Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

18-AMRP-0145

AUG 0 2 2018

Ms. Alexandra K. Smith, Program Manager
Nuclear Waste Program
Washington State Department of Ecology
3100 Port of Benton Boulevard
Richland, Washington 99354

Dear Ms. Smith:

ADDITIONAL INFORMATION TO SUPPORT REQUEST FOR TEMPORARY AUTHORIZATION TO IMPLEMENT THE CLASS 3 PERMIT MODIFICATION REQUEST FOR THE PUREX STORAGE TUNNELS CLOSURE UNIT GROUP 19 TO ALLOW INTERIM CLOSURE ACTIVITIES FOR PUREX STORAGE TUNNEL 2

In response to your July 23, 2018, request for additional information to support approval of the U.S. Department of Energy (DOE) Richland Operations Office (RL) request for Temporary Authorization (TA) to begin stabilizing PUREX Storage Tunnel 2 with grout, please find the attached PUREX Tunnel 2 Visual Inspection Results, CHPRC-03811, Revision 0 Draft, which is based on visual examinations completed during the spring of this year. Consistent with the engineering evaluation completed in 2017, the visual examinations show severe degradation of the tunnel support structure in the south end of the tunnel and further supports the conclusion that PUREX Storage Tunnel 2 remains at a potential high risk of localized collapse. Corrosion has resulted in degradation of several elements of the structure, but most significantly to the support bolts, nuts, and washers that hold the longitudinal metal beams in place in the roof of the tunnel. Failure of these components could result in a different and more significant mode of failure than PUREX Storage Tunnel 1, possibly breaching the highly radiologically-contaminated equipment in PUREX Storage Tunnel 2 and potentially releasing contamination to the environment.

The CH2M HILL Plateau Remediation Company currently has approved work processes and subcontracts in place to begin stabilizing PUREX Storage Tunnel 2 with grout beginning August 20, 2018. Stabilization of PUREX Storage Tunnel 2 with grout is consistent with the recommendation of the DOE Expert Panel and does not preclude future Comprehensive Environmental Response, Compensation, and Liability Act/Resource Conservation and Recovery Act remedial actions, similar to PUREX Storage Tunnel 1. PUREX Storage Tunnel 2 stabilization activities are paused until such time that RL receives the requested TA from the

Washington State Department of Ecology (Ecology). As a minimum, RL requests authorization to begin installing the equipment necessary to stabilize PUREX Storage Tunnel 2 by August 13, 2018, and authorization to begin stabilizing PUREX Storage Tunnel 2 with grout on September 6, 2018. Ecology's timely authorization to proceed will reduce risk to the workers, public, and environment, avoid potential long-term impacts to site operations and other cleanup activities, avoid potential weather delays, and will enable the most effective and efficient use of available funding given the uncertainty in the Fiscal Year 2019 appropriations process.

If you have any questions, please contact me or your staff may contact Joe Franco, Assistant Manager for the River and Plateau, on (509) 373-9971.

Sincerely,

Doug S. Shoop
Manager

AMRP:OAF

Attachment:
PUREX Tunnel 2 Visual Inspection
Results, CHPRC-03811, Revision 0 Draft

cc w/attach:
D. B. Bartus, EPA
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L. J. Cusack, CHPRC
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S. N. Schleif, Ecology
D. G. Singleton, CHPRC
B. L. Weese, Ecology
Administrative Record (TSD: S-2-1)
Ecology NWP Library
Environmental Portal
HF Operating Record (J. K. Perry, MSA)

CHPRC-03811
Revision 0

PUREX Tunnel 2 Visual Inspection Results

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company

P.O. Box 1600
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CHPRC-03811
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PUREX Tunnel 2 Visual Inspection Results

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CH2M HILL Plateau Remediation Company

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Assistant Secretary for Environmental Management

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APPROVED
By Janis D. Arndal at 7:53 pm, Aug 02, 2018

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Date

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CHPRC-03811, Rev. 0

PUREX Tunnel 2 Visual Inspection Results

Following the partial collapse of the Plutonium Uranium Extraction Plant (PUREX) Tunnel 1, a structural analysis was performed for PUREX Tunnel 2 and documented in CHPRC-03365, "PUREX Tunnel 2 Engineering Evaluation." The analysis did not account for corrosion or radiation effects on the steel support members and connections. The results indicated that the stresses on several structural support members were above design capacity. The conclusion of the analysis stated "Based on overstressed conditions in structural support members and connections and uncertainty of additional unknown stress induced during original construction, Tunnel 2 has a potential high risk of localized collapse." The Expert Panel convened to review the options for stabilizing Tunnel 2 reached the following conclusion: **"The panel concluded that stabilization with grout was the preferred stabilization method. The grout option provides protection to workers, the public, and the environment, while facilitating future options for disposition."**

