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Defense Waste Processing Facility (DWPF), Modular CSSX Unit (CSSX), and Waste Transfer Line System of Salt Processing Program (U)

by

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DISCLAIMER

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LIST OF ACRONYMS

Acronym	Description
ARP	Actinide Removal Process
BUOGCT	Backup Off-Gas Condensate Tank
CDC	Canister Decontamination Chamber
CDS	Canister Decontamination Chamber System
CDMC	Contact Decontamination Maintenance Cell
CRO	Control Room Operator
CSSX	Caustic Side Solvent Extraction
DCS	Distributed Control System
DDA	Deliquification Dissolution and Adjustment
DFSFT	Decon Frit Slurry Feed Tank
DWPF	Defense Waste Processing Facility
DWTT	Decontamination Waste Treatment Tank
ETP	Effluent Treatment Process
GWSB	Glass Waste Storage Building
HTF	H Tank Farm
LRW	Liquid Radioactive Waste
MCU	Modular CSSX Unit
MFT	Melter Feed Tank
OBU	Operations Business Unit
OGCT	Off-Gas Condensate Tank
PO	Process Operator
PRFT	Precipitate Reactor Feed Tank
PSO	Process Support Operator
PVVS	Process Vessel Vent System
RCO	Radiological Control Operator
RCT	Recycle Collection Tank
REDC	Remote Equipment Decontamination Cell

Acronym	Description
SAS	Steam Atomized Scrubber
SCT	Shielded Canister Transporter
SEFT	Salt Effluent Feed Tank
SEHT	Salt Effluent Hold Tank
SFHT	Spent Frit Hold Tank
SME	Slurry Mix Evaporator
SMECT	Slurry Mix Evaporator Condensate Tank
SPI	Schedule Performance Index
SRAT	Sludge Receipt and Adjustment Tank
SS	Saltstone
SSRT	Sludge Solids Receipt Tank
SSST	Sludge Solids Storage Tank
STAR	Site Tracking, Analysis, and Reporting
SWPF	Salt Waste Processing Facility
WT	Wrench Time
WTC	Weld Test Cell
WTL	Waste Transfer Line

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EXECUTIVE SUMMARY

All of the waste streams from ARP, MCU, and SWPF processes will be sent to DWPF for vitrification. The impact these new waste streams will have on DWPF's ability to meet its canister production goal and its ability to support the Salt Processing Program (ARP, MCU, and SWPF) throughput needed to be evaluated. DWPF Engineering and Operations requested OBU Systems Engineering to evaluate DWPF operations and determine how the process could be optimized. The ultimate goal will be to evaluate all of the Liquid Radioactive Waste (LRW) System by developing process modules to cover all facilities/projects which are relevant to the LRW Program and to link the modules together to: (1) study the interfaces issues, (2) identify bottlenecks, and (3) determine the most cost effective way to eliminate them. The results from the evaluation can be used to assist DWPF in identifying improvement opportunities, to assist CBU in LRW strategic planning/tank space management, and to determine the project completion date for the Salt Processing Program.

As part of the ultimate goal, the following scopes of work have been evaluated:

- Evaluate Continuous vs. Batch Sludge Transfer to DWPF
- Identify bottlenecks in DWPF and the Salt Processing Program
- Estimate tank sizes required to decouple DWPF from SWPF
- Identify ways to improve the DWPF Canister Decontamination Chamber (CDC) operations.
- Integrate MCU module with DWPF model
- Integrate Waste Transfer Line (WTL) Module with DWPF model
- Determine the impact of lowered DWPF canister production on Salt Program.

The Integrated DWPF model developed in this evaluation includes detailed processes for DWPF, SWPF, MCU/ARP, and the WTL. However, peripheral supporting systems, e.g., Saltstone, Tank Farm, and DWPF recycle water treatment system and associated evaporators, are treated as black-boxes.

Systems Engineering updated the Defense Waste Processing Facility (DWPF) Time and Motion model (module 1) developed in FY04 and integrated the DWPF model with the ARP/MCU model (module 2) built in FY04, and the Wastes Transfer Line model (module 3) built in FY05. The models were developed using the Vitech Corporation COREsim® application.

As part of the previous DWPF model, the SRAT was identified as a potential bottleneck after startup of salt processing. This evaluation included identified optimizations for the SRAT and its impacts to DWPF canister production. This evaluation showed that post SWPF startup, with an assumed Melter availability of 85%, DWPF will be able to achieve the 250 canisters per year goal only after SRAT optimization. However, this is still 3 canisters per year less than the current DWPF can production for sludge only feed. Without SRAT optimization, DWPF canister annual production rate will be 11 canisters per year less than the current DWPF canister production rate.

The evaluation showed that Continuous Sludge Transfer operation in DWPF will reduce SRAT cycle time slightly, but, the overall impact on DWPF canister production rate is minimal. Continuous Sludge Transfer is very complicated to execute, therefore, it is recommended to look closely into possible Conduct of Operations (Con-Ops) issues before implementing the Continuous Sludge Transfer strategy.

As part of bottleneck identification, the evaluation showed that the SWPF processing rate is very sensitive to Saltstone throughput. With the current Liquid Radioactive Waste (LRW) infrastructure and SWPF design, a canister production rate of 251 cans/yr, and a current Saltstone processing capacity of 83,000 gal/wk for processing DDA waste, the achievable SWPF throughput is 3.6Mgal/yr. Increasing the Saltstone capacity to 100,000 gal/wk, gives an SWPF throughput of 4.28 Mgal/yr. A Saltstone capacity of 143,000 gal/wk gives an SWPF throughput of 5.85 Mgal/yr. If Saltstone has a processing capacity of 180,000 gal/wk, with current SWPF design and DWPF canister production rate of 251 cans/yr, the achievable SWPF salt processing rate will be 6.4Mgal/yr. Saltstone must process at least 180,000 gal/wk to avoid being one of the bottlenecks in the Salt Processing Program.

With a DWPF canister production rate of 251 cans/yr, the SWPF annual throughput can be increased to 7.0Mgal/yr by decoupling SWPF from DWPF and if Saltstone processing capacity is at least 180,000 gal/wk. The decoupling can be achieved by using a bigger Stripped Effluent Hold Tank (SEHT) (38,000gal) vs. the existing tank size (16,600 gal) and a new 4,000 gal (MST) Sludge Solids Storage Tank (new SSST). Comparing the decoupled case to the non-decoupled case (both at a Saltstone processing capacity of 180,000 gal/wk); the Salt Processing Program completion date will be shortened by about 14 months.

With the current SWPF design, a Saltstone throughput at 180,000 gal/wk or greater, and a lowered DWPF canister production rate of 179 cans/yr, the achievable SWPF salt processing rate will drop to 5.4Mgal/yr. The SWPF annual throughput can be improved further to 7.0Mgal/yr by decoupling SWPF from DWPF. Comparing the later case (7.0Mgal/yr) to the former case (5.4Mgal/yr), the Salt Processing Program completion date will be shortened by about 44 months. Due to the time constraint, the two decoupling tanks, SEHT and new SSST, were not sized for this case.

The model also found that there are two critical parameters affecting the SWPF campaign: when the HTF is informed that it can transfer to DWPF and the MFT heel. By informing the HTF earlier, when the MFT is at 9,100 gallons versus 6,400 gallons, more cans/yr can be produced. The earlier transfer from HTF to DWPF allows SRAT and SME more time to prepare feed to MFT. The lowered MFT heel, 4,800 gallons to 3,250 gallons, would buy more time to accommodate any process upsets in SRAT and SME. This in turn allows more processing flexibility.

After the start up of MCU and SWPF, the DWPF recycle water will increase 35% and 62% respectively compared to the current recycle water sent back to Tank Farm. The model assumes the Tank Farm will have enough tank space and evaporator capacity to hold and handle all recycle water produced from DWPF. Validation of this assumption is needed.

Various DWPF CDC System improvements were identified. The improvement opportunities include (1) reducing the water in the decon frit slurry, (2) decoupling the CDC from the SME, (3) reducing contaminants from CDC cell covers, and (4) identifying leaks in the PVVS to improve the PVVS performance. The latter two improvements will also allow the CDC to be able to reclaim the clean storage canister racks in the Canister Decon Cell.

If the DWPF can maintain a canister production rate of at least 210 cans/yr, ARP/MCU will meet its minimum design requirements of 1Mgal (6.44 Na) per year through the combined ARP/MCU systems. However, if DWPF canister production drops to 179 cans/yr, the combined ARP/MCU system throughput will be 0.93 Mgal per year which is below minimum design requirements of 1 Mgal per year. Although the MCU module has been integrated with the DWPF model, it is important to note that due to time constraint, the latest design changes in the MCU project have not been incorporated into the current model. There is a need to update the ARP/MCU module based on the most recent design.

1.0 INTRODUCTION

The Defense Waste Processing Facility (DWPF) at the Savannah River Site is used to process high-level radioactive waste from the Tank Farms into borosilicate glass to reduce the mobility of the radionuclides. Since FY1996, DWPF has processed and vitrified nuclear wastes from the Liquid Radioactive Waste (LRW) Tank Farms into canisters for long-term disposal (Reference 1 and 2). All wastes vitrified to date in DWPF are "sludge only" wastes. Per the HLW Strategic Plan, DWPF will start processing "salt" waste in 2011 (Reference 3).

The former salt waste processing technology, In-Tank Precipitation (ITP), was suspended in FY1998. There are three different types of salt waste: low curie salt, low curie with actinide salt, and high curie with actinide salt. A small fraction of the current inventory of salt is low in cesium and low in actinides. This material (referred to as low curie salt) is treated by the removal of the cesium-bearing interstitial liquid, followed by dissolution of the saltcake, and transferred to the Saltstone Facility for disposal. Another portion of the salt is low in cesium but contains actinides. This material can be treated by performing an MST strike to adsorb the strontium and actinides followed by a filtration step. This process is referred to as the Actinide Removal Process (ARP). The majority of the salt inventory contains significantly higher levels of cesium and actinides. The selected technology for treating this waste is the CSSX process (References 2, 4, and 5).

CSSX is to be utilized in two separate facilities for the removal of cesium from salt waste, one facility for near term processing and one facility for longer term processing. The Salt Waste Processing Facility (SWPF), for the long term processing, is being designed to process most of the salt waste in the Tank Farm. The current schedule shows SWPF ready for processing waste in FY11. There is, however, a need for some cesium removal capability before SWPF goes online. Near term, the process for actinide and cesium removal from waste streams will be accomplished by the ARP at 241-96H & 512-S and the Modular Caustic-Side Solvent Extraction Unit (MCU). The Waste Transfer Line (WTL) Project was initiated to provide the necessary waste transfer infrastructure to support the start up and integration of two new processes (ARP/MCU and SWPF) into the LWR system. Modifications necessary to support this near term processing was described in the WTL Project scope as Phase I modifications. Modifications necessary to support long term processing by SWPF was described in the WTL Project scope as Phase II modifications. As part of these projects, the feed to SWPF is supplied by what is called Feed preparation, which is conducted in F- and H- Tank Farms. The Feed Preparation's primary objective is to prepare salt solution feed to support the SWPF throughput while supporting existing continuous Tank Farm missions.

All of the waste streams from ARP, MCU, and SWPF processes will be sent to DWPF for vitrification. The impact these new waste streams will have on DWPF's ability to meet its canister production goal and its ability to support the Salt Processing Program (ARP, MCU, and SWPF) throughput goals needed to be evaluated. DWPF Engineering and Operations requested OBU Systems Engineering to evaluate DWPF operations and determine how the process could be optimized. The DWPF COREsim model was first developed in FY04 and the results are documented in G-ESR-S-00014 (Reference 6). The original COREsim model was developed with detailed DWPF processes, but with salt feeds as input streams to the model.

Systems Engineering also developed several other models that interface with the DWPF model. The MCU/ARP model was developed in FY04. The objective for this model was to develop a high level operational research model for MCU to verify the throughput requirements specified in the Conceptual Design Package. The MCU/ARP model included Actinide Removal Process (ARP) and MCU, but treated DWPF as a black box. The results from this MCU/ARP model are documented in G-ESR-H-00073 (Reference 7). The WTL COREsim model was developed in FY05 and the results are documented in G-ESR-H-00086 (Reference 8). The WTL model includes SWPF, ARP, and associated waste transfer lines and tanks, but the DWPF process was treated as a black-box. The Feed Preparation model was also developed in FY05. This model included detailed process steps for Feed Preparation, Waste Transfer Line system, ARP, and SWPF modules. However, the Feed Preparation model treated Saltstone and DWPF as black boxes. The results are documented in G-ESR-H-00108 (Reference 9).

