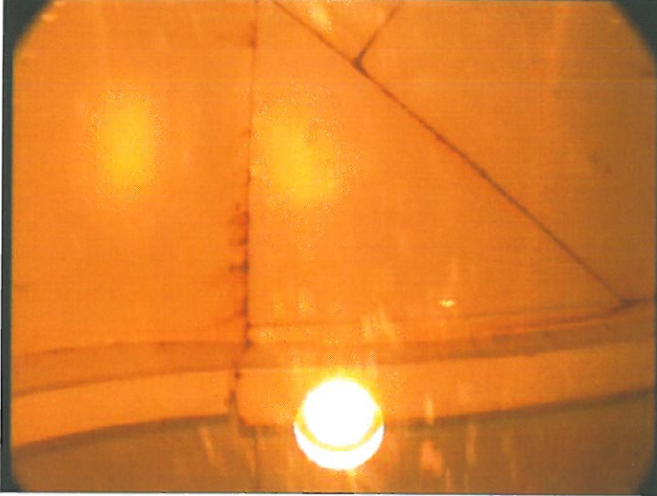
DP#26



Pinpoint and edge corrosion on roof support bracket

City of Kenai

VS#1



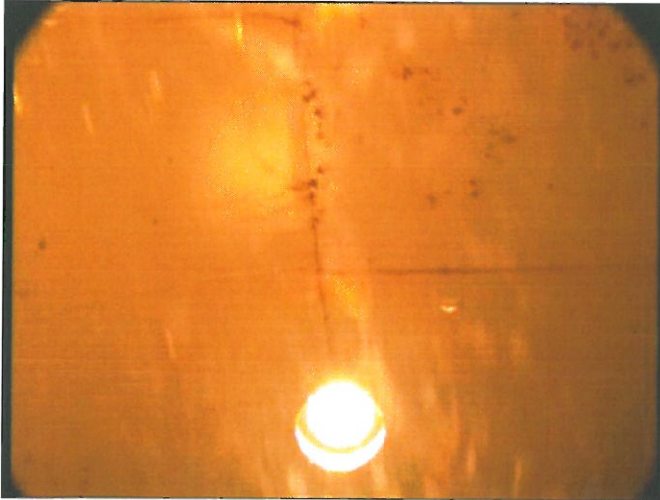
Edge corrosion on roof plate welds
(Time 1:08)

VS#2



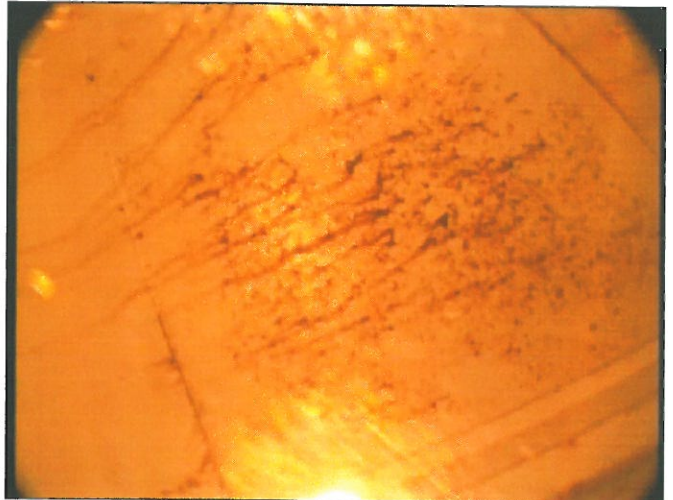
Edge corrosion and large area of coating failure on roof plates
(Time 2:53)

VS#3



Edge corrosion on roof support beams
(Time 3:39)

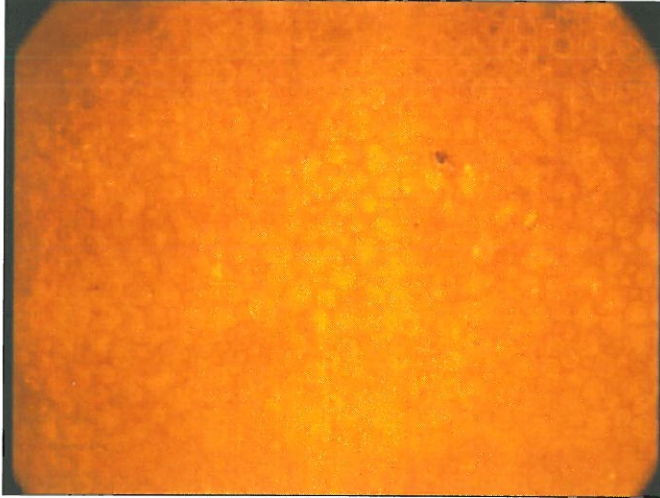
VS#4



Coating failure and surface corrosion on roof plate welds (Time 5:07)