Between February 2018 and April 2018, video inspections were performed of the interior of the tunnel. The inspections confirmed that the interior steel configuration matched the details shown on the construction drawings. During the visual inspections close attention was paid to the steel members and connections. The visual inspections found significant corrosion at the south end of the tunnel (refer to Figures 1 and 2), while the north end did not have the same level of corrosion (refer to Figure 3).

The ventilation system for Tunnel 2 flowed from the PUREX facility through the tunnel from north to south. During operation, the ventilation system exhausted out the south end through a high-efficiency particulate air (HEPA) filter. Therefore, moisture, whether entrained water or high humidity air, was drawn toward the south end by the exhaust fan located at the south end. This ventilation flow path likely explains the difference in the corrosion levels observed in the north and south end. When the tunnel was taken out of operation, the ventilation HEPA filter was removed and ventilation exhaust duct sealed.

Note that the railcars with waste were placed in the north end of the tunnel but pushed to the South end. The first waste placed in the tunnel is at the South end.

The conclusion of the evaluation of the visual inspections indicates PUREX Tunnel 2 is weaker than analyzed and grouting should proceed as soon as possible.

Figure 1, Wide view of structural steel members near South end of Tunnel 2

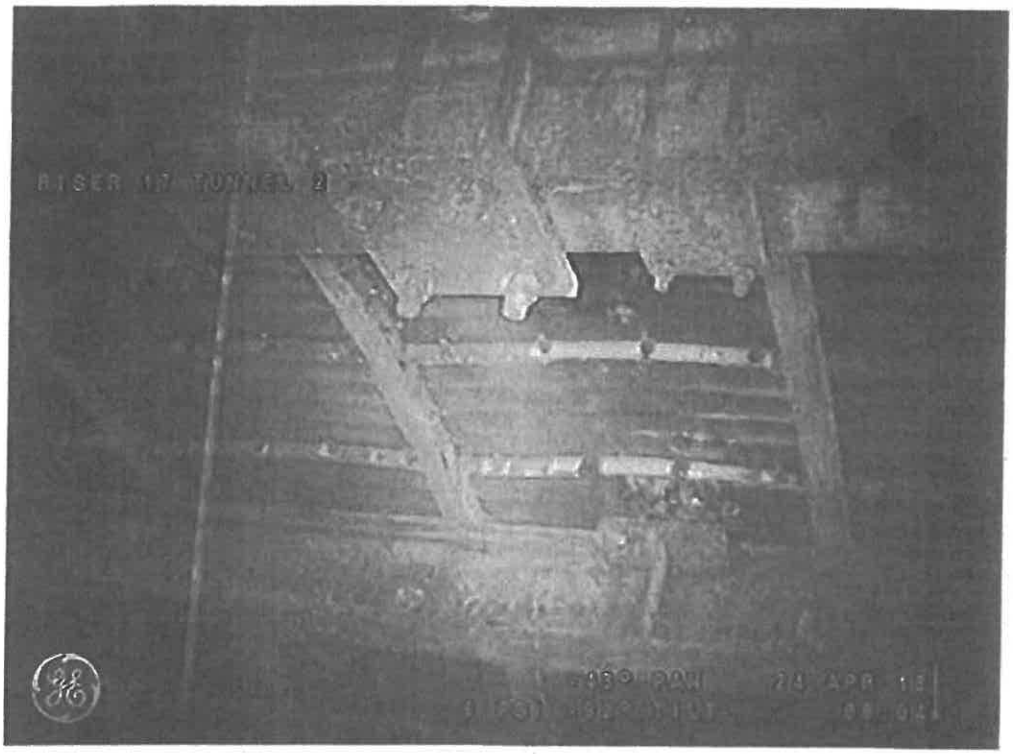


Figure 2, Close up of structural (bolted) connections in the South end of Tunnel 2