As part of the updated DWPF model, Systems Engineering was requested to integrate the WTL and ARP/MCU models with the DWPF model in order to more accurately simulate DWPF and the Salt Processing Program operations. The scopes of the current DWPF model are to:

- Evaluate Continuous vs. Batch Sludge Transfer to DWPF from Tank 40
- Identify bottlenecks in DWPF and Salting Processing Program
- Estimate tank sizes required to decouple DWPF from SWPF.
- Identify ways to improve Canister Decontamination Chamber operations.
- Integrate MCU module into DWPF model
- Integrate Waste Transfer Line Module into DWPF model
- Determine impact of lowered DWPF canister production on Salt Program.

It is worth noting that DWPF has been working diligently over the last few years to maximize the total quantity of waste in each canister by increasing the canister fill height and percent waste loading. The equivalent canister is referred to as a canister filled up to a 96" with glass containing 28.1 % waste. A discrete canister is a canister which may have a different waste loading and fill height than the equivalent can. In this study, it is assumed that each discrete canister to be produced from now to FY06 is filled up to 100" with 40.1% waste loading. With this assumption, each discrete canister is equal to 1.487 of an equivalent canister. All canister throughput rates mentioned in this report are "discrete cans", unless specified otherwise.

The DWPF COREsim model is classified as Level E software in the Software Quality Assurance Plan (SQAP) (Reference 10). Although Level E does not require a SQAP according to E-7, Section 5.0 or QAP 20-1, a decision was made to prepare a SQAP anyway. If the software is to be upgraded to Level D or higher in the future, the SQAP can be revised to reflect the upgrade.

2.0 DISCUSSION

2.1 Assumptions

Assumptions are the limitations that constrain the modeled process. Examples of assumptions are resource availability, facility availability, equipment capacities, system cycle times and batch size limitations. A complete list of assumptions imposed on the model are provided in

Appendices A and B. Appendix A contains assumptions for the DWPF model and Appendix B contains assumptions for the WTL/SWPF and ARP/MCU models. This section includes a list of the major assumptions used in this model.

This study makes the following major assumptions:

- The SWPF start date is October, 2011.
- The current waste tank inventory in SRS high level waste system is 17.4Mgal salt supernate, 16.4Mgal saltcake, and 2.6Mgal sludge. The saltcake will be dissolved before it can be treated in SWPF. The total effective salt solution inventory after saltcake dissolution is 84.7Mgal. It is assumed that 8.6Mgal salt solution will be processed during the Interim Salt Processing window. Therefore, it is assumed that a total of 76.1Mgal salt solution will be processed by SWPF.
- This study also assumes that SWPF is to start up and ramp up to its maximum sustainable throughput with no transition period. The assumption is based on the customer's expectation although it may be an aggressive and non-conservative assumption. If the assumption is not true, then, the salt campaign end date for different cases reported in this report will be adversely impacted.
- In the model, it is assumed processing salt feed has higher priority than meeting the canister production goal
- This study assumed a current Melter availability of 85%, versus the Melter availability of 80% used in the previous DWPF study (Reference 6). To approximate the impacts of lower DWPF canister production on the Salt Program, this model assumed adjusted values for the Melter availability of 60% and 70%.
- The SWPF availability of 83% was assumed for both the previous Waste Transfer Line model and the current model.
- The model assumes that Tank Farm has adequate tank space and evaporator capacity to accept the recycle water from DWPF.
- The model assumes that the MFT heel is 3,250 gallons versus 4,800 gallons. This change is due to the installation of a new pump that can give the lower heel value.
- Initial Saltstone throughput values are based on an SRNL report (Reference 11). These values are all assumed to be feasible for this study.
- The down time for Melter replacement is 4 months every 4 years. This downtime has been incorporated into the model results by looking at the estimated SWPF completion date and adding an additional 4 months for every 4 years it takes to reach completion.
- The model assumes that Tank 50 is available to collect DSS with an initial tank space of 800,000 gallons at startup of MCU and SWPF.
- The model treats Saltstone, Tank Farm, and DWPF Recycle Waste Treatment Systems as black-boxes. i.e. These systems are not modeled in detail in this study. The systems are assumed to receive, process, and transfer what ever is sent to them or from them with no time delays or operational upsets.
- The model assumes that the MCU design as of August, 2005 is adequate for this study. The latest design changes have not yet been incorporated in to the model.
- In this study, it is assumed that each discrete canister to be produced from now to FY06 is filled up to 100" with 40.1% waste loading. With this assumption, each discrete canister is equal to 1.487 of an equivalent canister.

2.2 Case Descriptions

Operating scenarios evaluated by this study are defined as cases. Table 1 identifies each case by case number, feed type, and description. The baseline model is the current DWPF mode of operations and is identified as Case 3B. The baseline model simulated the current operations to see how well the model results matched the field data. The other case studies, identified in Table 1, are for feeds with sludge and salt wastes. The difference between the case studies completed for sludge and salt wastes are that the Case 8s' are for cases with existing salting processing infrastructure and configuration; and Case 9s' are with decoupling SWPF from DWPF. The Case 8s' and 9s' are then broken down by changing various setpoints (e.g. equipment attainment values, tank levels required for batch notification, SRAT remediation frequency). Cases 8 and 9 are also broken down by Saltstone processing rate. For example, Case 8B(SS3) is with sludge and salt feed, but before SRAT optimization. The last three rows of Table 1, focused on MCU/ARP operations which will happen prior to SWPF. The MCU Minimum (MCU Min) is the case that MST strike time is assumed to be 24 hours (Reference 12). To study the potential impact of lowered DWPF canister production on the Salt Program, three Melter availabilities are studied: 85%, 70%, and 60%, which give canister production rates of 251 cans/yr, 210 cans/yr, and 179 cans/yr, respectively. All cases are described in Table 1 below. The results and variables used for each of the salt processing cases are provided in Tables 4, Section 2.3.3. Table 5 in the Section 2.3.5 shows the results for the MCU cases.

Table 1. Cases Studied

Case #	Feed Type	Descriptions
3B	Sludge	Notify HTF @ MFT = 6,400gal
8B(SS3)	Sludge + Salt	Notify HFT@MFT = 6,400gal;Saltstone = 143,000gal/wk
8A(SS1)	Sludge + Salt	Notify HTF @MFT = 9,100gal; Saltstone = 83,000gal/wk
8A(SS2)	Sludge + Salt	Notify HTF @MFT = 9,100gal; Saltstone = 100,000gal/wk
8A(SS3)	Sludge + Salt	Notify HTF @MFT = 6,400gal; Saltstone = 143,000gal/wk
8A	Sludge + Salt	Notify HTF @MFT = 9,100gal; Saltstone limitation = 180,000gal/wk
8A(60%)	Sludge + Salt	Notify HTF @MFT = 9,100gal; Saltstone limitation = 180,000gal/wk Melter Availability = 60%
8A(70%)	Sludge + Salt	Notify HTF @MFT = 9,100gal; Saltstone limitation = 180,000gal/wk Melter Availability = 70%
9A(SS3)	Sludge + Salt	Decoupling SWPF from DWPF; Saltstone = 143,000gal/wk
9A	Sludge + Salt	Decoupling SWPF from DWPF; Saltstone limitation = 180,000gal/wk
9A(70%)	Sludge + Salt	Decoupling SWPF from DWPF; Saltstone limitation = 180,000gal/wk Melter Availability = 70%
MCU Min	Sludge + Salt	Notify HTF @MFT = 9,100gal; Saltstone = 83,000gal/wk ARP/MCU flowrate = 3.803 gpm
MCU Min (60%)	Sludge + Salt	Notify HTF @MFT = 9,100gal; Saltstone = 83,000gal/wk ARP/MCU flowrate = 3.803 gpm Melter Availability = 60%
MCU Min (70%)	Sludge + Salt	Notify HTF @MFT = 9,100gal; Saltstone = 83,000gal/wk ARP/MCU flowrate = 3.803 gpm Melter Availability = 70%

2.3 Simulation Results and Observations

The following sections discuss the results and observations for the various cases and scenarios evaluated with the DWPF model. Each section contains the results of a specific requested scope item(s) (see bulleted list in Introduction section). Section 2.3.1 contains the data that validates the DWPF model results using actual field data. The remaining sections present the results pertaining to specific scope items.

2.3.1 Sludge Only Operation (Baseline Case 3B)

Case 3B represents the current mode of operations. In accordance with the software quality assurance plan (Reference 10), Case 3B was verified by executing the model logic and comparing resulting simulation data with process historical data. Historical data of interest for this model includes throughput system attainment, system downtime, and total waste water generated. Table 2 shows the simulation data for Case 3B and the associated historical data. The model has been validated since the outputs shown in Table 2 are within a 4% difference of the field data, except for the sludge processed per year output. The model shows a higher rate for the amount of sludge processed per year as compared to the field data. This is because over time, the leakage problem in the Tank 40 slurry pumps has progressively gotten worse. This has lead to diluted sludge batches. The model uses the latest water leakage rate, which gives a higher sludge processed rate for the model output (330,000 gal/yr) versus the field data (275,000 – 290,000 gal/yr).

Table 2. Case 3B Run Result

Case 3B	Field Data (FY2005)	Model Outputs
Discrete Canisters	257 cans/year	254 cans/yr
Sludge Processed	275,000 – 290,000 gal/yr	330,000 gal/yr
Recycle Water	1.80 – 1.85 Mgal/year	1.75Mgal/yr (one SAS)

2.3.2 Sludge Transfer Cases – Continuous versus Batch

Depending on the weight percent solids in the sludge, typically, DWPF receives two sludge transfers to make up one SRAT batch. If the weight percent solids of the sludge are too low, a third sludge transfer may be required. Low weight percent solids for the sludge are not expected, but can occur as a result of initial sludge batch preparation (i.e. due to the physical properties of the sludge) or dilution water from an unexpected equipment failure (such as a pump seal). Currently, Tank 40 has experienced water in-leakage from two slurry pumps that have seal damage. The continuous sludge transfer operation was identified as an alternative to minimize the SRAT cycle time and water in-leakage. The risks and benefits are analyzed for determining pros and cons of both options.

Table 3. Comparison of Continuous sludge Transfer vs. Batch Transfer

Cases	Batch (SRAT cycle Time)	Continuous (SRAT cycle Time)	Δ hr
<=6920 gal Salt + Sludge	156.5-217.5hr	155.9-216.9hr	+0.6
7700 gal Sludge	122.8-151.8 hr	121.1-150.1hr	+1.7
7400 gal Salt + Sludge	160.9-221.9hr	161.7-222.7hr	-0.8
7600 gal Salt + Sludge	165.1-226.1hr	163.2-224.2hr	+1.9

Table 3 summarizes the SRAT cycle times for each option and for different scenarios. The Continuous Sludge Transfer will shorten SRAT time between 0.6 to 1.9 hours except in 7,400 gal SRAT batch case. However, this SRAT cycle time reduction is insignificant and has no impact on DWPF canister production rate. With regard to SRAT cycle time, there is no difference between continuous or batch sludge transfers.

2.3.3 Salt Processing Cases

The following cases represent the various operational modes that could occur in DWPF when the Salt Processing Program starts up. The salt processing cases look at sludge and salt feeds after SWPF startup. These cases include the integration of both the MCU/ARP model and the WTL model. Variables were tested in each case to identify and optimize bottlenecks in processing. Table 4 shows all the salt processing cases studied including the baseline Case 3B. Case 3B was added to allow one to compare the current operations to date with future operating scenarios. Case 3B has been validated by actual data as noted in Section 2.3.1. The cases varied by infrastructure (current (no decoupling of SWPF and DWPF) vs. decoupling), feed type, HTF notification, and Saltstone throughput. DWPF and SWPF availability are also variables, but these were considered constants per assumptions in Section 2.1 and those collected in Appendices A and B. The variables can be seen in the first six lines in the left hand column of Table 4. The remaining lines in Table 4 show the results from each case. Table 4 also includes the cases outlined in Table 1 that contain a reduced Melter availability.

