U.S. Department of Energy
Office of River Protection
P.O. Box 450
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03-WEC-050

NOV 04 2003

Mr. E. S. Aromi, President
and General Manager
CH2M HILL Hanford Group, Inc.
Richland, Washington 99352

Dear Mr. Aromi:

CONTRACT NO. DE-AC27-99RL14047 – EVALUATION OF TANK WASTE WASH AND LEACH FACTORS

This letter provides a copy of D-03-Design-005, Evaluation of Tank Waste Wash and Leach Factors, dated October 2003, to CH2M HILL Hanford Group (CH2M HILL) for review. In the October 9, 2003, Technical Integration Activity (TIA) meeting, results from the U.S. Department of Energy, Office of River Protection assessment of water wash and caustic leach factors and oxidative leaching work were presented. Bechtel National, Inc. and CH2M HILL management committed to review the design oversight report (D-03-Design-005) and discuss open issues and potential paths for resolution at the next TIA meeting.

If you have any questions, please contact me, or your staff may call Bill Hamel, Waste Treatment Plant Engineering and Commissioning Division Director, (509) 373-1569.

Sincerely,

Roy J. Schepens
Manager

WEC:RAG

Attachment

cc w/attach:
J. Honeyman, CH2M HILL
B. Popielarczyk, CH2M HILL

U.S. Department of Energy, Office of River Protection

Evaluation of Tank Waste Wash and Leach Factors

D-03-Design-005

October 2003

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Executive Summary

The U.S. Department of Energy, Office of River Protection (ORP) conducted a technical design oversight of CH2M HILL Hanford Group, Inc. (CH2M HILL) newly estimated wash and leach factors for chromium, RPP-10222, *Chromium Wash and Leach Factors*, and aluminum, RPP-11079, *Aluminum Wash and Leach Factors*, in the Hanford tank wastes and their use in predicting feed compositions to the Waste Treatment and Immobilization Plant (WTP) and performance of the WTP. The review was initiated because of the dependence of High-Level Waste (HLW) glass canister count on the chromium leach factors; i.e., the high sensitivity of glass volume to chromium leach factors and glass loading compared with other process parameters. The principal objective of the oversight was to evaluate whether there is adequate technical basis for and improvement of the newly developed wash and leach factors to warrant their adoption.

The design oversight looked at CH2M HILL's RPP-15588, *Hanford Tank Waste Operation Simulator* (HTWOS) and HNF-SD-WM-SP-012, *Tank Farm Contractor Operation and Utilization Plan* (TFCOUP) models, TWINS, RPP-10222, RPP-11079, and RPP-15522, *Hanford Waste Tank Oxidative Leach Behavior Analysis*, and other technical reports. The design oversight also looked at Bechtel National, Inc. (BNI) models and calculations including 24590-WTP-RPT-PT-02-010, *WTP Tank Utilization Assessment* (G2), 24590-WTP-RPT-PT-02-012, *Material Balance and Process Flowsheet Assessment*, and the Engineering Mass Balance. Interviews with BNI and CH2M HILL technical staff were also conducted.

The primary conclusions from the design oversight are: 1) The waste type models for chromium and aluminum wash and leach factors are an improvement over previous wash and leach factor treatments; 2) While the waste type models are an improvement in predicting historical data, predictions of wash and leach factors are not representative of waste to be delivered to WTP or behavior in the WTP; 3) CH2M HILL should perform sensitivity analysis to determine HLW glass production quantities using the new waste type model for chromium and assuming oxidative leaching with permanganate. Based on the results from the recommended sensitivity analysis, ORP should determine whether oxidative leaching is adequate to mitigate potential increases in HLW glass production or whether additional strategies are required; and 4) Retrieval and work to evaluate alternative Low-Activity Waste (LAW) disposal paths provides an opportunity to obtain additional needed information. ORP should capitalize on these opportunities to conduct selective testing to confirm inventory and predict the fate of chromium in tank farms and WTP systems.

The primary objectives, conclusions, and recommendations are discussed in more detail below:

Objective: Determine if proposed refined wash and leach factors for chromium and aluminum (waste type models) are an improvement and appropriate for projecting glass volume.

The waste type models for chromium and aluminum wash and leach factors are an improvement over previous wash and leach factor treatments. The waste type models provide a better prediction of historical laboratory data. Use of the same classification (waste types) for both inventory and wash and leach factors is considered an improvement over the use of different classifications. However, use of these factors should clearly emphasize the inherent uncertainties and limitations discussed below.

While the waste type models are an improvement in predicting historical data, predictions of wash and leach factors are not representative of waste to be delivered to WTP or behavior in the WTP. Wash and leach factor data was developed on source tank compositions which will dramatically change as a result of waste transfer and staging operations. Waste storage, retrieval, transfer, and treatment conditions may alter chromium behavior. Organics in tank waste continue to decompose with time and hydrogen generation from radiolysis is decreasing as radionuclides decay. Both of these factors make tank waste environment less reducing and more oxidative. Many operations introduce air, take long periods of time, and may contribute to chromium oxidation. Twenty to thirty years will have elapsed from the time the samples used to establish wash and leach factors were taken to the time the waste will be processed.

The oversight team recommends performance of sensitivity analysis to determine HLW glass production quantities using the new waste type model for chromium and assuming oxidative leaching with permanganate resulting in a chromium concentration of 5,000 ppm or less in the waste destined for HLW vitrification. This recommendation is supportive of the River Protection Project System Plan recommendations to consider implementation of new water wash and caustic leach factors along with oxidative leaching. CH2M HILL informal sensitivity analysis reported in July 2003 up to 32,000 HLW canisters might be produced if the new wash and leach factors were implemented and no other mitigative strategy selected. This same informal sensitivity analysis indicated oxidative leaching could reduce HLW production to around 10,800 canisters.

Based on the results from the recommended sensitivity analysis, ORP should determine whether oxidative leaching is adequate to mitigate potential increases in HLW glass production or whether additional strategies are required such as glass formulation work to increase chromium loading, melter development, or other treatments. Assuming strategies to control HLW glass production quantities are adequate, CH2M HILL should adopt the new waste type model for chromium in conjunction with oxidative leaching in future system planning. Application in WTP-specific models should follow oxidative leach process design work discussed below.

Also, improved methodologies to predict the behavior of waste to be delivered to WTP or behavior in the WTP should be considered. This should include application of thermodynamic models in conjunction with limited testing to obtain improved information on speciation and kinetics.

Limited characterization data has been obtained over the past decade. Acceleration of single-shell tank retrieval and work to evaluate alternative LAW disposal paths provides an opportunity to obtain needed information. ORP should capitalize on these opportunities to conduct selective testing to confirm inventory and predict the fate of chromium in tank farms and WTP systems. Emphasis should be placed on the most problematic waste types, S1 and S2 salt cake, and R1 sludge. Samples may be available from retrieval waste compatibility analysis. Also, S-109 samples containing the more problematic high chromium waste type S1 salt cake may be available from planned bulk vitrification demonstrations in 2004.

RPP-10222 provided an uncertainty analysis for the chromium wash and leach factor waste type model. Uncertainty analysis comparable to that performed for the chromium waste type model should be performed for the aluminum waste type model. Results from this uncertainty analysis should be assessed prior to making a final decision to apply the new aluminum waste type wash and leach factor model.

Objective: Evaluate proposed approach to include oxidative leaching in models projecting HLW glass volume.

The oversight team found the CH2M HILL report RPP-15552, draft WTP test plans, and WTP Contract requirements to develop the oxidative leaching process were appropriately directed. This work should:

- Identify WTP pretreatment facility equipment design and changes, if any;
- Define impacts to pretreatment facility throughput;
- Identify HLW glass quantity impact from reagents;
- Identify LAW impacts due to oxidation or leaching of radionuclides; and
- Confirm the appropriateness of the 5,000 ppm chromium concentration oxidative leaching process assumption in solids.

Given the uncertainties in performance of oxidative leaching in WTP, the oversight team considers it prudent to consider approaches to oxidize chromium that could be applied in tank farms prior to delivery of waste to WTP. These approaches should consider options to enhance oxidation of chromium during tank waste storage, retrieval, and transfer operations. These methodologies could have slower kinetics than the WTP process oxidation steps. Concepts should be developed to a level of maturity to establish feasibility and support selection of optimum waste treatment systems. With the exception of Tank SY-102, oxidative leaching is not anticipated to be required for initial WTP feed through 2018.

Objective: Evaluate whether constituents other than chromium, aluminum, phosphorous, sulfur, and sodium will leach in quantities that will deleteriously impact operations or HLW and LAW production quantities.

Other constituents for which water wash behavior could impact WTP operations and glass production have been identified. A large number of chemical and radioactive constituents in HTWOS for tank waste planned to be delivered and processed by WTP before 2018 are predicted to exceed Contract maximum specifications. In many cases such as Tank AY-101/C-104, C-107, AZ-101, and batch HLW-PH2/1 waste is predicted to be delivered to WTP exceeding Contract limits for Sr-90 by as much as 12,500%. Other constituents exceeding Contract maximums include TRU, SO_4, Eu-154, total inorganic carbon, F, and PO_4. An assessment should be performed for each case where the Contract maximum is not met. The initial assessment should identify assumptions or data used in the model that may not have a sound basis and could lead to the out-of-specification predictions. Based on conclusions from this screening, appropriate actions should be identified and pursued.

Objective: Define how wash and leach factors are managed by CH2M HILL and BNI in models.

There is considerable variability in the control of the wash and leach databases and application in models. The modeling interface between the tank farm and waste treatment contractor is insufficient with regard to documentation and definition of the interface and configuration control. A technical baseline document defining wash and leach factors should be developed to improve configuration management and facilitate appropriate application of wash and leach factors.

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1.0 INTRODUCTION

During the month of September 2003, this design oversight evaluated BNI and CH2M HILL use of water wash and caustic leach (wash and leach) factors and the technical adequacy of chromium and aluminum wash and leach factors estimated by CH2M HILL in RPP-10222 and RPP-11079 issued in April and July of 2003. Based on the results of this evaluation a recommendation is made whether these new wash and leach factors represent substantial improvement over previous treatments and whether they should be adopted. Additionally, oxidative leaching and the potential leaching of constituents other than chromium, aluminum, phosphorous and sodium are also addressed.