City of Kenai

VS#5



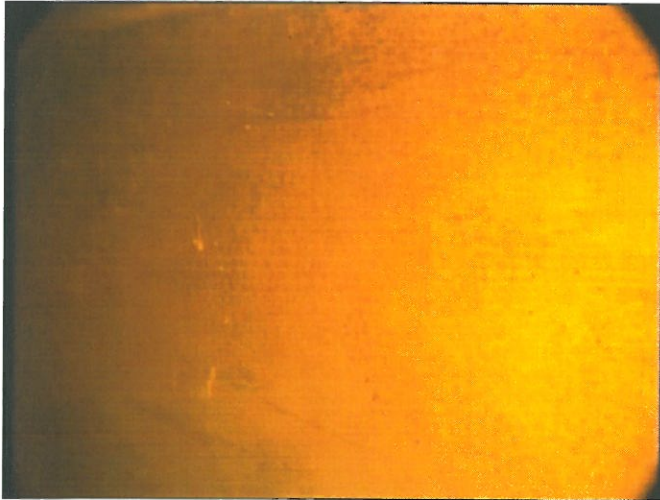
Small corrosion cell and blistering on upper shell coating
(Time 6:41)

VS#6



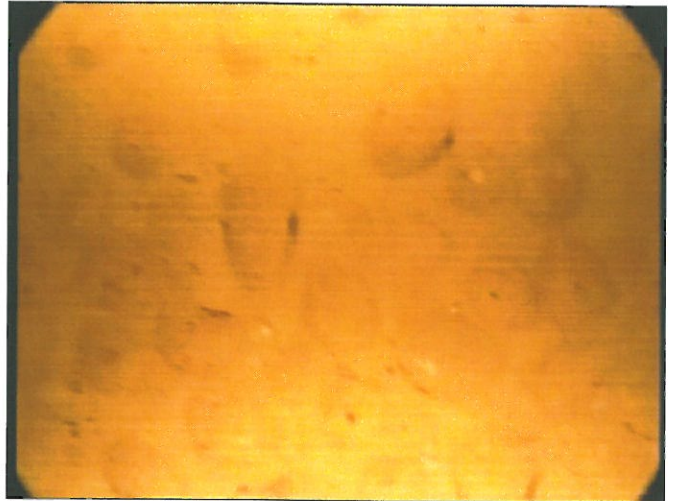
Area of coating missing with surface corrosion
(Time 9:00)

VS#7



Large area of blistering on upper shell coating
(Time 10:52)

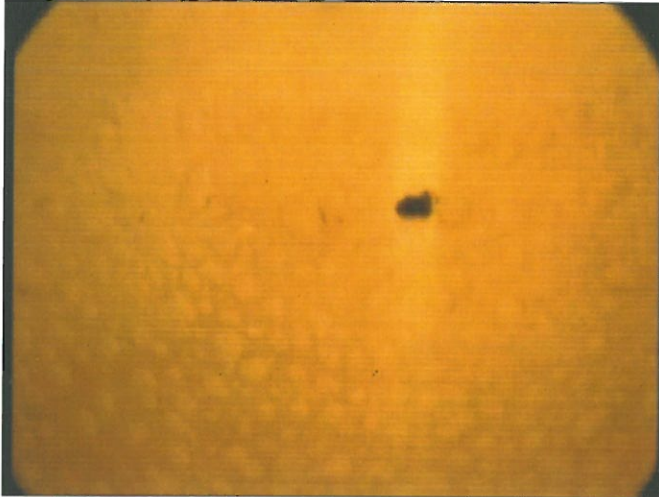
VS#8



Large area of blistering on mid shell coating
(Time 12:42)

City of Kenai

VS#9



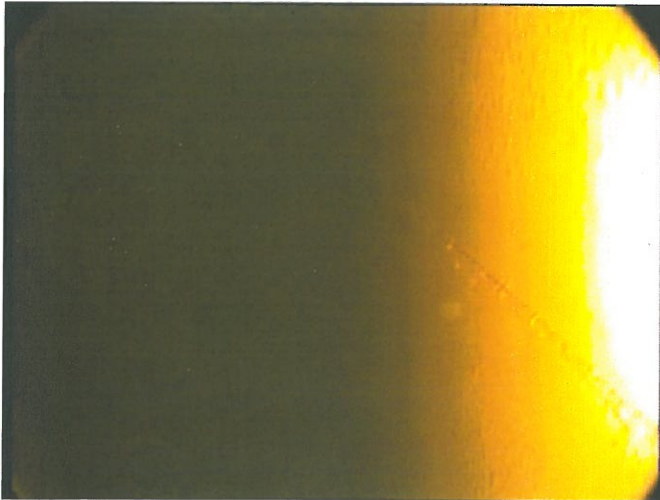
Cracked blister to steel substrate on mid shell
(Time 15:12)