Table 4. DWPF Integrated Model Results Summary

	Case 3B Baseline	Case 8B (SS3) Baseline + salt	Case8A(SS1) Current Infrastructure	Case 8A(SS2) Current Infrastructure	Case 8A(SS3) Current Infrastructure	Case 8A Current Infrastructure	Case 8A(60%) Current Infrastructure	Case 8A(70%) Current Infrastructure	Case 9A(SS3) Decoupled	Case 9A Decoupled	Case 9A(70%) Decoupled
Feed Type	Sludge Only	Sludge + Salt	Sludge + Salt	Sludge + Salt	Sludge + Salt	Sludge + Salt	Sludge + Salt	Sludge + Salt	Sludge + Salt	Sludge + Salt	Sludge + Salt
HTF Notification	Current DWPF operations	Notify @ MFT=6400gal	Notify @ MFT=9100gal	Notify @ MFT=9100gal	Notify @ MFT=9100 gal	Notify @ MFT=9100gal	Notify @ MFT=9100gal	Notify @ MFT=9100gal	Notify @ MFT=9100gal	Notify @ MFT=9100gal	Notify @ MFT=9100gal
Decoupling	No	No	No	No	No	No	No	No	Yes	Yes	Yes
Saltstone throughput (gal/wk)	N/A	143,000	83,000	100,000	143,000	180,000	180,000	180,000	143,000	180,000	180,000
DWPF Availability	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
SWPF Availability	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%
Discrete Canisters (cans/yr)	254	243	252	249	251.7	251	179	213	251	251	210
Sludge processed (gal/yr)	331,000	318,000	334,900	329,800	332,600	332,000	242,000	286,000	332,400	333,600	1,603,000
Recycle water to HTF (Mgal/yr)	1.75 (1 SAS)	2.72 (2 SAS)	2.6 (2 SAS)	2.6 (2 SAS)	2.77 (2 SAS)	2.83 (2 SAS)	2.39 (2 SAS)	2.62 (2 SAS)	2.78 (2 SAS)	2.88 (2 SAS)	2.64 (2 SAS)
SWPF (Mgal/yr)	N/A	5.77	3.60	4.28	5.85	6.4	5.4	6.1	5.9	7.0	7.0
Cs-Strip to DWPF (gal/yr)	N/A	419,000	258,200	311,000	427,800	474,500	388,600	444,900	432,400	506,800	467,000
MST/Sludge to DWPF (gal/yr)	N/A	117,000	73,800	87,700	119,450	130,200	104,400	121,900	120,900	140,700	124,400
SEHT (gal)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	32,900	38,000	TBD
New Sludge Solids Storage Tank (SSST) (gal)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2,000	4,000	TBD
SWPF Campaign End Date	N/A	1/13/26	8/24/34	11/12/30	9/22/25	8/17/24	2/06/27	3/20/25	7/01/25	6/09/23	6/09/23

2.3.3.1 Salt Campaign with Current Infrastructure

Four cases were looked at with the current infrastructure of the Salt Campaign. These are cases 8A(SS1), 8A(SS2), 8A(SS3), and 8A. The results of these cases are shown in Table 4. The varying factor in each of these cases is the Saltstone throughput with values of 83,000 gal/wk (current rate for DDA waste), 100,000 gal/wk, 143,000 gal/wk and 180,000 gal/wk. These throughput values were taken from an SRNL report (Reference 11) where the 83,000 gal/wk rate is what is considered the current Saltstone throughput with DDA waste before MCU/ARP and/or SWPF start ups. Once MCU/ARP and SWPF start up Saltstone is planning to process at a higher rate. The 100,000 gal/wk and 143,000 gal/wk values are with three and four cement layers per Saltstone cell, respectively. All of these cases use 9,100 gallons at the volume in the MFT to notify the HTF. The two figures below show the impact of the Saltstone throughput on the SWPF Campaign completion for cases 8A(SS2) and 8A(SS3). For both cases the Salt Solution inventory is considered to be 76.1 Mgal at the start up of SWPF. Figure 1 shows that with the Saltstone throughput at 100,000 gal/wk (Case 8A(SS2)), SWPF can process the salt inventory at a rate of 6.4Mgal/yr for the first 3.2 months. At this time Tank 50 becomes full. The remaining months of the SWPF Campaign, SWPF can only process at a rate of 4.28 Mgal/yr. Both of these values are below the desired 7Mgal/yr. Figure 2 shows that with an increase in the Saltstone throughput to 143,000 gal/wk (Case 8A(SS3)), SWPF can process the salt inventory at a rate of 6.4Mgal/yr for the first 13.3 months before Tank 50 becomes full. The remaining months of the SWPF Campaign, SWPF can only process at a rate of 5.85 Mgal/yr. Both of these values are still below the desired 7Mgal/yr. Even at a processing rate of 180,000 gal/wk, Case 8A, the processing rate for SWPF is still only 6.4Mgal/yr.

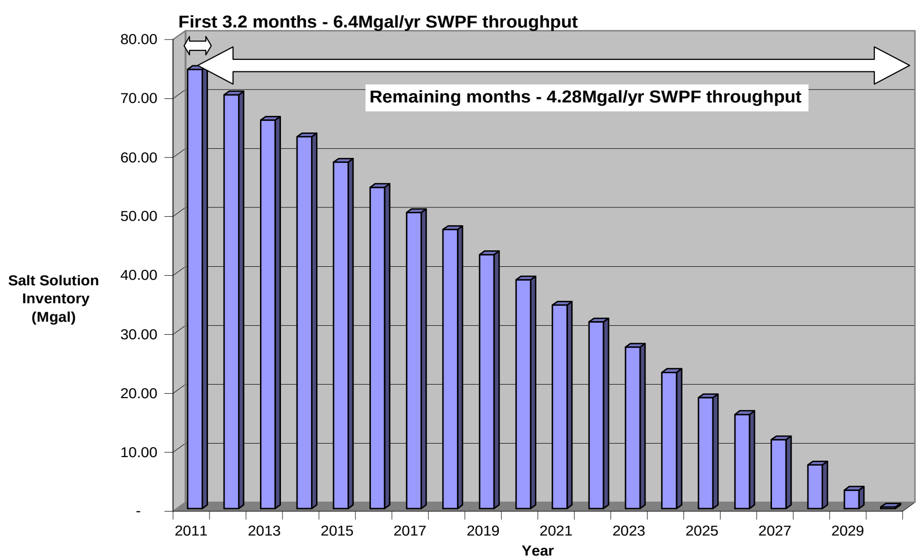

Figure 1. Case 8A (SS2) with Saltstone throughput at 100,000 gal/wk

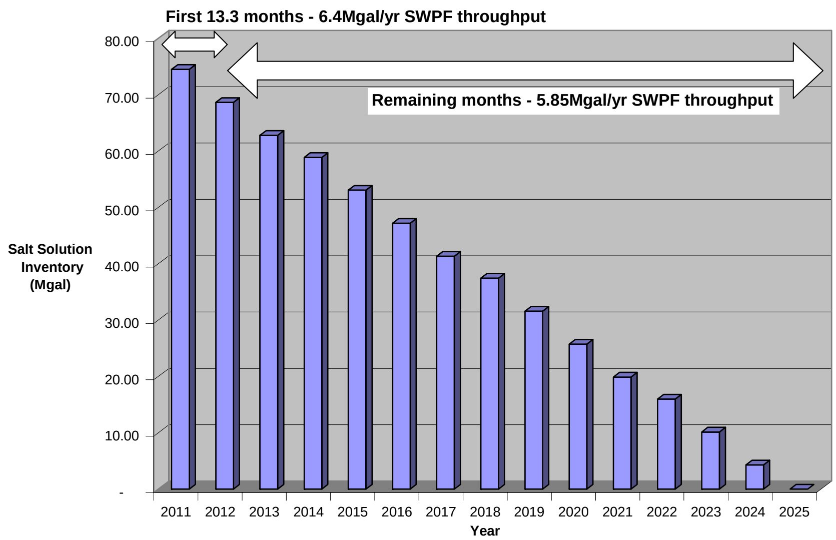

Figure 2. Case 8A(SS3) with Saltstone throughput at 143,000 gal/wk

2.3.3.2 Salt Campaign with Decoupling

The decoupled cases use two tanks to decouple SWPF from DWPF. One tank is a larger SEHT located in SWPF or between SWPF and DWPF. The current tank size is 16,600 gallons. The second tank is a new (MST) Sludge Solids Storage Tank (new SSST). A new SSST is added because the existing SSRT is to be used for Na wash. Table 4 shows that for Case 9A(SS3) with the Saltstone throughput at 143,000 gal/wk the SEHT must have the capacity to hold a minimum of 32,900 gallons and the second tank must be a minimum of 2,000 gallons. With these two tanks, SWPF can maintain a throughput of 7Mgal/yr for the first 7 months of the campaign. At that time, Tank 50 fills up and the SWPF throughput drops to 5.90 Mgal/yr. For Case 9A with Saltstone throughput at 180,000 gal/wk, the SEHT must have a capacity to hold an additional 38,000 gallons and the second tank must be 4,000 gallons. In this case, SWPF can maintain the desired 7Mgal/yr throughout its entire campaign. The model was not used to optimize processing with respect to Melter replacement outages. As stated in the assumptions, every 4 years the Melter is down for 4 months for replacement. This outage will impact SWPF processing, however, if the additional decoupling tanks are of a size great enough, they could possibly prevent impact to SWPF during Melter replacement. This scenario was not looked at in the current model.

2.3.3.3 Summary - Salt Processing Cases

The figures below are a graphical representation of the model results for the different cases studied. The model found that there are two critical parameters affecting the SWPF campaign: when the HTF is informed that it can transfer to DWPF and the MFT heel. Figure 3 shows how the variation in feed type, the sludge only versus sludge plus salt, and the HTF notification impacts DWPF canister production. By informing the HTF earlier, when the MFT is at 9,100 gallons versus 6,400 gallons, more cans/yr can be produced. The earlier transfer from HTF to DWPF allows SRAT and SME more time to prepare feed to MFT. This was due to the installation of a new pump. The lowered MFT heel, 4,800 gallons to 3,250 gallons, would buy more time to accommodate any process upsets in SRAT and SME. This in turn allows more processing flexibility.

Figure 4 below shows the amount of recycle water that is produced after the incorporation of the salt program. There is an increase in the recycle water for all cases modeled with the salt program. At this time, the model assumes that the Tank Farm will have enough available space to accept this amount of recycle water from DWPF. Figure 5, below, shows the SWPF Campaign end dates for all cases (except baseline) based on Saltstone through put. It can be seen that the greater the Saltstone throughput, the earlier the campaign end date. Overall, the increase of the Saltstone rate from 83,000 gal/wk to 100,000 gal/wk will increase the SWPF throughput by 0.67 Mgal/yr. An additional increase in the Saltstone rate from 100,000 gal/wk to 143,000 gal/wk would increase SWPF throughput by 1.57 Mgal/yr. An additional increase from 143,000 gal/wk to 180,000 gal/wk gives another SWPF increase of 0.58 Mgal/yr. Overall, the two decoupling tanks give an increase in SWPF throughput of approximately 0.6Mgal/yr.

Table 4 also shows the impact of the salt processing rate on the DWPF canister production rate. Table 4 shows the number of canisters produced per year for each of the cases studied. The baseline shows a current production rate of 254 cans/yr. With salt and sludge processing, before any optimizations only 243 cans/yr are processed. With both salt and sludge processing and optimizations in place, 251 cans/yr can be processed. The canister production rate is reduced by 3 cans/yr due to SRAT processing.