The oversight included review of applicable documentation (Section 6.0) and discussions with CH2M HILL technical personnel, BNI Process Engineering, Process Operations, and Research and Technology personnel as well as cognizant management personnel as specified in the Oversight Plan.

Due to limited resources and its notoriety as a borosilicate glass limiting constituent in the current WTP design, the design oversight team elected to focus primarily on chromium. Although the chemistry parameters differ in sensitivity, many of the open issues are applicable to the management of aluminum wash and leach factors.

2.0 BACKGROUND

The U.S. Department of Energy, Office of River Protection (ORP) will design, construct, commission, and operate a Waste Treatment and Immobilization Plant (WTP) to treat and immobilize a significant fraction of the waste contained in 149 single-shell tanks (SST) and 28 double-shell tanks (DST) at Hanford. These tanks contain approximately 53 Mgal waste with 190 MCi radioactivity. The WTP will receive waste in batches from the DSTs through transfer pipelines. This waste will be concentrated in an evaporator; strontium and transuranic (TRU) will be precipitated from select waste streams; solids will be water washed, caustic leached, and separated from the soluble fraction in an ultrafilter system; and cesium will be removed from the soluble fraction with an ion exchange system. The radionuclide rich solids and cesium ion exchange eluant will be combined and immobilized in HLW glass. The low-activity waste supernatant will be further concentrated and immobilized in LAW glass or immobilized in an alternative waste form currently being studied.

Wash and leach factors were initially developed for use in modeling tank waste retrieval and treatment. Retrieval activities were expected to use significant quantities of water, and in-tank washing and leaching of solids was under consideration. Wash and leach factors can have a significant impact on predicting the quantity of HLW glass. Significant uncertainty and potential change exists in the wash and leach factors assumed in flowsheet modeling. The tank farm contractor's flowsheet model (HTWOS) utilizes wash and leach factors from several sources including Colton (PNNL-11646), Hendrickson (HNF-3157, Rev. OA, published January 4, 1999), and indirectly Environmental Simulation Program (ESP) model. WTP's flowsheet models also utilize a combination of wash and leach factors, including those provided with the feed vectors, Hendrickson, and those derived from WTP R&T activities.

Historically, two approaches dominate the source derivation for wash and leach factors. The Sort on Radioactive Waste Type (SORWT) grouped tank waste by tank fill records and was used by Colton (1997) to predict wash and leach factors from a limited set of experimental data to other tank waste. In 1998 Hendrickson regrouped the tank waste using a cluster analysis based on major waste constituents. This new grouping was used to predict wash and leach factors similar to Colton. CH2M HILL issued RPP-10222 and RPP-11079 in April and July 2003, estimating chromium and aluminum wash and leach factors using a waste type approach. The waste types were initially derived from tank waste process and transfer history (Agnew 1995) and later refined through the Best Basis Inventory. The waste type grouping is the standard reporting method for the tank farm waste inventories.

Oxidative leaching with sodium permanganate is being studied by BNI as an approach to remove insoluble chromium from specific HLW tank waste compositions to reduce the quantity of HLW glass produced.

Most of the global inventory of chromium in tank waste is attributed to chemical usage in the REDOX plant, and a much smaller contribution from corrosion and chemical usage in B and T Plant operations (Kupfer 1999). A schematic of the overall genesis of Hanford tank waste, including the REDOX Plant HLW stream, R1 is provided in Figure 1 (Watrous 1997). More detailed REDOX flowsheets are provided by Agnew (1997) and Anderson (1990). The standard inventory review as reported by Watrous in 1997 reported a total chromium inventory of 790-980 MT, which includes less than 10% of the total as corrosion generated (refer to Table 1). Most of the REDOX waste was distributed to the S, SX and U tank farms, and cascading, treatments, and transfers resulted in further distributions. The standard inventory is a conservative estimate based on chemical process records and best engineering judgment. Since 1997, tank waste sampling and further development of the inventory estimates has lead to a decrease in the estimated total chromium inventory to approximately 600 MT. On a tank-by-tank basis, the uncertainty in the chromium inventory can be as high as a factor of two to three (DOE/ORP-2003-19).

The estimation of the chromium to be processed as HLW glass is one of the most significant contributors to HLW canister count and life-cycle cost. The key parameters are the inventory, the partitioning between solid and liquid fractions, and the glass solubility.

3.0 OBJECTIVES, SCOPE AND APPROACH

3.1 Objectives

The objectives were defined in the Design Product Oversight Plan (D-03-DESIGN-006). These were refined during the review to the following:

1. Determine if proposed refined wash and leach factors for chromium and aluminum (waste type models) are an improvement and appropriate for projecting glass volume.

Figure 1 - Source of Critical Components—Percent of Total Added (from Watrous 1997)

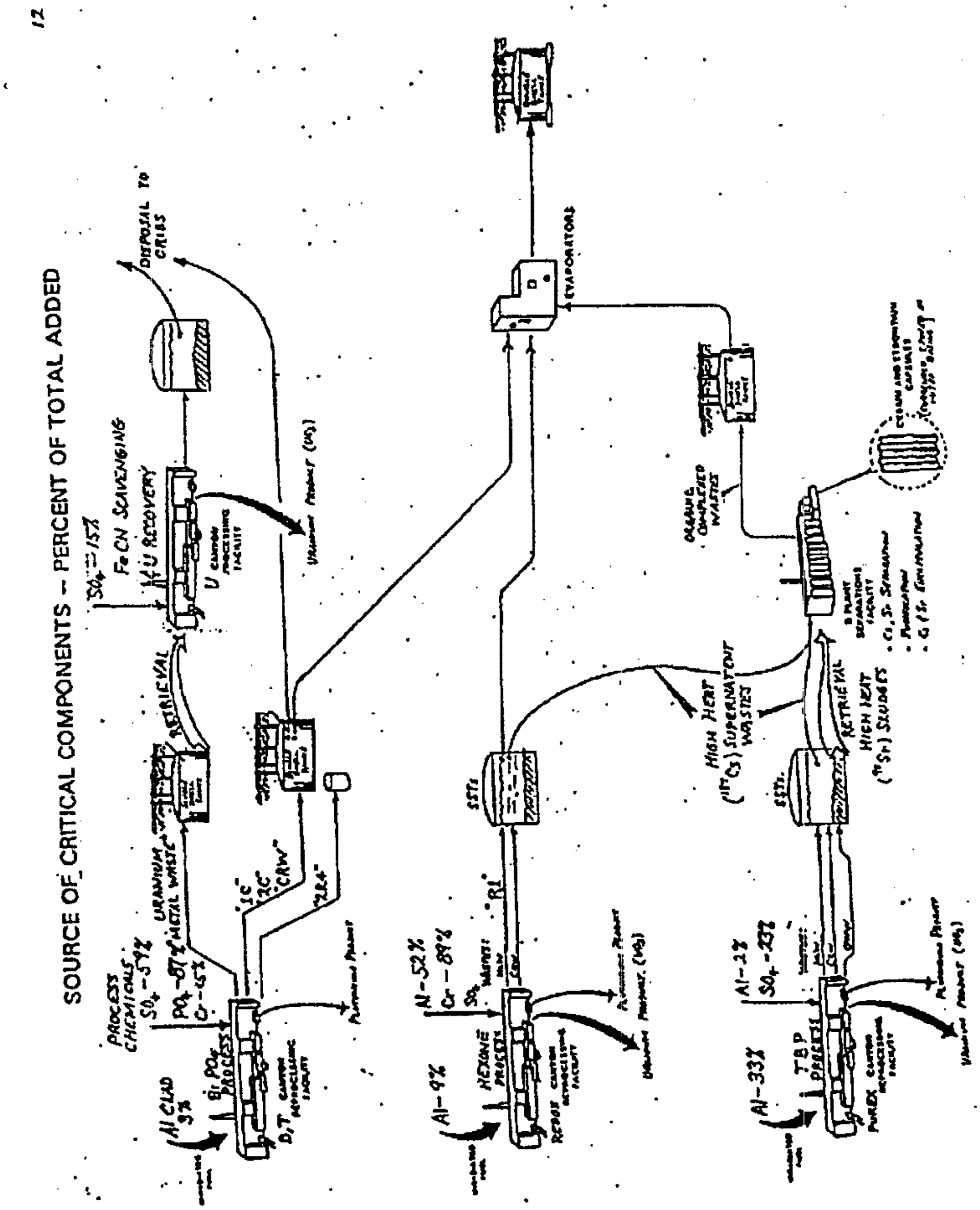

Table 1 - Metric Tons Chromium in Tank Waste (from Watrous 1997)

Metric Tons Chromium in Tank Waste

(Standard Inventory Estimate--WHC-SD-WM-TI-740, Rev. D-Draft)

Process or Source	Process Chemical Cr Addition (MT)	Corrosion Generated Cr Addition (MT)	Total
$BiPO_4$	19[a]	8.7	28
U Recovery	0	12	12
REDOX	703-895[b]	2.3	705-897
PUREX	0	37.9 (1956-1972) 9.6 (1983-1989)	38 10
B-Pl (Sr/Cs separation)	0	N/A	-
Loss to Cribs	N/A	N/A	-
Loss to Leaks	N/A	-	-
TOTAL	722-914	70.5	790-980

[a] Based on Allen 1976 (ARH-CO-610B). Subsequent flowsheet analyses (WHC-SD- WM-TI-740 Rev. C-Draft, Appendix C) estimate 47 MT Cr for $BIPO_4$

[b] Flowsheet uncertainty range

2.0 Summary of Conclusions and Recommendations

2.1 Conclusions

The following conclusions have been made based upon this evaluation.

1. A technical basis exists for achieving the ORP Stretch Goal of 20 wt% sodium oxide (Na_2O) loading in WTP LAW glass. The existing work in this area is applicable to the WTP LAW and is projected to exhibit acceptable performance at this waste-loading. The DOE glass model developed from this data results in higher acceptable sulfate and sodium oxide loadings in the glass compared to the Gimpel and VSL Models used by the WTP contractor to project LAW glass capability. These latter models, which are used by BNI in the design of the LAW facility are conservative, and consistent with contract requirements, but result in much lower glass sodium oxide loadings. Adherence to these waste-loading levels throughout the mission would reduce the effective production capacity of the LAW vitrification facility adding to life-cycle waste treatment costs and increasing the risk of not completing the mission on an accelerated schedule.