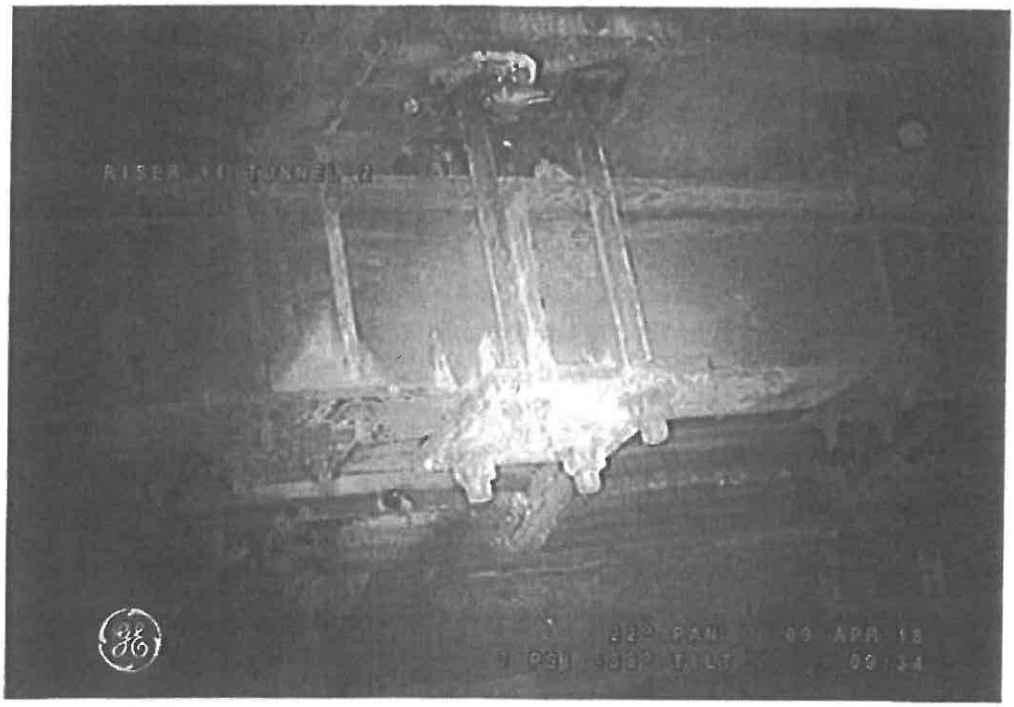
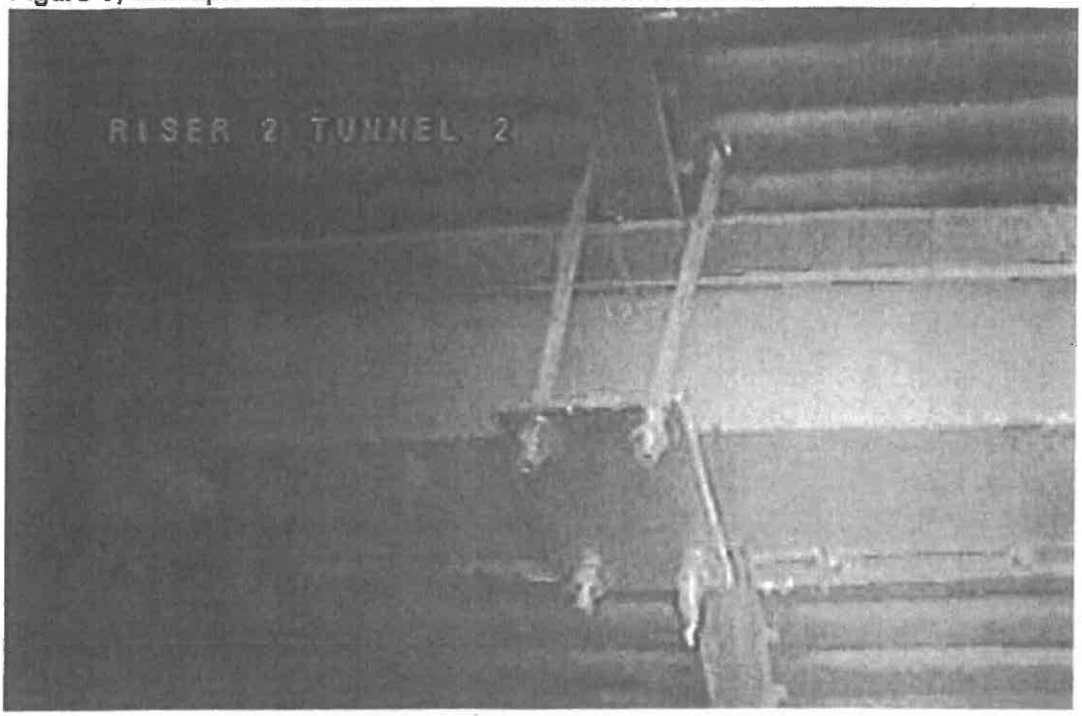