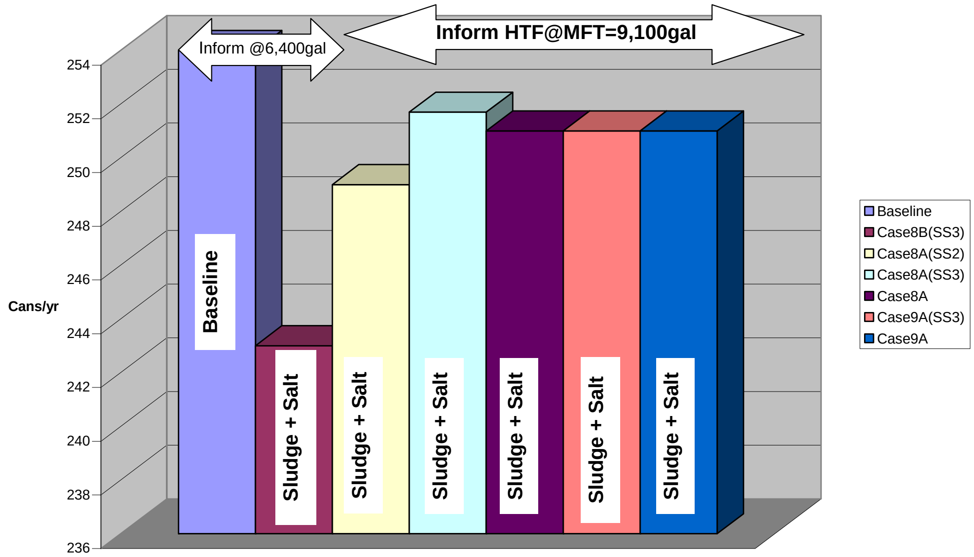

Figure 3. Canister Production Rate as a Function of Feed Type and HTF notification.

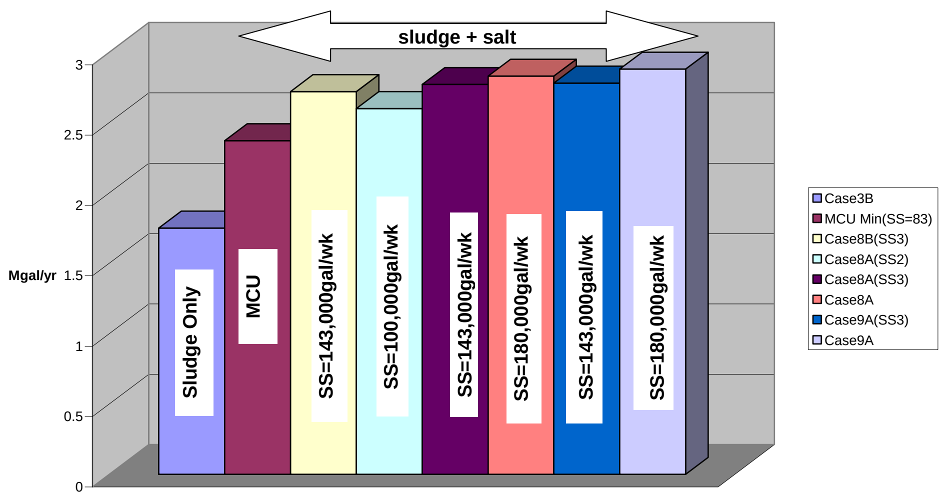

Figure 4. DWPF Recycle Water Generation as a Function of Feed Type.

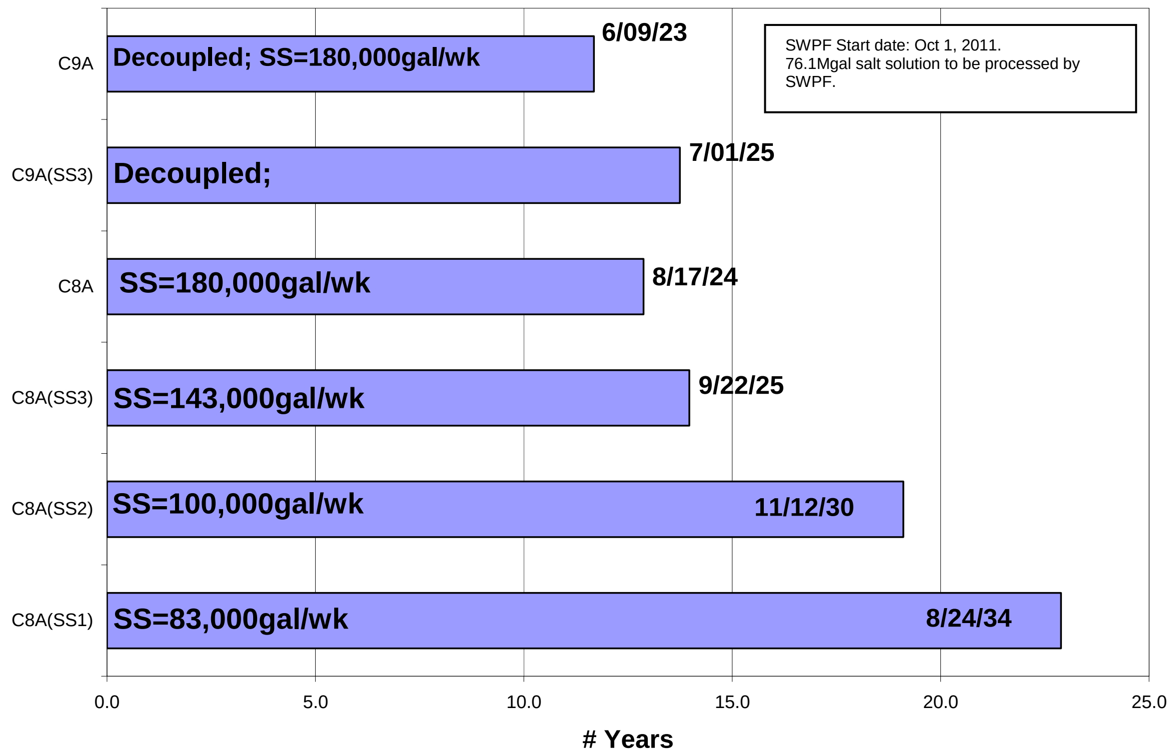

Figure 5. SWPF Campaign Duration based on various Saltstone throughputs

2.3.4 CDC System Improvements

The Canister Decontamination System (CDS), also called Canister Decontamination Chamber (CDC) system, is responsible for decontamination of the filled DWPF canisters before the canisters go to Weld Test Cell. In 2005, the CDS Annual System Health Report found that the CDS did not meet its goals for system maintainability, reliability, and availability (Reference 13). Canister decontamination is a set of sequential steps that are controlled by a Programmable Logic Controller (PLC). All PLC inputs and outputs are required to function during the CDS sequence otherwise the sequence will abort. The CDS historical reports and data trending of the causes of aborts have been used in the past to identify system improvements. DWPF requested, as part of a STAR Item, that the updated and integrated DWPF model be used to identify any improvements to the Decontamination and Smear Test process flow as part of the CDC system. The following process flow improvement opportunities were identified:

- Reduction of the water to frit ratio in the decontamination frit slurry. The amount of water required for canister decontamination could be reduced by increasing rotation and translational speeds and increasing slurry concentration (Reference 14). This could reduce the SME cycle time by reducing boil-up time, but could possibly cause canister wobbling and a potential impact on the DFSFT recirculation pump.
- Decouple CDS from SME by installing a new tank. This would give more time for processing in the CDS and reduce the interface between the CDS and SME.

- Reclaim clean canister racks in the CDC. This can be done by implementing improvements to the PVVS and decontamination of the CDS cell cover.
- Clean up and remove contaminants from the CDS cell covers. It can prevent contaminants fall from the contaminated cell covers during cell removal process.
- Improve PVVS system performance by identifying leaks in the PVVS. The PVVS system data shows that there are more trips and fan switchovers in today's operation versus 10 years ago. This could be due to degradation of the PVVS system.

2.3.5 MCU/DWPF/WTL Integration

The MCU model developed by Systems Engineering in FY04 (Reference 7) was successfully integrated into the DWPF/WTL model. Previously, the MCU model had both ARP and DWPF at a very high level with minimum system detail. Updates were also made to the current MCU model based on design plans as of August 2005. The integrated model shows that there is a 35% increase in DWPF recycled water to HTF, compared to the baseline case (Case 3B). The MCU case has DWPF operating with 2 SAS, while the baseline case has 1 SAS operating. The model showed no impact to canister production rate while MCU is operating. The model also showed that ARP/MCU will meet the minimum design requirement of 1Mgal (6.44M Na) salt solution per year through the combined ARP/MCU systems. The results from the integrated model can be seen in Table 5 below. The table below shows data for the minimum flowrate of MCU and ARP with HTF notification at MFT volume of 9,100 gallons, a Saltstone throughput capacity of 83,000 gallons, and the operation of 2 SAS. Although not presented in this report, the MCU/ARP was looked at with a lower Saltstone processing throughput. The lower throughput did not impact MCU/ARP meeting the minimum design requirement. Table 5 also includes the integrated MCU/DWPF model results for the lower DWPF canister production cases. These cases have a DWPF canister production reduced to 179 cans/yr and 210 cans/yr and the Melter availability reduced to 60% and 70%, respectively.

Although the MCU module has been integrated with the DWPF model, it is important to note that due to time constraint, the latest design changes in the MCU project have not been incorporated into the current model. The conclusion drawn from the model for the MCU study should be verified in the future by incorporating the latest design changes.

Table 5. Integrated MCU/DWPF Model Results

Min. Case w/ SS = 83,000 gal/wk	MCU Min	MCU Min (60%)	MCU Min(70%)
Canister poured	254.4 can/yr	179.9	210.6
Cs-Strip to DWPF	73,000 gal/yr	66,300 gal/yr	72,3000 gal/yr
MST/Sludge to DWPF	71,800 gal/yr	58,300 gal/yr	66,700 gal/yr
Waste Processed by ARP	1 Mgal/yr	0.93 Mgal/yr	1 Mgal/yr
Waste Processed by MCU	1.23 Mgal/yr	1.14 Mgal/yr	1.25 Mgal/yr
DSS Processed by Saltstone	1.27 Mgal /yr	1.19 Mgal /yr	1.29 Mgal /yr
Recycle Water back to HTF	2.38 Mgal/yr	2.02 Mgal/yr	2.19 Mgal/yr

2.3.6 Lowered Canister Production

The integrated DWPF model was used to evaluate the impact of a lowered canister production to both SWPF and MCU/ARP processing. This could have been done by adjusting several different variables in the model. In this model, a lowered canister production was achieved by reducing the DWPF Melter availability from 85% (see Appendix A) to 60% and 70%. This adjustment brought the canister production down from 251 cans/yr to 179 cans/yr and 210 cans/yr, respectively. The base cases selected were Cases 8A, 9A, and MCU Min. Each of these cases has a Melter availability of 85%. Cases 8A and MCU Min were looked at with a reduced canister production of both 179 cans/yr and 210 cans/yr. Case 9A was only looked at with a reduced canister production of 210 cans/yr. Cases 8A and 9A are those with a Saltstone throughput of 180,000 gallons/wk.

Figure 6 below shows the impact of lowered Melter availability on the recycled water to HTF. The figure shows that due to the lower Melter availability that the recycled water volume is reduced slightly from the original values for all cases.

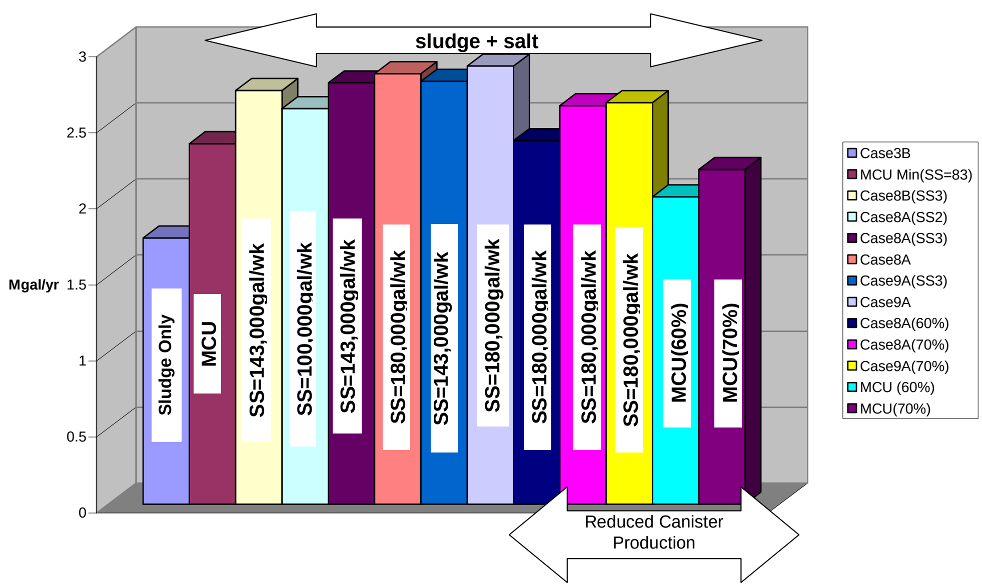

Figure 6. DWPF Recycle Water with Lowered DWPF Canister Production.