2. The Na_2O loading in WTP LAW glass can be increased from the estimated 14 wt% to ~17 wt% by the appropriate selection of waste feeds to be immobilized in the WTP versus supplemental treatment. Additional improvement in the LAW glass-loading to 20 wt% Na_2O will require additional glass testing and development to validate preliminary studies that have already been conducted by DOE technology programs.

3. One of the factors in limiting sulfate concentration in LAW glass is to minimize the sulfate corrosion of melter components (principally the melter bubblers glass contact refractory), thereby increasing melter life. However, the evaluation performed in this study shows that the decrease in plant availability due to the increased downtime required to replace a melter more frequently (3-year melter life as compared to 5-year melter life) that fails earlier is more than offset by the reduction in the amount of glass that would be produced at the higher waste-loadings.

4. The amount of high sulfate waste that has to be processed through WTP LAW can be significantly reduced by directing that waste to supplemental treatment. The majority of the high sulfate tank wastes contain low levels of radioactivity and require minimal pretreatment (e.g., filtering of solids) to meet the Nuclear Regulatory Commission's (NRC) Class C LAW limits as defined by 10 CFR 61. The waste from these tanks could, therefore, be sent directly to supplemental treatment for treatment and immobilization. These tanks contain approximately 33% of the total tank waste Na and are relatively evenly distributed in the current schedule for tank retrieval; facilitating parallel operation of WTP LAW and the supplemental treatment technology.

5. There is a small fraction of waste (~14%) that has high sulfate and high activity levels. If treated by WTP, the resulting glass-loading would be less than 20 wt% Na_2O even using the DOE Glass model. This waste can be sent to supplemental treatment from the WTP Pretreatment facility and immobilized at ~20 wt%.

6. A feed strategy that directs to supplemental treatment all low-level waste and low-curie LAW (directly if possible without pretreatment) and any LAW that cannot be immobilized at a waste-loading of 20 wt% Na_2O in WTP results in 53% of the waste being treated by WTP LAW in a period of 15 to 18 years, depending on the annual average glass production rate assumed for that facility. Further reductions in completion period to less than 12 years may be possible by limiting the amount of Na treated in WTP to 40% of the total, as defined in the DOE Target case. These outcomes are consistent with the ORP Target and Stretch case goals and meet the accelerated schedule for completion on or before 2028. This strategy assumes that the DOE Model is used for glass formulations in WTP. This strategy also requires commissioning of the supplemental treatment facility by 2011 at sufficient capacity.

7. Using this feed strategy in the initial phase of treatment from 2011-2018 results in processing an additional 4,300 to 6,800 MT Na. This is equivalent to 3 to 5 additional DST volumes created, which can greatly improve the potential to meet SST retrieval milestones, and reduce the current concerns raised by the Tank Farm contractor on meeting the Tri-Party Agreement milestone for tank retrieval.

8. The amount of sulfate that has to be managed in WTP LAW depends on whether the condensate from the LAW melter off-gas SBS is recycled to pretreatment or purged from the plant and treated elsewhere. Based upon the results of this evaluation, there does not appear to be an overall life-cycle benefit to the RPP for the purging of LAW melter condensate to either the Tank Farms or ETF. If the majority of the high sulfate tank waste is treated in supplemental treatment and the DOE glass model is applied, then the Na_2O glass-loading in WTP is not significantly changed whether the SBS condensate is recycled or not. Purging of the SBS condensate to other facilities would: 1) impact the waste retrieval and tank closure program in the near term, and 2) require upgrades or additions to the Tank Farms or ETF at significant costs to DOE. In addition, the SBS condensate will contain Tc-99. The disposal of this radionuclide through the ETF would unfavorably impact the LAW wastes form disposal assessments.

2.2 Recommendations

Recommendation #1

ORP should pursue separate funding in the near term through the Office of Science and Technology to support a LAW glass development program to increase the Na oxide loading over current contract requirements to take advantage of technical information that indicates 20% Na_20 at up to 0.8% SO_3 loading is possible. In the longer term glass formulation and testing should be part of the future WTP M&O contract.

Benefit:

This action will allow DOE to substantially reduce life-cycle costs by:
- Reducing the amount of glass produced in WTP;
- Processing waste at a faster rate in WTP by more effective waste incorporation; thus
- Resulting in a shorter time period required to complete the RPP mission.

Recommendation #2

The SBS condensate from the LAW Vitrification facility should be managed within WTP because with improved glass formulations, purging to the ETF or Tank Farms is not needed to achieve 20% Na_2O waste-loadings in LAW product.

Benefit: This action will prevent impacts to other parts of the RPP system and help to reduce Life-Cycle Costs. Other considerations in this assessment include:
- WTP is designed to manage the LAW SBS recycle stream.
- This allows ORP to shut down the 242A Evaporator in 2018 as planned. This could not be done, or another new evaporator would be required, if the Tank Farm is to be the purge point for LAW SBS condensate.
- This avoids the complication with DST space management and the retrieval program. Conflicts with near term retrieval and tank closure milestones will also be avoided for the case in which the Tank Farm is the purge point for the LAW SBS condensate.
- This recommendation avoids the need for significant upgrades (and cost) to the ETF to handle solids and Tc-99 from the LAW SBS condensate in cases where the ETF is the purge point.

Recommendation #3

The near term feed immobilization plan should consider transferring, to the extent practical, pretreated AZ-101 and AZ-102 supernatant to the supplemental treatment technology to improve system performance and reduce life-cycle costs

Benefit: This action allows ORP to:

- Treat a greater quantity of waste because the supplemental treatment technology has a greater waste-loading capability for the chemistry of AZ-101 and AZ-102 compared to the WTP LAW glass, even with improved glass formulations;
- Provide additional DST space (~3 to5 tanks equivalent) in the 2011 to 2018 time frame because waste is treated faster and improves availability of tank space to support retrieval; and
- Results in greater quantity of Na immobilized (>40% or 4,300 to 6,800 MT Na) in the early treatment phase.

Recommendation #4

A strategy similar to that discussed in this report should be developed for selection of whether a specific tank waste needs to be pretreated, and whether it should be treated by WTP or supplemental treatment. This strategy would consider, for example:

- The tank waste classification, e.g., LLW or HLW;
- The level of activity in the tank, and whether the tank has already been treated to remove critical nuclides and the waste could meet LAW 10 CFR 61 Class C limits for near surface burial with solids removal by filtering alone; and
- The sulfate level in the waste, and the ability to achieve 20 wt% Na_2O loading in WTP.

Benefit: The analyses in this report show:

- A large fraction of the waste could be sent to supplemental treatment without passing through WTP pretreatment if solids are removed by filtration. This reduces the load on pretreatment and also reduces the total amount of waste Na treated since the amount added in pretreatment would be eliminated.
- All the waste sent to WTP could be treated at 20 wt% Na_2O.
- The mission could be completed three to seven years sooner than the current Target and Stretch goals define, reducing mission life-cycle costs.

3.0 Low-Activity Waste Glass-Loading Models and Tank Waste Chemistry

This section summarizes the LAW glass models that were considered as technical bases for this assessment. A detailed discussion of the LAW glass models is presented in Appendix A. This section also summarizes the effect of the variations in the waste chemistry between tanks on the glass Na_2O loading for each glass model. As shown below, it is the relative concentrations of Na and sulfate in the tank waste that establish permissible Na_2O loading in the glass.

3.1 LAW Glass-Loading Models

Four glass models are identified and used as a basis for analysis in this assessment. Each of these models establishes a different relationship between the amounts of Na that can be incorporated into the glass waste form as a function of the sulfate concentration in the glass. It is believed that all of these glass models produce glass forms that are acceptable with respect to the current performance assessment for WTP LAW and obtain acceptable melter corrosion rates. A summary of actual glass performance, including their relative Na and sulfate concentration and durability as measured by the Product Consistent Test (PCT) and Vapor Hydration Test (VHT), is summarized in Appendix B.

Figure 1 shows the relationship between sodium oxide (Na_2O) in the glass and the sulfur trioxide (SO_3) in the WTP LAW glass for the models considered in this study. The technical bases for the models and their derivations are summarized in Appendix A and Appendix B. Referring to Figure 1:

- The **Gimpel Model** is a mathematical correlation based upon glass testing completed by VSL. This model is used by BNI in the WTP design and modeling processes to estimate glass-loadings and production rates.

- The **"Rule of 5"** is an anecdotal model that has been used to project waste-loading. It is not used in the current design process. However, this model has been used in the past to project glass volumes to be produced by the WTP LAW vitrification facility based upon specific tank waste chemistries.

- The **VSL Model** is an empirical model based on LAW Pilot Melter runs designed to meet WTP contract requirements, (e.g., Envelope A = 14 wt%, Envelope B = 5 wt% and Envelope C = 3 wt%) and thus is conservative relative to the true capability of the glass waste form. This model was derived from an examination of the experimental data developed by the WTP LAW Vitrification Research and Technology Program.

- The **DOE Model** is a correlation based upon glass testing for the WTP, Idaho Sodium Bearing Wastes (SBW) and laboratory-scale testing using the Sodium Boro-Silicate (SBS) formulation approach to Hanford waste chemistry.

As shown in the figure, the DOE Model provides a much higher sodium oxide waste-loading estimate than the other models for sulfate concentrations greater than ~0.25 %. Thus, if the assumptions for the DOE glass model hold true, there is a significant potential to increase the overall waste-loading in WTP LAW glass.

The following analyses examine the improvement in glass sodium oxide waste-loading and the resultant reduction in total glass production that could be realized by applying the DOE Model compared with the Gimpel and VSL Models.

3.2 Sulfate Concentrations in Hanford Waste

Figure 2 summarizes the sulfate concentrations in the tank waste at Hanford; presenting the sulfate to sodium (SO_4 /Na) ratio for each tank in ascending order as a function of the cumulative mass of sodium requiring treatment.[4] This figure illustrates the effect of limiting the sulfate concentration on the glass Na waste-loading and the differences in the results for the Gimpel and DOE Models. Using the Gimpel Model, about 7% of the waste can be incorporated into the glass at 20 wt% Na_2O because that model limits the sulfate concentration at 20 wt% Na_2O to 0.25 wt% SO_3 (equivalent to a feed SO_4/Na ratio of 0.02). For the DOE Model, a little more than 60% of the waste can be incorporated into the glass at 20 wt% Na_2O because that model permits the Na_2O loading up to a sulfate concentration of 0.8 wt% in the glass (equivalent to a feed SO_4/Na ratio of 0.065).