Figure 3, Example of structural steel conditions in North end of Tunnel 2



Corrosion Effects on Tunnel Structure

The corrosion in the South end of the tunnel on the bolts and threads which extend to the external concrete support ribs is a concern. Corrosion at threaded connections is a common cause of failure in general industry. The concrete support ribs, wale beams and the bolted connections were specifically installed to prevent the collapse of the tunnel (after earlier designs without these features failed during backfill). The Engineering Evaluation identified several overstressed structural support members and connections. The presence of significant corrosion means the structure is weaker than analyzed.

If one of the connections to the concrete ribs failed, the load would shift to other connections increasing their overstressed conditions and likely causing failure. The failure could be a localized collapse. However, the shifted loads could create a failure sequence, commonly called a "zipper" effect, leading to a failure larger than that experienced in Tunnel 1 (the collapse would expand until overburden could not be supported by adjacent members). In addition, dropping structural steel components present a greater threat to the waste containers/equipment stored in Tunnel 2 (as compared to the wooden timbers used in Tunnel 1).

This new information means that the 'potential high risk of localized collapse' is greater than previously known.

Radiation Effects on Tunnel Structure

During the video inspections, the steel members were also inspected for other defects. Radiation damage to steel would be unlikely to cause visual damage. In addition, damaging effects of radiation exposure is highly dependent on radiation type and the material of consideration. Nonmetals such as wood and elastomers have limited resistance, whereas metals have a very high tolerance. The radiation encountered in the tunnel is primarily beta/gamma radiation. The highest radiation level observed within the tunnel was 5.57 R/hr. The radiation levels needed to cause an increase in corrosivity is 100,000 R/hr. Therefore, the radiation levels will have no impact on the structural steel.

Grouting Task Effects on Tunnel Structure

To access the tunnel for grouting and observation, the riser plugs, which weigh 2200 lb. each, will be removed. A grout insertion device (Ref. H-2-837316), weighing less than 450 lb, will be inserted. This results in the removal of 1750 lb. of load at multiple risers along the full length of the tunnel.

A grout insertion extension boom is used to convey grout to the grout insertion device. The boom is self-supporting and positioned approximately 31 ft from the tunnel centerline. The boom is connected to the grout insertion device with a flexible hose so that the extension boom cannot transfer significant weight to the tunnel.

Grout passing through the grout insertion device may impart additional weight during grouting operations. The amount of grout in the insertion device, the connecting hose, and extension boom elbow would weigh 190 lb. This weigh is far less than the weight removed by replacing the riser plug.

Based on the visual observations of the interior of the tunnel, no design changes are required for the grouting operation. The grouting will be accomplished, like Tunnel 1, utilizing a positive displacement concrete pump.

Grout velocity changes could impart minor additional load fluctuations to the grout insertion device. Positive displacement pumps, by their nature create a pulsing effect while in operation. This is caused by 1) the flow difference between the forward stroke and return stroke (where the piston rod diameter reduces stroke volume, and 2) the flow disruption as piston direction changes. For large pumping systems, twin cylinder pumps are used which use alternate stroke directions and essentially eliminate flow variation. The load variation is small compared to other loads described above and still result in a net removal of weight from the tunnel (by removing riser plugs).

Collateral Operations Effects on Tunnel Structure

To minimize other effects on the tunnel during grouting, a load exclusion zone has been established. The exclusion zone extends approximately 30 ft from the tunnel centerline. The Grout Insertion Extension Boom allows support activities, such as personnel, grouting equipment, and truck movement to be well away from the tunnel. Grouting will be performed

in two risers at a time for the day. The grout will be pumped into the tunnel and then the grouting equipment will be flushed with water. The pumpers will then be moved to the next two risers for the next day. At the end of each day, video inspections will be performed after each grouting evolution to look for changes in the structure.