The impact of lowered DWPF canister production on SWPF throughput is given in Figure 7. With the canister production dropping from 251 cans/yr to 179 cans/yr and the Melter availability dropping from 85% to 60%, the SWPF throughput will decrease from 6.4Mgal/yr to 5.4Mgal/yr. However, if two decoupling tanks (SEHT and a new SSST) are available, and with the canister production dropping from 251 cans/yr to 179 cans/yr and the Melter availability dropping from 85% to 60%, the SWPF throughput of 7Mgal/yr will not be affected. In the case with the canister production of 251 cans/yr and Melter availability of 85%, the decoupling case (Case 9A) will complete the Salt Program campaign 14 months ahead of the case without decoupling tanks (Case 8A). The campaign completion date will be greatly improved for the decoupling case compared to the case without decoupling tanks, if canister production is trending down. In the case with a canister production of 179 cans/yr and a Melter availability of 60%, the decoupling case (Case 9A(60%)) will complete the Salt Program campaign 44 months ahead of the case without decoupling tanks (Case 8A(60%)). Due to the time constraint, no attempts were made to optimize Case 8A(60%) and Case 8A(70%). The actual SWPF throughputs for Case 8A(60%) and Case 8A(70%) may be slightly better than the throughputs reported in this study.

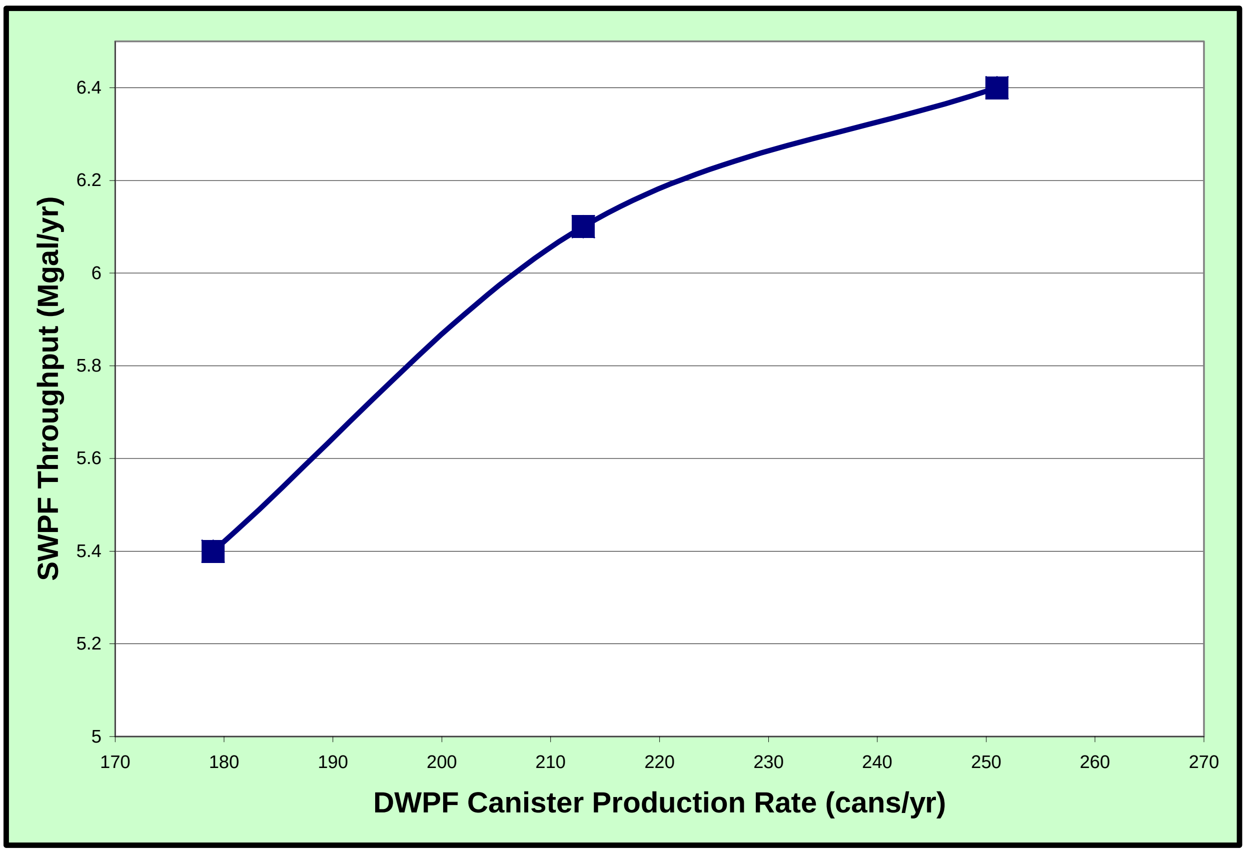

Figure 7. Impact of DWPF Canister Production on SWPF Throughput

Figure 8 below shows all the campaign end dates including both the original and modified SWPF campaign end dates for Cases 8A and 9A. The lowered Melter availability, and therefore lower canister production, impacts the SWPF Campaign duration for Case 8A but not for Case 9A. Case 9A(70%), with the Saltstone throughput at 180,000 gal/wk and the two decoupled tanks, shows no change in SWPF Campaign completion date due to the lower canister production rate. Cases 8A(60%) and 8A(70%), with a Saltstone throughput at 180,000 gal/wk and no decoupled tanks, shows an extension of 2.6 years with a Melter availability of 60% and a canister production rate of 179 cans/yr and an extension of 0.6 years with a Melter availability of 70% and a canister production rate of 210 cans/yr.

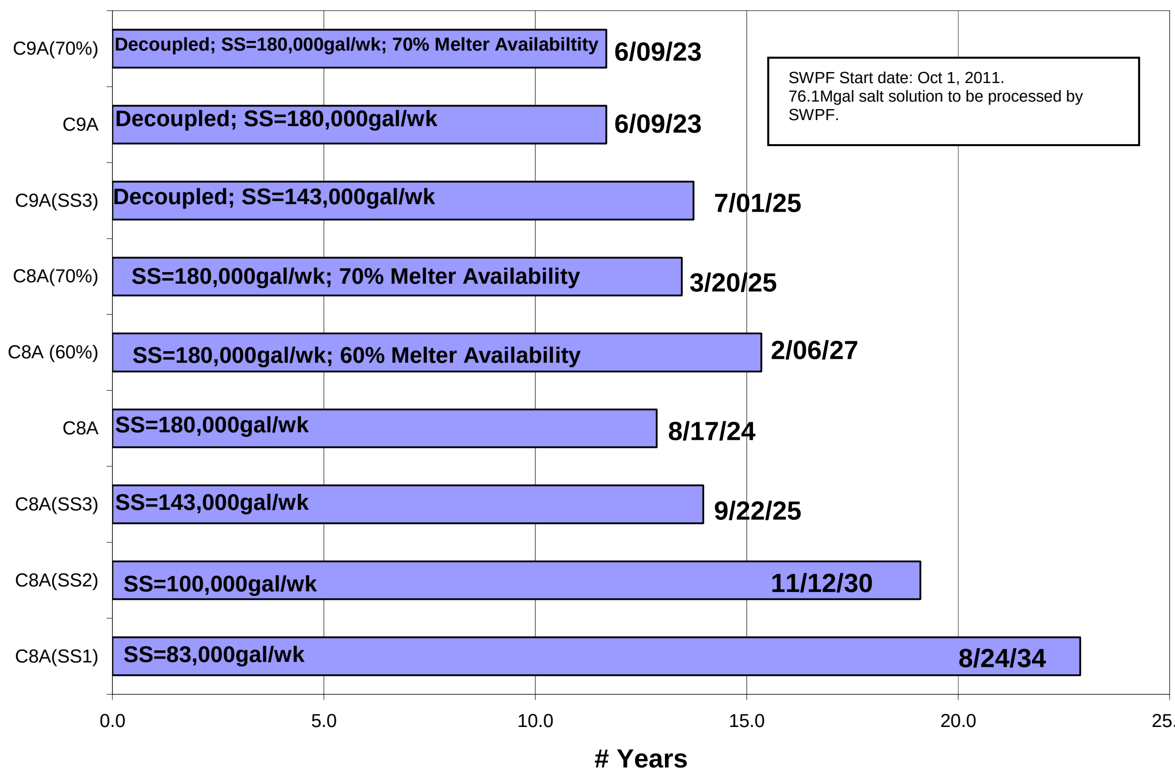

Figure 8. SWPF Campaign Duration with Lowered DWPF Canister Production

The lowered canister production has a greater impact on SWPF throughput than on MCU because the SEFT and PRFT provide relatively larger buffering capacity for the later case than the former case. With the Melter availability at 60% and a canister production rate of 179 cans/yr, MCU was shown to not meet the minimum design requirement of 1Mgal (6.44M Na) salt solution per year. MCU/ARP was only able to process 0.93Mgal/yr. With the Melter availability at 70% and a canister production rate of 210 cans/yr, MCU was able to meet the minimum design requirements. This data is shown in Table 5 in the MCU section above. There was also a large decrease in the amount of sludge sent to DWPF due to the reduction in Melter availability.

With a Melter availability drop from 85% to 60% and 70%, the expected canister production rates will drop 251 cans to 179 cans and 210 cans, respectively. These values are compared to the cans/yr produced for a Melter availability of 85%. This reduction can be seen in Table 4 for cases 8A, 8A(60%), 8A(70%), 9A, and 9A(70%).

3.0 CONCLUSION

Based on the results presented in this report, several conclusions can be made regarding the processing of DWPF, SWPF, Saltstone, and MCU/ARP and the impacts of ARP, MCU, and SWPF to DWPF's ability to meet its canister production goal and its ability to support the Salt Processing Program.

Looking at the impacts to DWPF canister production due to addition of salt feeds, the evaluation showed that post SWPF startup, with an assumed Melter availability of 85%, DWPF will be able to achieve the 250 cans per year goal canister production rate of 250 cans per year only after SRAT optimization. However, this is still 3 canisters per year less than the current DWPF can production for sludge only feed. Without SRAT optimization, DWPF canister annual production rate will be 11 canisters less per year than the current DWPF can production rate.

The evaluation showed that Continuous Sludge Transfer operation in DWPF does not have a significant impact in reducing the SRAT cycle time. The Continuous Sludge Transfer will shorten SRAT time between 0.6 to 1.9 hours except in 7,400 gal SRAT batch case. The SRAT cycle time reduction due to Continuous Sludge Transfer has a minimal impact on DWPF canister production. However, if a decision is made to implement the Continuous Sludge Transfer strategy, the Con-Ops issues need to be addressed due to the complexity in the execution.

As part of bottleneck identification, the evaluation showed that the SWPF processing rate is very sensitive to Saltstone throughput. With the current LRW infrastructure and SWPF design and a current Saltstone processing capacity of 83,000 gal/wk for processing DDA waste, the achievable SWPF throughput is 3.6Mgal/yr with a completion date of 8/24/34. Increasing the Saltstone capacity to 100,000 gal/wk, gives an SWPF throughput of 4.28 Mgal/yr and a completion date of 11/12/30. A Saltstone capacity of 143,000 gal/wk gives an SWPF throughput of 5.85 Mgal/yr and a completion date of 9/22/25. If Saltstone has a processing capacity of 180,000 gal/wk, with current SWPF design and a DWPF canister production of 251 cans/yr, the achievable SWPF salt processing rate will be 6.4Mgal/yr and a SWPF Campaign completion date of 8/17/24. Saltstone must process at least 180,000 gal/wk to avoid being the one of the bottlenecks in the Salt Processing Program.