(Note: In the following analyses the cumulative amount of Na treated includes the Na in the tanks plus the amount added in WTP pretreatment.)

3.3 Submerged Bed Scrubber (SBS) Condensate Recycle or Purge

The correlations shown in Figure 1 establish a permissible Na_2O loading for the residual sulfate concentration in the glass. During the glass melting process, a certain percentage of the sulfate entering the melter is either evolved as SO_x (SO_2 + SO_3) or entrained and leaves the melter in the off-gas. This sulfate stream is collected as a constituent in the SBS condensate. Figure 3 shows the relationship between the amounts of sulfate that are retained in the glass as a function of the concentration of the sulfate in the entering waste stream [5]. For this analysis it is assumed that at target SO_3 concentrations above 0.8%, the residual percentage does not drop below the value for a 0.8% target concentration; (i.e., 68.9%). The target concentration is defined as the concentration of SO_3 in the glass if none of the feed sulfate is evaporated, but is fully incorporated in the glass.

The current plant design assumes that the SBS condensate is recycled and eventually is processed in the LAW glass. The WTP project has been considering purging the SBS condensate from the cycle to be treated elsewhere in the Hanford complex. In the following analyses, the effect of recycling or purging the SBS condensate on LAW glass waste-loading is examined.

Comparisons of the tank waste that can be processed at 20wt% Na_2O shown in Figure 2 are based on the recycle condition, (e.g., the entire tank sulfate fed to WTP LAW is eventually incorporated in the glass). Comparing Figures 1 and 3, it is noted that for the Gimpel Model there is 100% sulfate retention at 20wt% Na_2O (SO_3 at 0.25%). Accordingly, recycling or purging of SBS condensate has no effect on the results at this Na_2O loading for that model. There is, however, an effect when applying the DOE Model or at 14wt% Na_2O. This effect is explored in further analysis below.

4.0 WTP LAW Glass Waste-Loadings

4.1 Impact of the Sulfate Model and SBS Condensate Recycle or Purge

Figures 4 and 5 compare the percent of Na present in the Hanford tanks that can be treated at a minimum of 20 wt % Na_2O and 14 wt % Na_2O for the three different models. The figures also show the effect of recycling or purging the SBS condensate. Based on these figures:

- Glass formulations using the DOE Model are required to approach the ORP Stretch goal of treating 60% of the tank waste Na at a minimum 20 wt % soda glass-loading. The Gimpel and VSL Models would permit 20 wt% Na_2O loading in only 6.5% and 18% of the waste, respectively.

- Purging of the SBS condensate from the stream is not required to meet the target goal of 60% of the total Na treated at 20 wt% when applying the DOE Model. This is the only model that is significantly affected by recycling or purging SBS condensate.

- *Significantly higher percentages of the waste can be processed at a minimum of 14 wt%* Na_2O glass-loading using all three models. The Gimpel and VSL Models show that greater than 50% of the waste can be processed at an average Na_2O loading of about 17 wt%. Using the DOE Model with SBS condensate recycled, over 90% of the waste can be processed at an average Na_2O loading of 19.5 wt%. Accordingly, all three models produce results that satisfy the ORP Target objective of treating 40% of the LAW waste at a minimum of 14 wt% Na_2O.

These available processing percentages must be resolved, however, against the glass production rate of the WTP facility and the total time available to process glass in the accelerated schedule to complete by 2028. This and other factors affecting glass waste-loading and schedule are addressed below.

4.2 Impact of Glass Production Rate

Figure 6 compares the percent of total tank waste Na treated in 18 years of production for the ORP Target case and Stretch case WTP LAW facility annual average glass production rates of 28.8 and 34.0 MTG/day, respectively. These figures assume the tanks are treated in increasing levels of sulfate and are, therefore, idealized. This figure shows that only if the higher production rate is maintained, and the DOE Model is applied, can the goal of treating 60% of the total tank waste be approached and complete the mission by 2028. About 50% of the Na can be treated at the lower rate if the Gimpel or VSL Model is applied. Only the DOE Model meets the 20 wt% Na_2O loading target. The other models achieve about 17 wt% loadings on average.

Comparing Figures 5 and 6 shows that the annual average production rate for the LAW facility is a constraint on the percentage of the waste that can be treated at 20 wt% Na_2O when applying the DOE sulfate model. It is not a constraint on processing at a minimum of 14 wt% Na_2O when applying the Gimpel and VSL Models.

Figure 7 shows the separate and combined effects of the glass model assumption, feed selection and glass production rate on the amount of Na that can be treated in the WTP LAW Vitrification facility. This figure illustrates that the increase in Na_2O loading in the glass and increased LAW glass production rate have comparable impacts on the overall amount of Na that can be treated in the 18 years of the accelerated schedule. The feed selection strategy used to develop this figure is discussed below.

5.0 Effect of Melter Replacement on Life-Cycle Treatment Rate

Figure 8 compares the total amount of waste treated over the mission for different LAW facility peak productions rates, glass Na_2O loading and melter replacement frequency. In all the cases shown, it is assumed that when the melters need replacement, the plant is shutdown for six months to replace both melters, but that the facility has 100% availability at the peak production rate when the melters are operating. The "Contract case", (i.e., 14 wt% Na_2O and 30 MTG/day peak facility production rate), is shown for comparison with the Target case of 45 MTG/day peak production rate at 14 wt% Na_2O and 20 wt% Na_2O. This figure shows that operating with higher Na_2O loading has more impact on total waste treatment than the frequency at which the melter has to be replaced. For example, if operating at 20 wt% Na_2O instead of 14 wt% Na_2O decreases melter life from 5 years to 3 years, the total amount of waste processed over the 19-year period is about 38% higher at the higher loading. Accordingly, melter lifetime should not be the principal factor limiting Na_2O loading in the glass.

6.0 Tanks Containing Low Curie Waste

There are a number of tanks with LAW that may not require WTP pretreatment prior to immobilization and disposal as Class C low-level waste. Prior estimates show that approximately 33% (~17,000 MT Na) of the total waste Na to be immobilized falls into this category [6]. A large number of the high sulfate tanks also fall into this category (e.g., the B Farm tanks). Figure 9 compares the sulfate to sodium ratio for the tanks that would remain after removal of these tanks from the inventory with that ratio for all tanks. It is possible that the waste from these tanks could be sent directly to the supplemental treatment facility for immobilization. This has several advantages:

- The pretreatment production capacity is reduced.
- The Na added in pretreatment that must be immobilized (~8% of the entering Na) is reduced the total amount of Na that must be treated.
- Supplemental treatment can be operated in parallel with pretreatment and WTP LAW reduced and therefore reducing the total time required to treat all waste.
- A large fraction of the high sulfate waste is sent to supplemental treatment (1) reducing the potential for accelerated LAW melter corrosion and (2) increasing the average Na_2O loading in the LAW glass

A small number of these tanks contain low-level waste that can be treated with no pretreatment. There are 6 tanks totaling 104 MT Na that fall into this category.

There are 35 tanks potentially containing waste compositions that have already had some treatment. Accordingly, sending the waste from these tanks through WTP pretreatment would constitute a second treatment and may not provide any appreciable environmental benefit. Appendix D summarizes the relevant nuclide concentrations of these tanks LLW and Low-Curie LAW (LCLAW) tanks) and the as-found classification of the wastes in accordance with 10 CFR 61. As shown, the tanks will require some filtering to remove solids, principally transuranic (TRU) and ^{90}Sr to meet Class C limits for near-surface burial. The tables show that a filter with DF as low as 10 would obtain Class C limits in 98% of the waste in these tanks. These tables in Appendix D also show that the ^{137}Cs and possibly the ^{99}Tc concentrations may be high enough to require engineered shielding in the supplemental treatment facility. It is recommended that cost benefit and "As Low as Reasonably Achievable" (ALARA) analyses be completed to determine which tank wastes should be treated in WTP versus direct treatment in supplemental treatment.

7.0 Criteria for Selection of whether a specific tank waste is treated in WTP or Supplemental Treatment

The results of the preceding evaluations suggest applying the following criteria for selecting whether a specific tank waste should be treated in WTP or in supplemental treatment to support ORP's goals in treating LAW. See Figure 10.

- Waste should be treated in WTP if the sulfate concentration permits a 20 wt% or higher soda concentration.

- Waste should be treated in supplemental treatment: (1) if the waste does not require full WTP pretreatment, (i.e., LLW or LCLAW); or (2) the sulfate concentration restricts soda concentration to less than 20 wt% in WTP glass.

In both cases, the DOE glass model should be applied to establish the acceptable soda concentration in the WTP glass.

Application of this selection logic will: (1) achieve the ORP Target goal of a minimum 20 wt% Na_2O loading in all WTP glass; and (2) complete all LAW waste treatment on or before 2028 at achievable WTP LAW glass production rates comparable to the ORP Target and Stretch rates. The following analyses support this conclusion.

8.0 Assessment of Tank Wastes and Treatment Preference, WTP versus Supplemental Treatment

The proposed selection logic of Figure 10 was applied to the sequence of tanks used in the October 2002 Hanford Tank Waste Operations Simulator Case 1 study and the Best Basis Inventory 2002 for tank waste composition. This evaluation was performed assuming that the SBS condensate is recycled to pretreatment so all sulfate fed to WTP LAW is ultimately treated in WTP LAW glass. It was also assumed that all tank waste must pass through pretreatment prior to immobilization either in the WTP LAW facility or in supplemental treatment.

8.1 Tanks Treated in WTP versus Supplemental Treatment

Figure 11 shows the destination for each tank over the total mission sequence by applying this logic. Table 1 lists the tanks by destination and type. Even though the sequence has not been optimized for the selection logic, the distribution of destinations is fairly uniform after treatment of the first series of waste in the DSTs. The split between treatment in WTP and supplemental treatment is about equal; 53% is ultimately treated by WTP LAW.

8.2 Mission Completion Time versus Selection of Treatment

Depending on the average annual glass production rate achieved in the WTP LAW facility, the sequence of waste treatment shown in Figure 11 meets or improves the objective of completing the mission in 18 years; 17.8 years at 28.8 MTG/day and 15.0 years at 34.0 MTG/day. The supplemental treatment rate required for these periods ranges from 1,373 MT Na/year

(17.8 years) to 1,622 MT Na/year (15.0 years). These are well within the treatment rates projected for supplemental treatment in prior studies [3].