VS#10



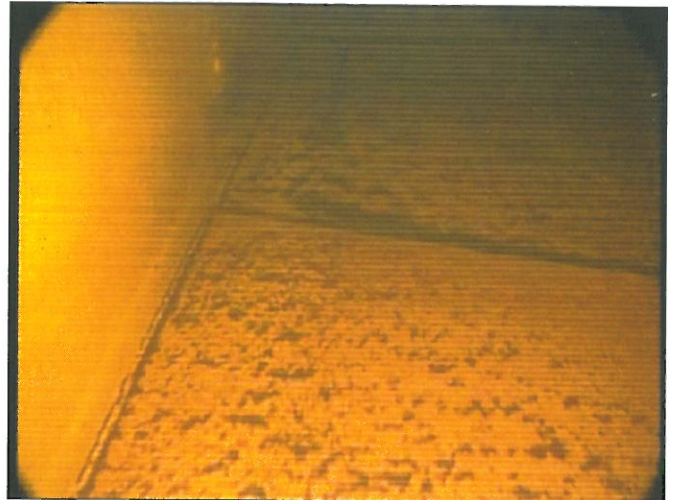
Large cracked blister on mid shell coating
(Time 17:33)

VS#11



Area of blistering on lower shell plate coating
(Time 22:36)

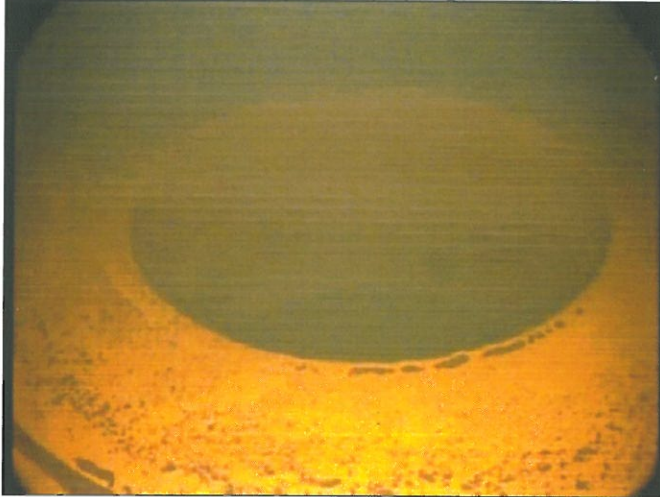
VS#12



Minor dusting of sediment on floor
(Time 24:59)

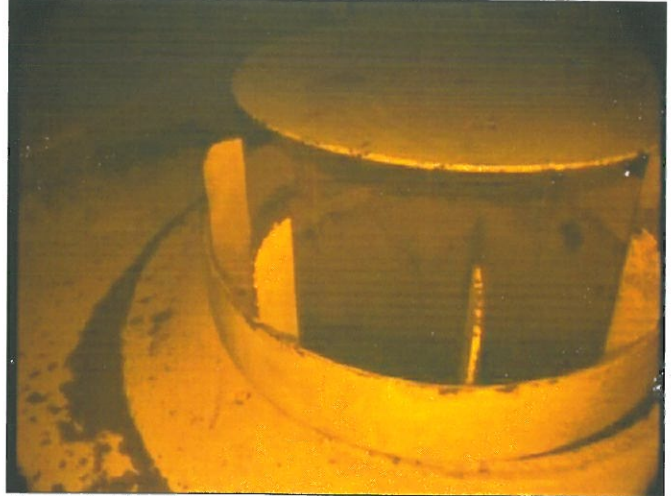
City of Kenai

VS#13



Large tank drain on floor
(Time 24:59)

VS#14



Combo inlet/outlet pipe with broken vortex breaker
(Time 26:31)

VS#15



Minor dusting of sediment on tank floor
(Time 27:29)

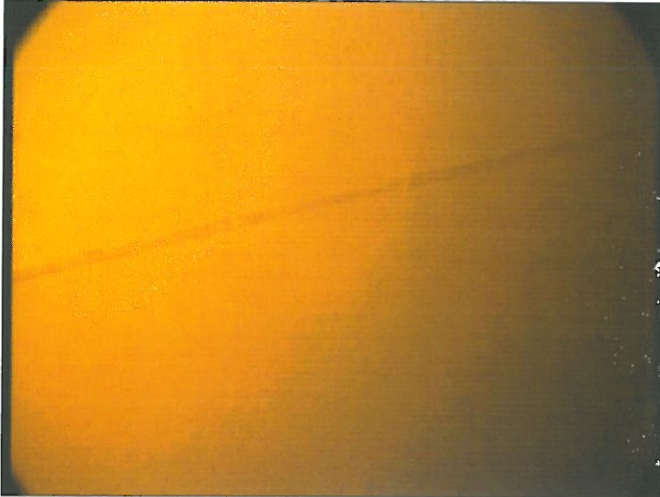
VS#16



Light staining on floor plates
(Time 36:01)

City of Kenai

VS#17



Blistering on lower shell coating
(Time 37:54)

VS#18



Area of blistering on mid shell coating
(Time 42:27)

VS#19



Staining and corrosion on painters ring
(Time 46:13)

VS#20



Large area of coating failure and surface corrosion on upper shell plate
(Time 47:47)

City of Kenai

VS#21



Light film of sediment on floor plates
(Time Ch. 2 00:10)

VS#22



Floor coating in good condition
(Time Ch.2 1:25)