With a DWPF canister production rate of 251 cans/yr, the SWPF annual throughput can be increased to 7.0Mgal/yr by decoupling SWPF from DWPF and if Saltstone processing capacity is greater than 180,000 gal/wk. The decoupling can be achieved by using a bigger 38,000gal (vs. 16,600 gal existing tank size) Stripped Effluent Hold Tank (SEHT) and a new 4,000 gal (MST) Sludge Solids Storage Tank (new SSST). Comparing the decoupled case to the non-decoupled case (both at a Saltstone processing capacity of 180,000 gal/wk); the Salt Processing Program completion date will be shortened by about 14 months to 6/09/23.

Currently, the model assumes that there is enough space to hold all recycle water produced from DWPF. With the incorporation of the Salt Program, the amount of water produced from DWPF increases. This model did not look at the capability of the evaporators to be able to support this new recycle water volume.

The model also found that there are two critical parameters affecting the SWPF campaign: when the HTF is informed that it can transfer to DWPF and the MFT heel. By informing the HTF earlier, when the MFT is at 9,100 gallons versus 6,400 gallons, more cans/yr can be produced. The earlier transfer from HTF to DWPF allows SRAT and SME more time to prepare feed to MFT. The lowered MFT heel, 4,800 gallons to 3,250 gallons, would buy more time to accommodate any process upsets in SRAT and SME. This in turn allows more processing flexibility.

Various CDC System improvements were identified. The improvement opportunities include (1) reducing the water in the decon frit slurry, (2) decoupling the CDC from the SME, (3) reducing contaminants from CDC cell covers, and (4) identifying leaks in the PVVS to improve the PVVS performance. The latter two improvements may also allow the CDC to be able to reclaim the clean storage canister racks in the Canister Decon Cell.

With the DWPF canister production rate dropping from 251 cans/yr to 179 cans/yr the SWPF throughput will decrease from 6.4Mgal/yr to 5.4Mgal/yr for the Saltstone throughput of 180,000 gal/wk. However, if two decoupling tanks (SEHT and a new SSST) are available, and with the DWPF canister production rate dropping to 179 cans/yr, the SWPF throughput of 7Mgal/yr will not be affected. In the case with the DWPF canister production rate of 251 cans/yr, the decoupling case (Case 9A) will complete the Salt Program campaign 14 months ahead of the case without decoupling tanks (Case 8A). The campaign completion date will be greatly improved for the decoupling case compared to the case without decoupling tanks, if the DWPF canister production rate is trending down. In the case with canister production rate of 179 cans/yr, the decoupling case (Case 9A(60%)) will complete the Salt Program campaign 44 months ahead of the case without decoupling tanks (Case 8A(60%)). Due to the time constraint, the two decoupling tanks, SEHT and new SSST, are not sized for Case 9A(60%).

If the DWPF can maintain a canister production rate of at least 210 cans/yr, ARP/MCU will meet its minimum design requirements of 1Mgal (6.44 Na) per year through the combined ARP/MCU systems. However, if the canister production drops to 179 cans/yr, the combined ARP/MCU system throughput will be 0.93 Mgal per year which is below minimum design requirements of 1 Mgal per year. As described above, the lowered canister production has a greater impact on SWPF throughput than on MCU. Although the MCU module has been integrated with the DWPF model, it is important to note that due to time constraint, the latest design changes in the MCU project have not been incorporated into the current model. The conclusion drawn from the model for the MCU study should be verified in the future by incorporating the latest design changes.

4.0 RECOMMENDATIONS

This integrated model developed for DWPF is a step toward having an integrated model for the entire Salt Processing Program. This model has integrated DWPF, SWPF, WTL, and ARP/MCU and the following recommendations can be made.

In order to achieve the SWPF throughput goal of 7Mgal/yr, there needs to be an increase the DSS processing capacity and use of decoupling tanks between DWPF and SWPF.

The DSS processing capacity can be increased by the following:

- Install new evaporator or improve existing evaporator capacity to reduce the DSS volume sent to Tank 50.
- Improve the Saltstone throughput. This can be done by building a new vault, eliminating conservatism in the temperature calculations, or using a new type of cement in the vaults, etc.
- Use non-compliant type waste tanks to store DSS if there is a technology available to empty and clean the tanks to a point they can be classified as a low level waste tank.

In order to decouple DWPF and SWPF (if DWPF canister production rate is 250 cans/yr or greater) it is recommended that the SEHT tank size be increased to hold 38,000 gallons working volume (working volume does not include heel or free board) and add a new SSST tank of 4,000 gal work volume tank between the (MST) Sludge Solids Receipt Tank in SWPF and the PRFT in DWPF. The importance of decoupling tanks is more significant when DWPF Melter availability is trending down.

To optimize SRAT cycle time, it is recommended to investigate ways to increase the SRAT boilup rate to 5,000 lb/hr steam (design basis rate). One possible cause for the SRAT not meeting its design basis could be leaks in the PVVS system. Elimination of leakages to this system could help with the SRAT and CDS operations. The SRAT cycle time can also be optimized by having HTF notified as early as possible to transfer to DWPF. This allows the SRAT and SME more time to prepare feed to MFT and more cans/yr can produced. Also, decreasing the MFT heel as much as possible would optimize the SRAT cycle time. This would allow for extra time to accommodate process upsets. The MFT heel is already decreased from 4,800 gallons to 3,250 gallons. If possible, use a pump that would allow for an even lower MFT heel.

To achieve improvements in CDS maintainability, reliability, and availability, it is recommended to (1) decouple CDS from the SME by use of a new SFHT tank, (2) improve PVVS performance by identifying leaks, (3) clean CDS cell covers, and (4) reduce the water content in the decon frit slurry. It is also recommended that for the last improvement that the pros and cons of water reduction are thoroughly investigated.

This integrated DWPF model has shown various ways in which to improve the current salt processing within DWPF, SWPF, WTL, and MCU/ARP. However, several black boxes still exist in this model. In order to have a complete Salt Processing Program model, it is recommended that the following activities be included in future modeling tasks in order to fully understand the processing capabilities of the Salt Processing Program:

- Develop Saltstone model module. This would include raw material delivery logistics, detailed vault pouring process, and Saltstone process optimization.
- Link Saltstone module with DWPF/WTL model.
- Update and develop more detailed SWPF process.
- Expand Feed Prep module to include DWPF Recycle Water Treatment System, e.g. evaporators, tank space, etc.
- Expand the Integrated Model to include tank space management to validate SPACEMAN. The Integrated Model and SPACEMAN have complimented each other very well as demonstrated in the development of Interim Processing Plan (Reference 15).
- If Tank 50 is not available to store DSS solution during MCU and SWPF campaigns, develop a model to determine the optimized tank size for the alternative DSS storage tank.
- Re-visit the PVVS model to identify leaks.
- Incorporate latest ARP/MCU design changes into the MCU model.
- Maintain and update the Integrated Model to reflect future facility configurations.
- Incorporate ACM Process Chemistry Model outputs and glass chemistry into the model.
- Load resource (e.g., control room operators, process operators, RCO, etc.) into the model to further refine the Integrated Model.
- Perform a cost analysis to compare the existing infrastructure to the decoupled infrastructure to justify possible investment.

5.0 REFERENCES

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6.0 APPENDICES

Appendix A – DWPF Major Assumptions for Manufacturing Floor Model

Appendix B – WTL/SWPF/MCU/ARP Major Assumptions

Appendix C – Melter Attainment Data

APPENDIX A
DWPF COREsim® Manufacturing Floor Model Major Assumptions

Assumption #	System	Assumption	Note	Owner	Source Document
1	Availability - CDC	*12 hours down time per event. Average down time per year = 412 hours (based on FY04 data). *CDC aborted during the decon 15% of the time and had to repeat part of the decon process again. (additional decon time is from 1 to 2.5 hours, evenly distributed) *Canisters were found contaminated in the smear test 5% of the time and had to be deconned again. Average time to decon a can is 2.25 to 2.75 hours.	Email from Dale Hutsell to Mike Norato dated 10/30/2003 and 4/22/05: I reviewed my data base for maintenance and modification events involving common CDC equipment which would affect availability of both CDC's. Most events were pump or valve replacements which normally would take a shift to work, so I assumed 12 hours of downtime per event. I did not include events that only affected one CDC, since the other CDC was still available to operate. A copy of my CDC data base is attached. FY #Common events Hours Unavailable 04 12 412 03 22 264 02 24 288 01 16 192 00 18 216	D. Hutsell	
2	Availability - Melter	85% attainment (used in the model) Note: Between April 03 to April 05, the actual availability (melter + feed pump + others) = 85.1%. Melter Replacement Outage not included in this assumption. Melter is down 4 months every 4 yrs due to melter replacement.	Taking into account plugging of melter spout, MFT feed pump failure, OGCT failure, and other support system failures which would stop melter operations. 50% of time, melter downtime is represented by: Uniform Distribution: lower bound=30 hr; upper bound = 114hr. Another 50% of time, melter downtime is represented by: Triangle Distribution: lower bound=152 hr; upper bound = 300hr; peak = 226hr.		

3	Availability - RCT	1% failure rate. Average down time = 36 hours.	Random failure		
4	Availability - SME	Total 7 down days a year. If a support system like GC's failed, the outage is 12 to 24 hours. If it is actual system failure, like a failed coil, it can be a 7 days delay.	Random failure		
5	Availability - SMECT	1% failure rate. Average down time = 36 hours.	Random failure		
6	Availability - SRAT	Total 7 down days a year. If a support system like GC's failed, the outage is 12 to 24 hours. If it is actual system failure, like a failed coil, it can be a 7 days delay.	Random failure		
7	Availability - SCT	3.5% failure rate. Average down time = 24 hour Normal Distribution with 5 stdv. (Random failure) 7% failure rate. Average downtime = 8 to 12 hours (Upon request) Note: This failure is to account for the type of failure mentioned on the right hand column.	Historical data: Y1999 = 54 hr unavailable Y2000 = 368 hr unavailable Y2001 = 434 hr unavailable Y2002 = 404 hr unavailable Y2003 = 445 hr unavailable According to Mike Norato, most of the corrective maintenance (about 39.9% of the maintenance time) occurs because while trying to start up SCT to move canisters and something is not working. Mike said to use 10% combined overall failure rate.		
8	Availability – Tank Farm (RCT)	• HTF is unavailable 3 days every three months. (Random outage) • Upon request, HTF is unavailable 10% of time. Each delay is 2 hours.	Affect RCT transfers to HTF only.		