Future efforts to optimize the selection logic and the sequence of tank retrieval would take into account that some tank waste will not require pretreatment in WTP and could, therefore, potentially bypass transfer to the WTP. As noted on Figure 10, it is recommended that at-tank treatment be considered for those tanks. That approach to supplemental treatment would free up space in the DSTs. It is recommended that additional studies be completed to develop and optimize selection logic and tank retrieval sequence.

Figure 12 compares the results of applying the selection logic using the DOE sulfate model with similar results using the Gimpel Model and the DOE Model for the Stretch Case in which 60% of the waste is treated in WTP. As shown, the total mission time is reduced by about 10 years if the DOE Model and selection logic are applied versus treating 60 percent of the waste in WTP and using the Gimpel Model. The selection logic reduces the mission time by three years if the DOE Model is used in treating 60 percent of the waste in WTP. The advantage of the selection logic applied with the DOE sulfate model is that all the waste is treated at 20 percent Na_2O loading and supplemental treatment and WTP are operated in parallel. The time is reduced for this case because only 53 percent of the waste is treated in WTP LAW at 34 MTG/day. The rest is treated by supplemental treatment at 1,635 MT Na/year. Based on prior analyses, only two lines of bulk vitrification would be required to support this treatment rate. Figure 13 shows the treatment by tank and treatment facility in time for this case. The projected 15-year completion time betters the accelerated schedule by three years.

Figure 4 shows the results of applying the selection logic for the Target Case in which 40 percent of the waste is treated in WTP at an annual average rate of 34.0 MTG/day. The supplemental treatment rate for this case is 2,765 MT Na/year which is equivalent to a three-line bulk vitrification plant. This figure shows that the mission can be completed in 11 years for this case or seven years earlier than required to meet the accelerated schedule.

Figure 15 summarizes the results of all of these cases, illustrating the full potential of developing a more robust LAW glass capability and devising an effective selection logic for specific tank wastes on reducing RPP mission completion time.

8.3 Near Term Decisions on Treatment Selection

Figure 16 compares application of the selection logic and the DOE Model with the results of the Gimpel Model in the first eight years of processing; 2011 through 2018. Current projections using the Gimpel Model show that about 10,000 MT Na can be treated over this eight-year period at an average annual production rate of 28.8 MTG/day and an average glass waste-loading of 15.3 wt% Na_2O. Applying the DOE Model, the amount of waste processed at this glass production rate increases to about 11,500 MT Na and the average glass-loading increases to 18.3 wt% Na_2O. If the selection logic is applied so that both WTP LAW and supplemental treatment are used over this period, the amount of waste treated increases to approximately 14,000 MT Na and the average waste-loading is 20 wt% Na_2O.

Assuming that each DST contains about 800 to 1000 MT Na, the increase of 4,000 MT Na treated by using the selection logic when compared with treating all waste in WTP using the Gimpel Model, would clear space in an additional three to five DSTs over this initial processing period. This could address concerns raised recently by the Tank Farm contractor on being able to meet Tri-Party Agreement milestones for tank retrieval.

One of the principal factors that lead to the significant difference in the results for the selection logic versus the Gimpel Model is the treatment of the high sulfate wastes in the AZ-101 and 102 tanks. Using the Gimpel Model, the glass-loading is limited to 5 wt% to 8 wt% Na_2O for these tanks significantly increasing the amount of glass required to immobilize these wastes and increasing the time for treatment. It is recommended that the near term feed immobilization plan consider transferring, to the extent practical, pretreated AZ-101 and A101-102 supernatant to the supplemental treatment technology to improve system performance and reduce life-cycle costs. This action allows ORP to:

- Treat a greater quantity of waste because the supplemental treatment technology has a greater waste-loading capability for the chemistry of AZ-101 and AZ-102 compared to the WTP LAW glass even with improved glass formulations;
- Provide additional DST space (~three to five tanks equivalent) in the 2012 to 2016 time frame because waste is treated faster and improves availability of tank space to support retrieval; and
- Results in greater quantity of Na immobilized (>40%) in the early treatment phase

8.4 SBS Condensate Recycle or Purge

As discussed above, the amount of sulfate that has to be managed in WTP LAW depends on whether the condensate from the LAW melter off-gas SBS is recycled to pretreatment or purged from the plant and treated elsewhere. Based upon the results discussed above, there does not appear to be an overall life-cycle benefit to the RPP for the purging of LAW Melter condensate to either the Tank Farms or ETF. If the majority of the high sulfate tank waste is treated in supplemental treatment and the DOE glass model is applied, the Na_2O glass-loading in WTP is not changed whether the sulfate is recycled or not. Purging of the condensate to other facilities would require upgrade or additions to these facilities at significant cost to DOE for no benefit to the project. Accordingly, it is recommended that SBS Condensate from the LAW Vitrification facility be managed within WTP because with improved glass formulations, purging to the ETF or Tank Farms is not needed to achieve 20% Na_2O waste-loadings in LAW product.

9.0 References

1. DOE-ORP Commitment to Supplemental Treatment – 2 LAW Melter Facility.

2. ORP-11242, Rev 2.0, "River Protection Project System Plan," September 2003, Office of River Protection, Richland, Washington.

3. "Assessment of Low Activity Waste (LAW) Treatment and Disposal Scenarios for the River Protection Project (RPP)," April 14, 2003.

4. Best Basis Inventory 2002.

5. 24590-WTP-MCR-PT-02351, Rev. 0, Attachment A1 [Correlation of SO_3 Retention in the glass versus sulfate concentration in the waste].

6. RPP-13678, March 2003, Integrated Mission Acceleration Plan, Office of River Protection, Richland, Washington.

7. HNF-SD-WM-SP-012, Rev. 4A, Tank Farm Contractor Operation and Utilization Plan, October 30, 2002.

Table 1 Summary of Waste Type by Tank

TRU[1] Packaging	Supplemental Treatment			WTP LAW	
	LLW	LCLAW[2]	WTP< 20wt% Na$_2$O[3]	WTP LAW ≥ 20 wt% Na$_2$O[3]	
1,218 MT	**104 MT**	**16,839 MT**	**7,467 MT**	**27,880 MT**	
AW-103	C-204	B-101	A-101	A-104	SX-102
AW-105	U-201	B-103	A-102	A-106	SX-103
B-201	U-202	B-104	A-103	AN-101	SX-104
B-202	U-203	B-105	A-105	AN-103	SX-105
B-203	U-204	B-106	AN-102	AN-104	SX-106
B-204	T-110(tentative, may be TRU)	B-107	AW-104	AN-105	SX-107
SY-102		B-109	AX-101	AN-106	SX-108
T-111		BX-110	AX-103	AN-107	SX-109
T-201		BX-111	AX-104	AP-101	SX-110
T-202		BY-102	AZ-101	AP-102	SX-111
T-203		BY-103	AZ-102	AP-103	SX-112
T-204		BY-105	B-102	AP-104	SX-113
		BY-108	B-108	AP-105	SX-114
		BY-109	B-110	AP-106	SY-101
		BY-110	B-111	AP-107	SY-103
		BY-111	B-112	AP-108	T-102
		BY-112	BX-101	AW-101	T-103
		S-109	BX-103	AW-102	T-104
		S-110	BX-105	AW-106	T-108
		S-112	BX-107	AX-102	TX-101
		T-109	BX-108	AY-101	TX-104
		TX-103	BX-109	AY-102	TY-101
		TX-105	BX-112	BX-102	TY-104
		TX-106	BY-104	BX-104	U-101
		TX-108	C-101	BX-106	U-102
		TX-110	C-103	BY-101	U-103
		TX-111	C-105	BY-106	U-104
		TX-112	C-107	BY-107	U-106
		TX-113	C-109	C-102	U-107
		TX-114	C-110	C-104	U-108
		TX-115	C-111	C-106	U-109
		TX-116	C-112	C-108	U-110
		TX-117	SX-115	C-201	U-111
		TX-118	T-101	C-202	U-112
		TY-102	T-105	C-203	
			T-106	S-101	
			T-107	S-102	
			T-112	S-103	
			TX-102	S-104	
			TX-107	S-105	
			TX-109	S-106	
			TY-103	S-107	
			TY-105	S-108	
			TY-106	S-111	
			U-105	SX-101	

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[1] TRU tanks are not included in the Total Waste Na to be treated

[2] Low Curie Low Activity Waste tanks that may be able to go directly to Supplemental Treatment without pretreatment