9	Availability – Tank Farm (SRAT)	• Upon request, HTF is unavailable 20% of time. Each delay is 12 to 24 hours. • Need 48 hours advance notification.	Affect transfer to SRAT Operations only		
10	Availability – WTC	WTC Average outage = 11 days a year. 1% of chance, WTC smear failed, send canister back to CDC.	Letter from Mark-L Johnson to Mike Norato (11/03/2003): For the past couple of years, the welder has been very reliable. We are able to schedule our Preventive Maintenance (PMs) around the times the welder is in use. The PMs which require the greatest amount of time to perform are the Geokon load cell calibration (2 times a year) where the welder is unavailable for about 1 day and the current tranducer calibrations (Halamrs - 1 time per year) which usually takes 3-4 days of welder down time. The current transducers are in the process of being replaced with a new design which will allow much easier calibration. The rest of the PMs usually take less than a day. The Corrective Maintenance (CMs) over the last couple of years have been for limit switch adjustment (typically 1 day outage), canister trolley lift cylinder rebuild (2-3 days) and transducer replacement (1 day). Baring any catastrophic failures, these are the typical outages that will be required with the welder. Additionally, we have in the past taken the canisters to the GWSB unwelded when the welder was down due to a catastrophic failure. The canisters are then brought back to the WTC to be welded.		
10A	Availability – SEFT,	The combined system (SEFT, PFRT, WTL, LPPP-PT) is expected	Each downtime is represented by a normal distribution: mean = 72 hr. Standard		

	PRFT, WTL transfer Lines, LPPP-PT	to down 2.5 weeks a year.	deviation (STD) = 14.4hr.		
11	Cycle Time – HTF to SRAT	20% of time, HTF not available. Add 12 to 24 hours delay.			
12	Cycle Time – Melter	• Fill Time = 24 to 32 hours (Uniform). • Average = 28 hours a canister. • Cycle Time = 29 hours. (90%) • Cycle Time (plug failure) = 30 hours (10%)	Baseline Case		
13	Cycle Time – RCT to HTF	RCT to HTF Cycle Time: Normal = 7.75 hours (90%) With HTF delay = 9.95 hours	7.75 hrs includes 2 hrs to process the RCT with $NaNO_3$ and NaOH and 5.75 hrs to physically make the transfers.		
14	Cycle Time – SME	• Cycle time = 86.2 hours if no remediation (99%) • Cycle time = 121.35 hours with remediation (1%)	Per Pete Patel, SME Cycle time (including wait time) = 95 hours. Actual SME processing time = 86 hours.		
15	Cycle Time – SRAT	• Cycle time = 57.85 hours if no remediation (90%) • Cycle Time = 100.35 hours with remediation (10%)	Per Pete Patel, SRAT Cycle time (including wait time) = 94.5 hours. Actual SRAT processing time = 58 hours.		
16	CDMC	Generate 250 gal waste water per quarter	Waste water to DWTT, then to RCT		
17	DWTT	• DWTT heel = 2,000 gal • DWTT makes a transfer to RCT when DWTT reaches 8,500 gal. • 6,000 gal per month to RCT.	DWTT allowable maximum tank level = 9500 gal. Generation frequency = 500 gal every 61 hours. If DWTT reaches 8,500 gal and RCT		

		Total 72,000 gal / year transfer from DWTT to RCT. 72,000 gal/year implies 8.2 gal/hr. So, 500 gal is generated every 61 hrs. Three different sources: REDC to DWTT = 54,000 gal/year CDMC = 1,000 gal/year Others = 17,000 gal/year.	available space < 1000 gal, no transfer will be made. If RCT available space >=1000 gal, make a partial or full transfer depending on RCT tank space. Email dated 1/15/2004 from Mike: I logged in to PI and looked at DWTT transfers to the RCT over the last 5 years and estimated the following for approximate amount transferred and number of transfers: 1999 28,000 gallons in 14 transfers 2000 24,000 gallons in 9 transfers 2001 20,000 gallons in 8 transfers 2002 72,000 gallons in 17 transfers 2003 68,000 gallons in 18 transfers Ross tells me that approximately 80 % to 90 % of the amount comes from the REDC, although the DWTT receives input from CDMC, REDC, and many other sumps. It's difficult to quantify how much exactly comes from the REDC, as there is no way to measure it. In 2002 and 2003 we had outages where a lot of equipment was deconned. That's why the numbers are relatively high for those two years.		

18	Melter	Throughput goal = 250 (discrete) canisters per year Melter is out of service 4 months every 4 years due to Melter Replacement.	Baseline case for discrete canister production. Each canister = 800 gal feed from MFT = 3,800 lb glass		
19	Miscellaneous Drains	100 gal every three months	Waste water to RCT		
20	MFT	Notify HTF when MFT level @ 6400 gal. MFT tank heel = 4800 gal. For integrated model, MFT tank heel = 3250.	MFT H-alarm = 9200 gal; HH-alarm=9400gal. MFT heel can range from 2500 to 3000 gal. If pump is lost below 3500 gal, then MFT need to be filled up before pump can be primed. Will use 3250 gal for MFT heel.		
21	OGCT	• If OGCT is not available, BUOGCT will be put in service and melter is in standby mode.	BUOGCT train has no melter spout jet or melter spout jet pump.		
22	OGCT	• Condensate to OGCT = 450,000 gal/year. (Note: 1800 gal OGCT per canister is used in the model) • OGCT tank heel = 5000 gal. • OGCT maximum tank level = 9500 gal • If OGCT reaches 10,000 gal, put Melter in standby mode. • OGCT makes a transfer to RCT when OGCT reaches 7250 gal.	• If OGCT reaches 7,250 gal and RCT available space < 1000 gal, no transfer will be made. If RCT available space >=1000 gal, make a partial or full transfer depending on RCT tank space. • Per Vic Buch, "While Melter is down, condensate accumulation rate to OGCT or BUOGCT is 1 gal/hr (water sparying to HEME).		
23	RCT	RCT maximum tank level = 9740 gal RCT heel = 1500 gal RCT makes a transfer to HTF when	280 gal $NaNO_3$ and 260 gal NaOH are added for each RCT batch.		

		RCT reaches 8,460 gal			
24	RCT to HTF (Based on <6920 gal SRAT Batch)	Assume 250 canisters a year production, various waste water transfer to RCT: SRAT = 250/5.5*2900=132,800 gal SME = 250/6*11720 = 533,000 gal Sumps = 100 * 365 = 36,500 gal REDC = 54,000 gal OGCT = 450,000 gal CDMC = 250 * 4 = 1,000 gal DWTT = 6,000 * 12 = 72,000 gal (include REDC and CDMC) Misc. Drains = 100 * 4 = 400 gal Sampling & Analytical Cell = 1000 * 52 = 52,000 gal. SAS to OGCT = 394,200gal/yr (one SAS)	Total waste water to HTF = 1,725,900 gal/year. Assume each transfer to HTF = 6960 gal (excluding chemical adjustment), then number of transfer to HTF = 1,725,900/6960 = 248 times / year.		
25	REDC	4,500 gal, 12 times a year	Waste water to DWTT then RCT. Total = 54,000 gal/year which is 75% of all waste to DWTT.		
26	Sampling and Analytical Cell	Generates 1000 gal waste water per week to RCT.			
27	SME	Batch size to MFT = 4800 gal. Each SME batch fills 6 canisters. Each SME batch would average three frit additions from process frit (two full batches and one short batch) and 6 frit additions from canister decon. Heel = 1500 gal.	Each Canister frit batch = 200 lb frit and 1250 gal water. (total = 1300 gal) Each process frit batch = 6000 lb frit and 1000 gal water (total = 1500 gal). The 3rd short batch = about 2800 lb frit and 465 gal water (700 gal total). Chemical addition = 220 gal (40 gal formic		

		4500 gal transfer from SRAT to SME. Steam rate to SME ranges from 3000lb/hr to 4500 lb/hr. The boil-up rate used in model is 350 hr/hr. If everything is perfect in SME, the cycle can be as low as 72 to 96 hours.	acid and 180 gal antifoam) Total waste water to SMECT /batch = (6,000+220 + 1300*6 + 1500*2+ 700) – 6,000 = 11,720 gal. SME "Water Balance": Heel + Incoming SRAT Batch = 6,000 gal Add Chemicals = 220 gal Add Decon Frit = 6*1,300 gal Add Process Frit = 2*1,500 gal Add Process Frit (short batch) = 700 gal Then Concentrate (boil) down to 6,000 gal		
28	SMECT	SMECT heel = 3600 gal SMECT makes a transfer to RCT when SMECT reaches 8500 gal. SMECT can receive multiple streams and pump out to RCT at the same time.	If SMECT reaches 8,500 gal and RCT available space < 500 gal, no transfer will be made. If RCT available space >= 500 gal, make a partial or full transfer depending on RCT tank space.		
29	SRAT	Heel = 1500 gal. Batch size to SME = 4500 gal. Initial tank volume = 8000 gal. Chemical addition = 680 gal. End point tank volume = 6000 gal. SRAT target max working volume = 9100 gal. H.H. Alarm set at 9,400 gal.	Each batch, SRAT waste water to SMECT = (8680 – 6000) = 2680 gal/batch. Chemical Addition to SRAT: 220 – 240 gal antifoam ~350 gal formic acid ~75 gal nitric acid	P. Patel	
30	Sumps	100 gal per day to RCT			
31	Tank Farm	Only one physical transfer of material between HTF and DWPF at a time.	Although sludge comes from HTF-E and recycled goes to HTF-W, there is a procedural/administrative prohibition on simultaneous transfers.		
32	Vitrification Building	Interim storage space for incomplete canisters inside vitrification building:	Total storage space for canisters inside the vitrification building = 28	D. Hutsell	

		*Melter cell = 14 *CDC/Smear Test Station (contaminated) = 4 *CDC/Smear Test Station (clean) = 4 *Weld Test Cell = 5	*Melter cell = 14 [rack (5), insulated rack (4), ICC (1), PTT (3), MC-CDC (1)]. (Note: There are 4 PTT position) *CDC/Smear Test Station (contaminated) = 4 [temperature rack, dirty rack, clean rack (2)]. *CDC/Smear Test Station (clean) = 4 [CDC1, CDC2, STS turntable, STS exit pedestal]. Note: CDC1 and CDC2 can store clean or dirty cans. *WTC = 6 [shielded racks (4), exit tunnel (1); Weld Station/Smear Test Station = 1]		
32A	Vitrification Building (after start up of Salt Processing)	Interim storage space: Melter Cell = 11 CDC/Smear Test Station (clean) = 1 CDC/Smear Test Station (contaminated) = 4 Weld Test Cell = 4	*Melter Cell = 11 [rack (5), insulated rack(4), PTT(2)] *CDC/Smear Test Station (clean) = 1 [STS pedestal] *CDC/Smear Test Station (contaminated) = 4 [temperature rack, dirty rack, clean rack (2)]. *WTC = 5 [shielded racks (4); Weld Station/Smear Test Station = 1]	D. Hutsell N. Norato	
33	Initial Condition	Initial conditions of the model: SRAT tank is 8000 gal, ready to start process. MFT Tank is 9800 gal. The rest of tanks are at heel.			
34	Canister Loading & Fill Height	Baseline: 96 inches with glass contains 28.1% waste.	Note: During FY04, canister waste loading is 34% filled up to 100 inches. (1 discrete can = 1.26 equivalent cans). The latest waste loading = 40.1% (Oct. 05) And 100”.		
35	Credited	*220 discrete cans produced as of	115 in FY03; 105 in FY04. Total 220		

	Canisters Produced	2/29/2004. *Actual = 514 cans. Equivalent = 663.3 cans As of 4/17/05.	discrete cans = 269.5 equivalent cans. (33% waste loading) FY03: 143 equivalent cans FY04: 319 equivalent cans		
36	CDS	*SME does not wait for decon frit if CDC is not available. *CDC decontamination will occur only if SME is accepting frit.	There is nowhere to collect decon frit if SME is not available.	D. Hutsell	
37	With SWPF: Transfer Lines between HTF and DWPF	Only one physical transfer of material between HTF and DWPF at a time. Transfers include CS-Strip, MST Sludge, RCT to HTF, and Sludge to SRAT.	WTL model eliminated the constraint.		
38	Melter Offgas System	SAS (scrubber) will be turned on. (for Salt) Net water accumulation rate in OGCT = 1.5 gpm. (for both SAS)	For Sludge only, currently there is one SAS on. The water rate is 0.75gpm.		
39	SRAT	SRAT alkaline boil up rate = 275gal/hr. Boil up rate = 370~400gph during SRAT concentration step. Current boil up rate = 383gph. Design Basis: Steam = 5000lb/hr; boil up rate = 600gph.	SRAT will run with sludge, Cs-Strip, MST/sludge if all three feeds are available. If Cs-Strip batch is not available, SRAT will run with sludge and MST/sludge only. If MST/sludge is not available, SRAT will run with sludge and Cs-Strip batches only.	P. Patel F. Washbur n	
40	RCT to HTF (SWPF)	Assume 250 canisters a year production, various waste water transfer to RCT: SRAT = 250/5.5*21618= 982636gal SME = 250/5.5*11720 = 532727gal Sumps = 100 * 365 = 36,500 gal	Total waste water to HTF = 2914600 gal/year. Assume each transfer to HTF = 6960 gal (excluding chemical adjustment), then number of transfer to HTF = 2914600/ 8100 = 360 times / year.		