[3] It is assumed that SBS Condensate will be recycled to pretreatment

10.0 Figures

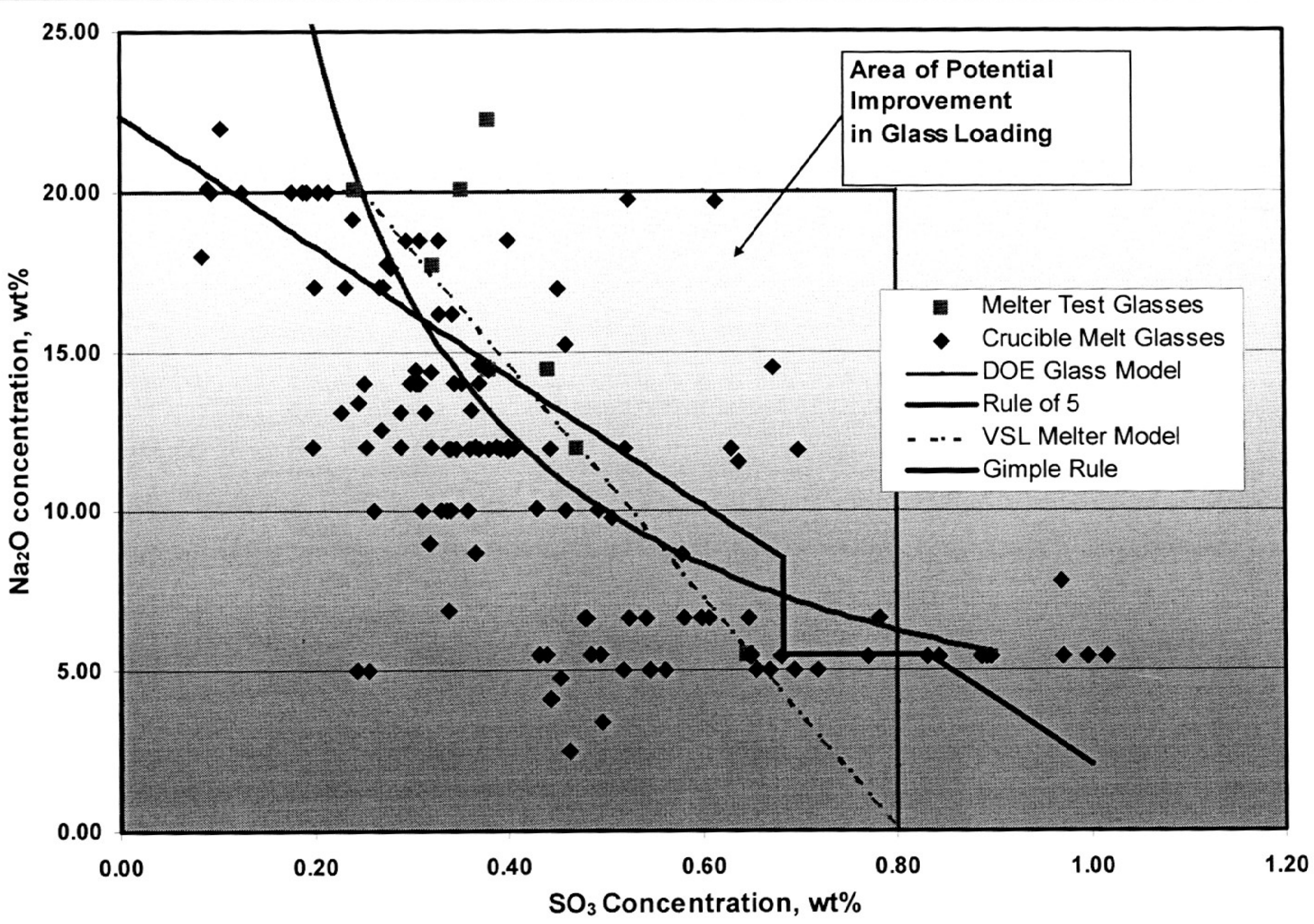


Figure 1 WTP LAW Glass Models

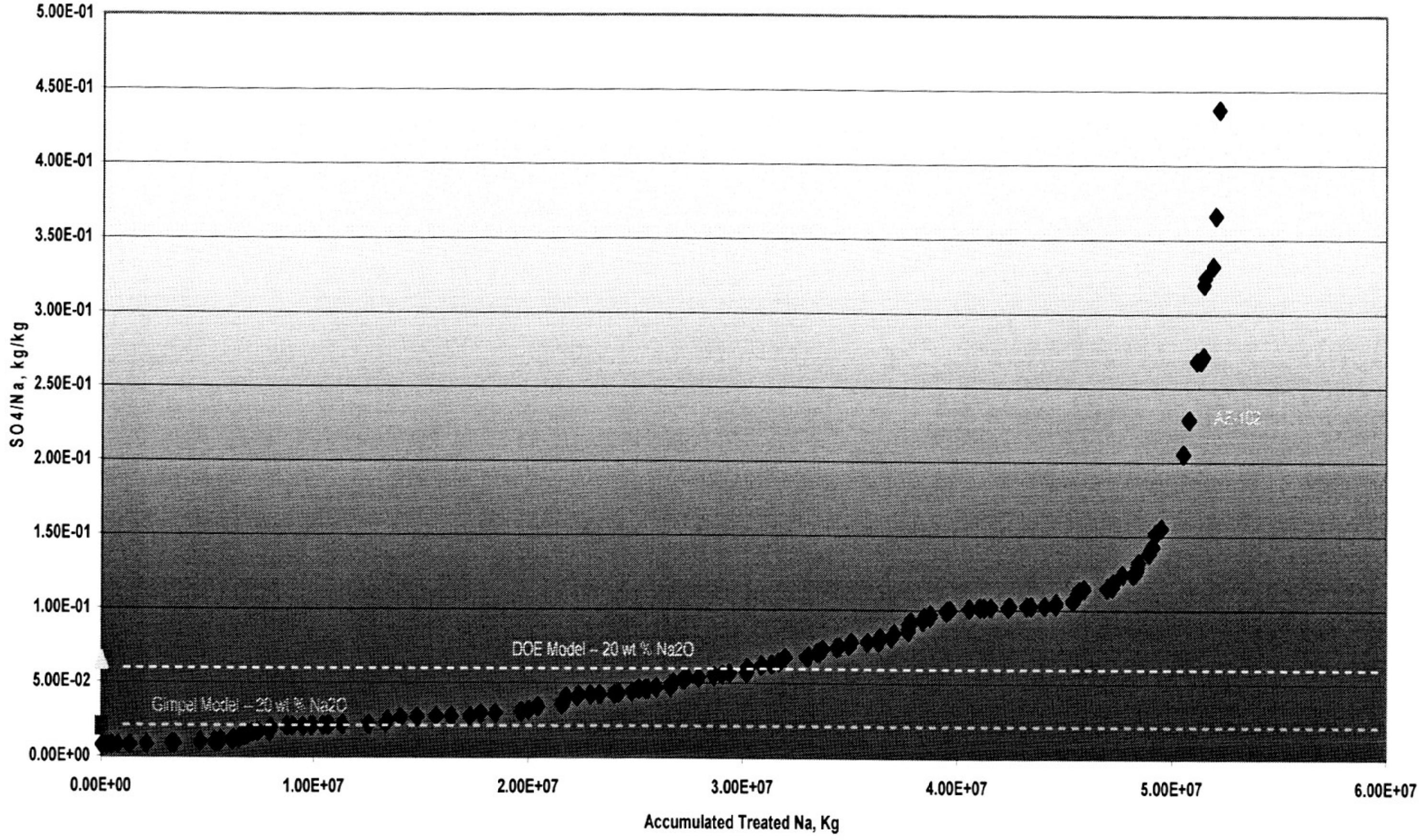
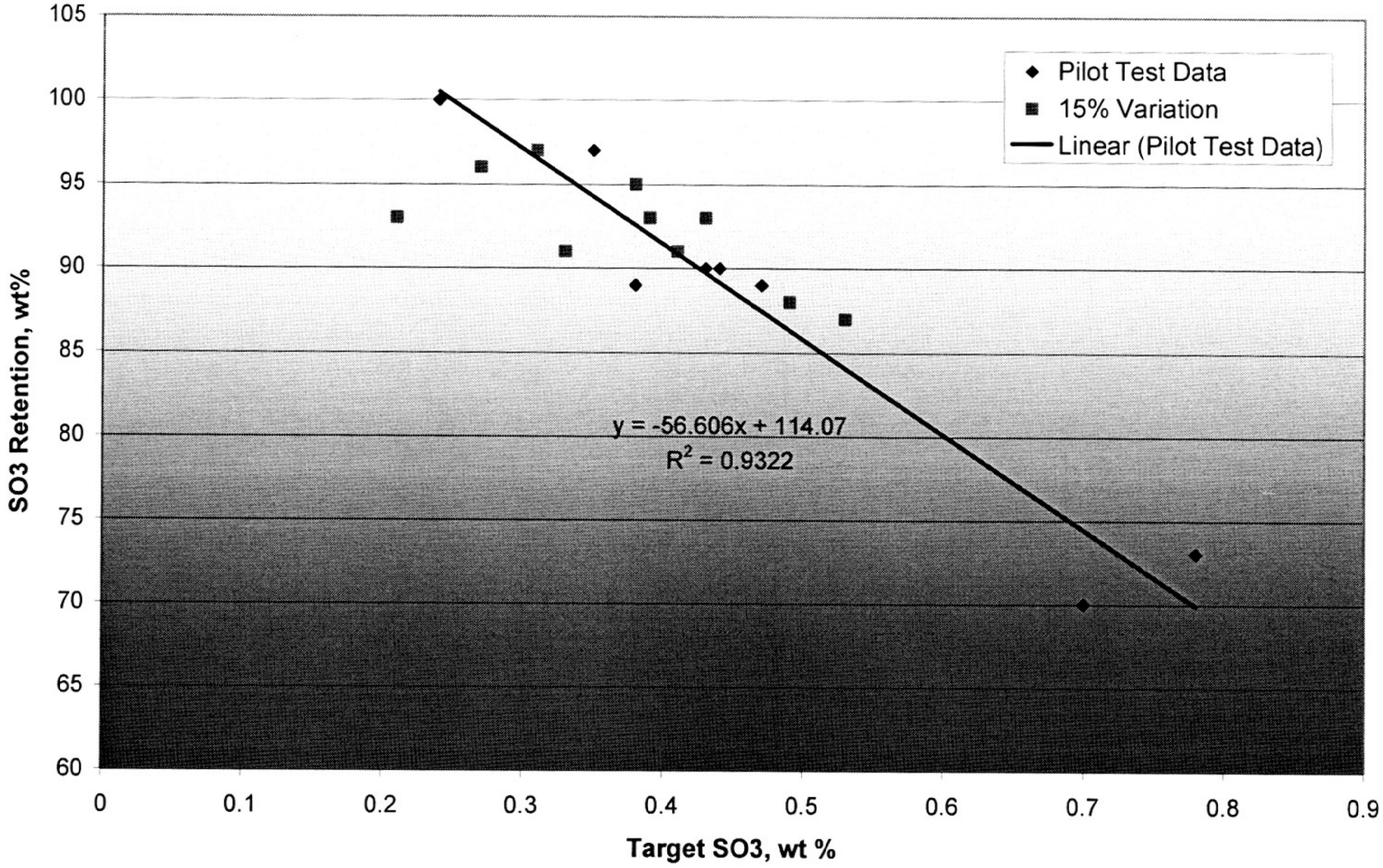
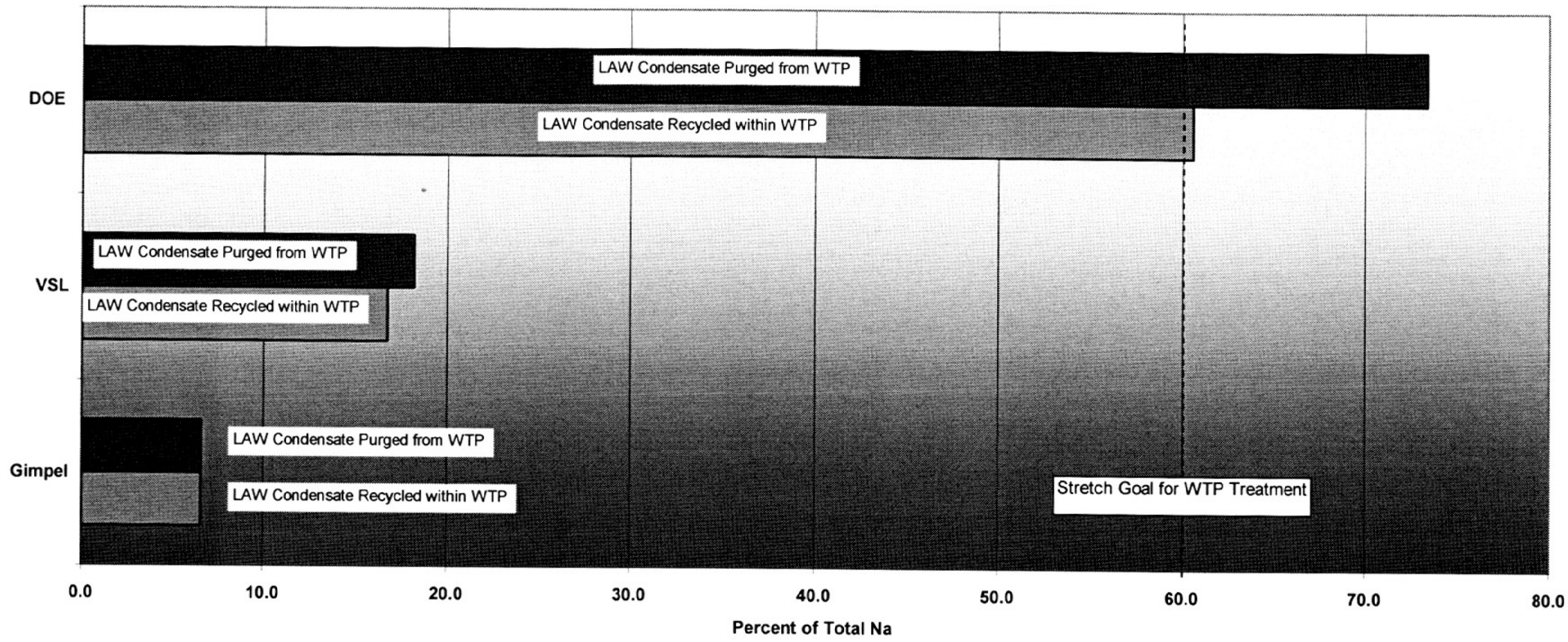


Figure 2 SO4/Na in Ascending Order by Tank and Accumulated Waste Na



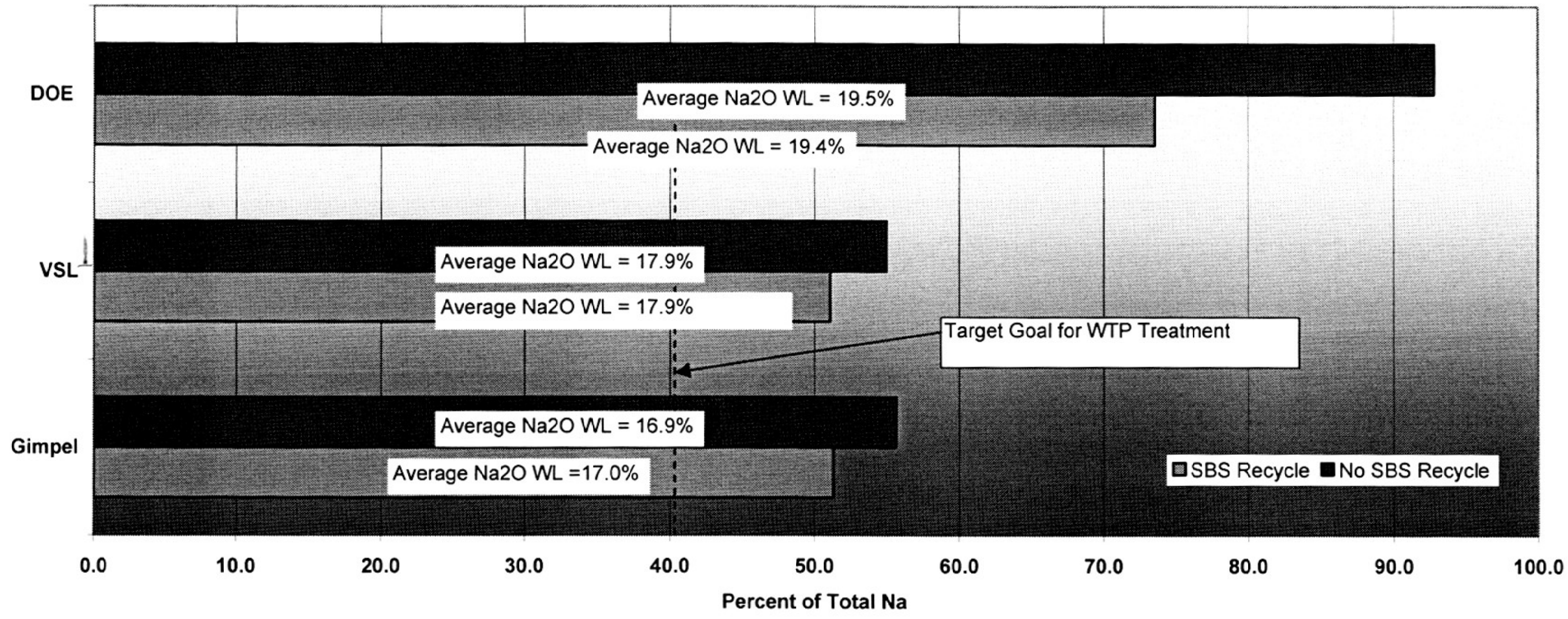
- **Retention of SO3 in the Glass decreases in proportion to the concentration of SO3 in the LAW Feed**

Figure 3 Retention of SO_3 in the LAW Glass



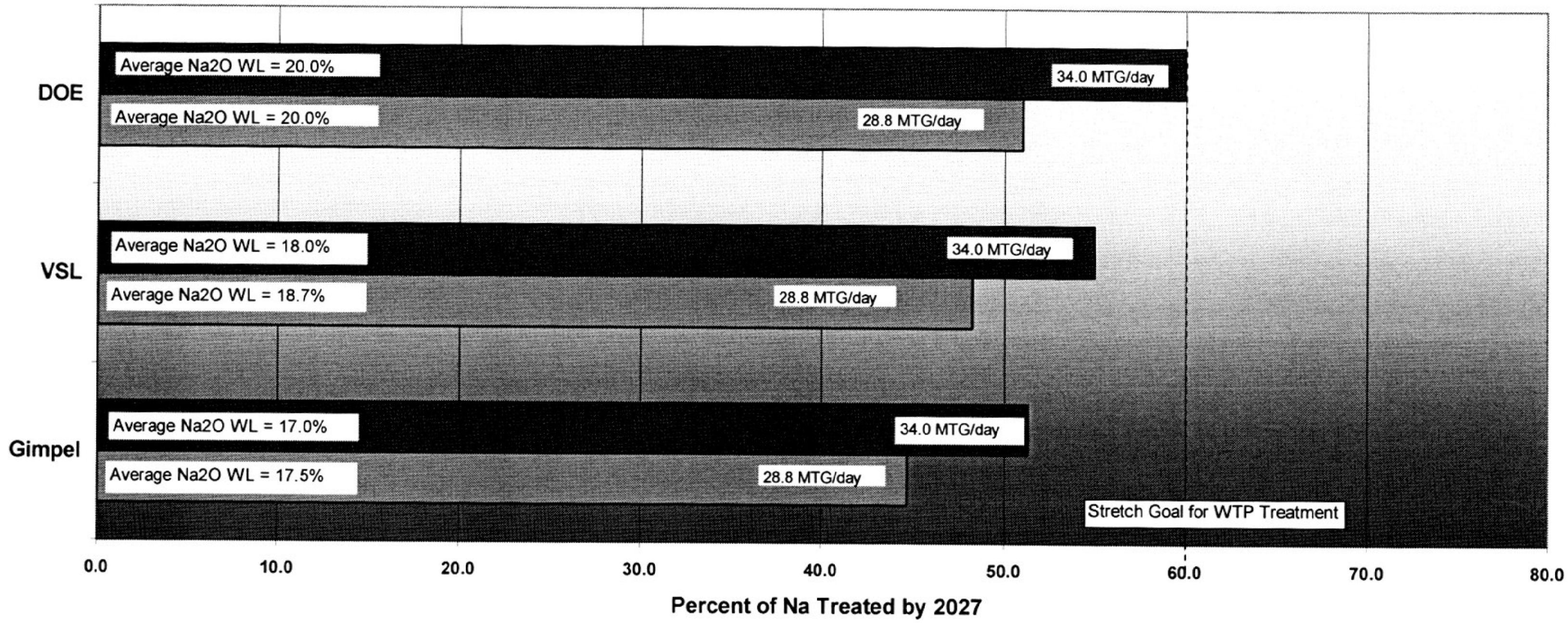
- Target goal of treating 60% of total Na in WTP at 20 wt% glass can only be met with DOE Model
- Purging of LAW Condensate containing sulfate increases amount of Na that can be immobilized at 20 wt% Na2O for DOE glass model only

Figure 4 Percent of Na Treatable at 20% Na_2O Waste Loading versus Glass Sulfate Model (with and without recycle of LAW Condensate within WTP)



- **Target (Base) goal of treating 40% of Na in WTP at a minimum of 14 wt% Na_2O can be met with all three models**
- **Purging of LAW Condensate containing sulfate increases amount of Na that can be immobilized at 14 wt% Na2O. Improvement is greatest for DOE glass model.**

Figure 5 **Percent of Na Treatable at 14% Na_2O Waste Loading versus Glass Sulfate Model (with and without recycle of LAW Condensate within WTP)**



- The Target goal of treating 60% of the total Na at 20 wt% Na_2O by 2028 can be approached only for the DOE Model and for a WTP LAW facility annual average production rate of 34.0 MTG/day
- The increase from Base to Target LAW glass production rate has a slightly greater impact to overall amount of Na treated compared to improvement in waste-loading

Figure 6 Comparison of Percent of Total Na Treated in 18 years of production (2011-2018) at Target and Stretch Production Rates using Different Glass Sulfate Models

Table 4: Summary of Open Issues from the Design Oversight

Item No[1]	CARS No	Open Issue Summary	Recommendation for Resolution
1		RPP-10222 provided an uncertainty analysis for the chromium wash and leach factor waste type model. Uncertainty analysis comparable to that performed for the chromium waste type model was not performed for the aluminum waste type model. (Report Section 4.1)	Uncertainty analysis comparable to that performed for the chromium waste type model should be performed for the aluminum waste type model. Results from this uncertainty analysis should be assessed prior to making a final decision to apply the new aluminum waste type wash and leach factor model. (Report Section 4.1)
2		Limited characterization data has been obtained over the past decade. Acceleration of single-shell tank retrieval and work to evaluate alternative LAW disposal paths provides an opportunity to obtain needed information. (Report Section 4.1.2)	CH2M HILL and BNI should capitalize on these opportunities to conduct selective testing to confirm inventory and predict the fate of chromium in tank farms and WTP systems. Emphasis should be placed on the most problematic waste types S1 and S2 salt cake and R1 sludge. Samples may be available from retrieval waste compatibility analysis. Also, S-109 samples containing the more problematic high chromium waste type S1 salt cake may be available from planned bulk vitrification demonstrations in 2004. (Report Section 4.1.2)
3		Improved methodologies to predict behavior of waste to be delivered to WTP should be considered. This should include application of thermodynamic models in conjunction with limited testing to obtain improved information on speciation and kinetics. (Also see Open Issue (2)) (Report Section 4.1.2)	CH2M HILL should consider improved methodologies to predict behavior of waste to be delivered to WTP. Application of thermodynamic models in conjunction with limited testing obtained to improve information on speciation and kinetics should be considered. (Report Section 4.1.2)

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[1] Item No – Each item shall be identified with a unique number and entered into the CARS database for tracking to resolution. Typically a single CARS number is assigned to the oversight and each open issue is a subtask under that CARS number.

Item No[1]	CARS No	Open Issue Summary	Recommendation for Resolution
4		Documented assessment of the impacts of application of the new chromium and aluminum waste type models is not available. Additionally, potential improvements in system performance (reduced canister production) are not documented or available. (Report Section 4.2)	The oversight team recommends performance of sensitivity analysis to determine HLW glass production quantities using the new waste type model for chromium and assuming oxidative leaching with permanganate resulting in a chromium concentration of 5,000 ppm or less in the waste destined for HLW vitrification. This recommendation is supportive of the River Protection Project System Plan recommendations to consider implementation of new water wash and caustic leach factors along with oxidative leaching. (Report Section 4.2)
5		It is unknown whether oxidative leaching alone would result in acceptable system performance and a reasonable quantity of HLW canister production. (Report Section 4.2)	Based on the results from the recommended sensitivity analysis, ORP should determine whether oxidative leaching is adequate to mitigate potential increases in HLW glass production or whether additional strategies are required such as glass formulation work to increase chromium loading, melter development, or other treatments. Assuming strategies to control HLW glass production quantities are adequate, CH2M HILL should adopt the new waste type model for chromium in conjunction with oxidative leaching in future system planning. Application in WTP specific models should follow oxidative leach process design work discussed below. (Report Section 4.2)
6		System performance with application of oxidative leaching in WTP is unknown and may not support milestones for completing treatment of Hanford tank waste. Other treatment approaches may be more advantageous. (Report Section 4.2)	Given the uncertainties in performance of oxidative leaching in WTP, the oversight team considers it prudent to consider approaches to oxidize chromium that could be applied in tank farms prior to delivery of waste to WTP. These approaches should consider options to enhance oxidation of chromium during tank

Item No[1]	CARS No	Open Issue Summary	Recommendation for Resolution
			waste storage, retrieval, and transfer operations. These methodologies could have slower kinetics than the WTP process oxidation steps. Concepts should be developed to a level of maturity to establish feasibility and support selection of optimum waste treatment systems. With the exception of tank SY-102, oxidative leaching is not anticipated to be required for initial WTP feed through 2018. (Report Section 4.2)
7		A number of key analytes are predicted by HTWOS to exceed contract maximums. (Report Section 4.3)	An assessment should be performed of each case where the Contract maximum is not met. CH2M HILL should evaluate calculation and assumptions leading to out of specification feed to identify uncertainties. BNI should compare results from testing performed on initial feed tank samples provided for WTP testing and compare them against TFCOUP predictions. Based on this information a plan of action should be determined and implemented. (Report Section 4.3)
8		There is considerable variability in the control of the wash and leach databases and application in models. The modeling interface between the tank farm and waste treatment contractor is insufficient with regard to documentation and definition of the interface and configuration control. (Report Section 4.4.2)	A technical baseline document defining wash and leach factors should be developed to improve configuration management and facilitate appropriate application of wash and leach factors. (Report Section 4.4.2)

E-STARS™ Report
Task Detail Report
10/27/2003 0110

TASK INFORMATION

Task#	ORP-WEC-2003-0047		
Subject	CONCUR: 03-WEC-050 EVALUATION OF TANK WASTE WASH & LEACH FACTORS		
Parent Task#		**Status**	~~Open~~ Closed ajh
Reference		**Due**	
Originator	Bennett, Tery	**Priority**	None
Originator Phone	(509) 376-4267	**Category**	None
Origination Date	10/22/2003 1317	**Generic1**	
Remote Task#		**Generic2**	
Deliverable	None	**Generic3**	
Class	None	**View Permissions**	Normal

Instructions

bcc:
ORP Off File
Mgr Rdg File
JR Eschenberg, AMWTP
WJ Taylor, AMWTP
JS O'Connor, OPA
RA Gilbert, WEC
WF Hamel, WEC

RECORD NOTE: This letter, under letter # 03-WEC-049, is also being sent to JP Henschel at BNI.

10/22/03: Added Noyes and Swailes, removed Hamel and Taylor from concurrence per RA Gilbert. ~Tery
10/27/03: Removed Noyes from concurrence per CS Louie. Also made changes to attachment per Genie in Letter #03-WEC-049 (Attachments are identical). ~Tery

ROUTING LISTS

1 Route List Active

- Gilbert, Rob A - Approve - Approved - 10/23/2003 0845
- Hamel, William F - Approve - Withdrawn - 10/22/2003 1457
- Taylor, William J - Approve - Withdrawn - 10/22/2003 1459
- Schepens, Roy J - Approve - Awaiting Response 10/31/03 OK
- Noyes, Delmar L - Approve - Withdrawn - 10/27/2003 1309
- Swailes, John H - Approve - Awaiting Response JS for 10/27/03, Genie

ATTACHMENTS

Attachments 1. 03-WEC-050.rag.doc

COMMENTS

No Comments

TASK DUE DATE HISTORY

No Due Date History

SUB TASK HISTORY

No Subtasks

-- end of report --

E-STARS™ Report
Task Detail Report
10/22/2003 0301

TASK INFORMATION

Task#	ORP-WEC-2003-0047		
Subject	CONCUR: 03-WEC-050 EVALUATION OF TANK WASTE WASH & LEACH FACTORS		
Parent Task#		**Status**	Open
Reference		**Due**	
Originator	Bennett, Tery	**Priority**	None
Originator Phone	(509) 376-4267	**Category**	None
Origination Date	10/22/2003 1317	**Generic1**	
Remote Task#		**Generic2**	
Deliverable	None	**Generic3**	
Class	None	**View Permissions**	Normal
Instructions	bcc: ORP Off File Mgr Rdg File JR Eschenberg, AMWTP WJ Taylor, AMWTP RA Gilbert, WEC WF Hamel, WEC RECORD NOTE: This letter, under letter # 03-WEC-049, is also being sent to JP Henschel at BNI. 10/22/03: Added Noyes and Swailes, removed Hamel and Taylor from concurrence per RA Gilbert. ~Tery		

ROUTING LISTS

1	Route List	Active
	• Gilbert, Rob A - Approve - Awaiting Response RAG 10/23/03	
	• Hamel, William F - Approve - Withdrawn - 10/22/2003 1457	
	• Taylor, William J - Approve - Withdrawn - 10/22/2003 1459	
	• Schepens, Roy J - Approve - Awaiting Response	
	• ~~Noyes, Delmar L - Approve - Awaiting Response~~	
	• Swailes, John H - Approve - Awaiting Response	

ATTACHMENTS

Attachments	1. 03-WEC-050.rag.doc

COMMENTS

No Comments

TASK DUE DATE HISTORY

No Due Date History

SUB TASK HISTORY

No Subtasks

-- end of report --

E-STARS^{TM} Report
Task Detail Report
10/22/2003 0123

TASK INFORMATION

Task#	ORP-WEC-2003-0047		
Subject	CONCUR: 03-WEC-050 EVALUATION OF TANK WASTE WASH & LEACH FACTORS		
Parent Task#		**Status**	Open
Reference		**Due**	
Originator	Bennett, Tery	**Priority**	None
Originator Phone	(509) 376-4267	**Category**	None
Origination Date	10/22/2003 1317	**Generic1**	
Remote Task#		**Generic2**	
Deliverable	None	**Generic3**	
Class	None	**View Permissions**	Normal
Instructions	bcc: ORP Off File Mgr Rdg File JR Eschenberg, AMWTP WJ Taylor, AMWTP RA Gilbert, WEC WF Hamel, WEC RECORD NOTE: This letter, under letter # 03-WEC-049, is also being sent to JP Henschel at BNI.		

ROUTING LISTS

1	Route List	Active
	• Gilbert, Rob A - Approve - Awaiting Response	
	• Hamel, William F - Approve - Awaiting Response	
	• Taylor, William J - Approve - Awaiting Response	
	• Schepens, Roy J - Approve - Awaiting Response	

ATTACHMENTS

Attachments	1. 03-WEC-050.rag.doc

COMMENTS

No Comments

TASK DUE DATE HISTORY

No Due Date History

SUB TASK HISTORY

No Subtasks

-- end of report --