		REDC = 54,000 gal OGCT = 450,000 gal CDMC = 250 * 4 = 1,000 gal DWTT = 6,000 * 12 = 72,000 gal (include REDC and CDMC) Misc. Drains = 100 * 4 = 400 gal Sampling & Analytical Cell = 1000 * 52 = 52,000 gal. SAS to OGCT = 788,400 gal/yr.	Assume sludge batch to SRAT = 7400 gal. Total waste water to SMECT from SRAT = (7400+680[chemical addition]-4500) + 2938 [MST/Sludge] + 15100[Cs-Strip] = 21618gal/batch.		
41	SWPF Start Date	October, 2011	SWPF will start up at year 2011 and ramp to its' maximum sustainable throughput with no transition period.	M. Mahoney	
42	Salt Waste Inventory	The breakdowns of current waste tank inventory are: *17.4Magl salt supernate *16.4Mgal saltcake *2.6Mgal sludge	The total salt waste inventory after salrcake dissolution = 84.7Magl. Salt waste will be treated during interim salt processing window = 8.6Mgal. Total salt solution will be treated by SWPF = 76.1Mgal.		CBU-PIT-2005-00130
43	New Cycle Time – RCT to HTF Continuous transfer	RCT to HTF Cycle Time: Normal = 4.5 hours (90%) With HTF delay = 8 hours (10%) (current mode of operations)	6 hrs includes 2 hrs to process the RCT with $NaNO_2$ and NaOH and 2.5 hrs to physically make the transfers. Transfer is essentially continuously by maintaining the LPPP-RWT at a constant level.		
44	With SWPF: Vitrification Building	Lag storage space (temporary parking) for incomplete canisters inside vitrification building: Melter cell = 5 CDC/Smear Test Station = 4 Weld Test Cell = 4	Total canister storage space for canisters is 13 due to increase in dose rate. The radiation level is expected to be 10X when the Cs is introduced to the feed.		
45	Availability	75% attainment	CSSX studied in the model is the skid-		

	– CSSX		mounted unit, not SWPF.		
46					
47					
48					
49	SEHT (used to be ASRT)	Maximum working volume = 9600 gal Heel = 1500 gal	Same availability as SRAT and SME. Need to maintain a minimum of one SRAT batch-worth of inventory.		
50	PRFT	Maximum working volume = 6000 gal Heel = 500 gal	Hold 4.5 SRAT batches of MST/Sludge. Same availability as SRAT and SME. Need to maintain a minimum of one SRAT batch-worth of inventory.		
51	LWPT	Maximum working volume = 5400 gal Heel = 1600 gal			
52	LWHT	Maximum working volume = 5400 gal Heel = 1600 gal			
53	LPPP-PT LPPP-ST	Maximum working volume = 5300 gal Heel = 1200 gal			
54					
55	SWPF	Feed from SWPF is expected to be average 7 Mgal/yr and 9.4Mgal instantaneous rate			
56	Cs Strip and MST Sludge Batch size (SWPF and SRAT)	Refers to the WTL model for Case numbers.. Case 1: @7.52 Mgal/year of salt processed by SWPF, Cs strip is 597,082 gal/yr. 44 SRAT batches a year. Cs-Strip batch to SRAT = 13570 gal / SRAT batch.	Source: B. Brasel. Dilution factor from 6.44M Na to 5.6M Na = 1.22 MST added at 0.4 g/L. 23213 lb MST/yr for 1st strike. Note: Duration = metering duration + 15 minutes at the end.		

		Case 6: Cs SRAT batch size = 16,962 gal/batch. Case 1: One strike: MST Sludge = 129,276 gal/yr. 2938 gal / SRAT batch. (WTL model) Case 1: 2 strikes: MST sludge = 190,836 gal/yr. Case 1: 3 strikes: MST Sludge = 250,128 gal/yr. ____- Example: Spg (end point SRAT) = 1.2; Spg (15wt% Sludge) = 1.1; Spg (MST/Sludge) = 1.03; Heel = 1500 gal; SRAT final volume = 6000 gal; Sludge = 15wt%. 25% * 6000 * 1.2 = 2938 *4% * 1.03 + 25% *1500*1.2 + X * 1.1 * 15%. Where X = sludge batch size. Therefore, X = 7448 gal. (need three transfers)	Source: F. Washburn. Final solid content in SRAT before sent to SME is targeted at 25wt%. (Lately, it is around 27wt%-28wt%) This the basis for determining the Sludge batch size in SRAT. (goal: 11,000lb solids in SRAT batch) Example: Spg (end point SRAT) = 1.2; Spg (18wt% Sludge) = 1.14; Spg (MST/Sludge) = 1.03; Heel = 1500 gal; SRAT final volume = 6000 gal; Sludge = 18wt%. 25% * 6000 * 1.2 = 2938 *4% * 1.03 + 25% *1500*1.2 + X * 1.14 * 18%. Where X = sludge batch size. Therefore, X = 5989 gal.		

APPENDIX B
WTL/MCU/ARP COREsim® Model Major Assumptions

Definition: **Phase I** – run 241-96H, MCU, and 512S. **Phase II** – run 241-96H, 512S, and SWPF.

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
1	Facility Availability ARP <u>(Phase I)</u> <u>(Phase II)</u>	• Planned outage: 7 weeks a year. 4 planned outages per year, 1.75 weeks per outage. • Unplanned outage = 6 weeks a year • ARP will operate 7 days/week, 24 hr/day. • ARP Facility availability includes 96-H and 512-S ops.	*Net attainment = 75% *To assume CSSX, ARP, DWPF will conduct planned outages at the same time. (Base Case) * Short unplanned outages: 3 weeks per year. Each outage is "Normal Distribution with mean time = 24 hours, with standard deviation = 4.8 hours". Frequency: failure rate = 21 times a year. Mean time between failure = 417 hours (presented by Exponential Distribution) * Long unplanned outage: 3 weeks per year. Each outage is "Normal Distribution with mean time = 72 hours, with standard deviation = 14.4 hours". Frequency: failure rate = 7 times a year. Mean time between failure = 1251 hours (presented by Exponential Distribution)	B. Voegtlen	
2	Facility Availability MCU <u>(Phase I)</u>	• Planned outage = 7 weeks a year. 4 planned outages per year, 1.75 weeks per outage. • Unplanned outage = 6 weeks a year • If CSSX is to schedule "planned outage" in sync with ARP and DWPF, then a larger maintenance crew will be required to serve all facilities at the same time. • If the plan is to stagger CSSX "planned outage" with ARP "planned outage", the throughput of CSSX might suffer, however, the same maintenance crew can work on both CSSX and ARP. • MCU will operate 7 days/week, 24 hrs/day	*Net attainment = 75% *To assume CSSX , ARP, and DWPF will conduct planned outages at the same time. * Short unplanned outages: 3 weeks per year. Each outage is "Normal Distribution with mean time = 24 hours, with standard deviation = 4.8 hours". Frequency: failure rate = 21 times a year. Mean time between failure = 417 hours (presented by Exponential distribution) * Long unplanned outage: 3 weeks per year. Each outage is "Normal Distribution with mean time = 72 hours, with standard deviation = 14.4 hours". Frequency: failure rate = 7 times a year. Mean time between failure = 1251 hours (Exponential	M. Geeting	G-ESR-H-00073, Rev. 0

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
			Distribution) Per RAMI analysis: - For all Maintenance work done within the Contactor Enclosure, there will be an outage lasting 192 hours ~ 8 days. During this time there can be no transfers into SSRT(s) while in the contactor enclosure. The contactor enclosure would be entered for repairs to contactors or CWT. - For all Maintenance work done within the process cell, there will be an outage lasting 144 hours ~ 6 days. During this time there can be no transfer into SSRT(s) while in the process cell. The process cell would be entered if have to replace pumps or agitators, or problems with the SSRT(s), SSFT, DSSHT, or DSSD.		
3	Facility Availability DWPF (Phase I) (Phase II)	• Net attainment = 80% • Planned outage = 4 weeks a year. 4 planned outages per year, 1 week per outage. • Unplanned outage = 6.5 weeks a year	*To assume ARP, DWPF, and SWPF (or MCU) will conduct planned outages at the same time. * Short unplanned outages: 3.25 weeks per year. Each outage is "Normal Distribution with mean time = 24 hours, with standard deviation = 4.8 hours". Frequency: failure rate = 22.75 times a year. Mean time between failure = 361 hours (presented by Exponential distribution) * Long unplanned outage: 3.25 weeks per year. Each outage is "Normal Distribution with mean time = 72 hours, with standard deviation = 14.4 hours". Frequency: failure rate = 7.6 times a year. Mean time between failure = 1083 hours (Exponential Distribution)	M. Norato	G-ESR-H-00073, Rev. 0

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
		* Net attainment = 85% *Planned outage = 4 weeks a yaer. 1 week per outage. *unplanned outage = 3.8 wk/yr.	• Short unplanned outages 1.9 wk/yr. Each outage is "Normal Distribution with mean time = 24 hours, with standard deviation = 4.8 hours". Frequency: failure rate = 13.3 times a year. Mean time between failure = 634.6 hours (presented by Exponential distribution) • Long unplanned outage: 3.25 weeks per year. Each outage is "Normal Distribution with mean time = 72 hours, with standard deviation = 14.4 hours". Frequency: failure rate = 7.6 times a year. Mean time between failure = 1083 hours (Exponential Distribution)		
4	Facility Availability SWPF <u>(Phase II)</u>	• Planned outage = 4 weeks a year. 4 planned outages per year, 1 week per outage. • Unplanned outage = 4.8 weeks a year • If SWPF is to schedule "planned outage" in sync with ARP and DWPF, then a larger maintenance crew will be required to serve all facilities at the same time. • If the plan is to stagger SWPF "planned outage" with ARP, DWPF "planned outages", the throughput of SWPF might suffer, however, the same maintenance crew can work on both SWPF and DWPF. • SWPF will operate 7 days/week, 24 hrs/day	*Net attainment = 83% *To assume SWPF, ARP, and DWPF will conduct planned outages at the same time. * Short unplanned outages: 2.4 weeks per year. Each outage is "Normal Distribution with mean time = 24 hours, with standard deviation = 4.8 hours". Frequency: failure rate = 17 times a year. Mean time between failure = 493 hours (presented by Exponential distribution) * Long unplanned outage: 2.4 weeks per year. Each outage is "Normal Distribution with mean time = 72 hours, with standard deviation = 14.4 hours". Frequency: failure rate = 5.6 times a year. Mean time between failure = 1479 hours (Exponential Distribution)	S. Blanco (P) B. Brasel	
5	Facility Availability Tanks 50, 49, and 48	Upon request, Tank Farm is not available 10% of time. Each delay is 12 to 24 hours. ® Based on historical data and facility experienced personnel, Tank Farm is not available 10% of time is a valid	Assumed Tank 50 is available for the Phase I and Phase II operations to receive DSS from MCU and SWPF.	M. Mahoney Confirmed by Barrick Blocker (6-14-05)	Refer to ® at left.

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
		assumption.			
6	Facility Availability Saltstone	Assume Tank 50 is available to receive DSS waste from SWPF. Therefore, Saltstone availability has no impact on SWPF or MCU.	Tank 50 availability has been captured in Assumption #5. Baseline case.	S. Robertson (P) T. Chandler	
6a	Saltstone (Phase II)	Saltstone is to operate 2 days a week. Max processing rate is 100,000gal/week. Tank 50 is not available to receive DSS. Saltstone availability = 75%. SSHT in Saltstone is available to store DSS, tank working volume = 45,000 gal. (interlock = 8900 gal, used in model)	Upon request, Saltstone is 25% not available. Each time down time is one day. Heel = 1800 gal. 6500 gal feed tank to Saltstone available. 100 gpm process rate. This is not the baseline case.	S. Robertson (P) T. Chandler	M-CLC-A-00219
7	System Availability CSSX <u>(MCU)</u>	75% Attainment	CSSX system will be treated as a system with availability of 75%. (as shown in MCU Process Flow Diagram)	M. Geeting	G-ESR-H-00073, Rev. 0
8	System Availability MST / Sludge System	Attainment included in ARP and DWPF.			
9	Filtrate to CSSX <u>(MCU)</u>	All filtrate to CSSX will have sodium concentration @ 5.6 molar (except the batch with spent wash water which has 1.8 M Na)	All ARP solution to be diluted to 5.6 M Na+ even when there is no MST strike.	M. Geeting	CBU-SPT-2004-00059, Rev. 1
10	**Line 3056** <u>(Alternative Case)</u>	*Line 3056 could be used to transfer waste from Tank 49 into one of two Monosodium Titanate (MST) Strike Tanks at 241-96H. In this case, the line will also be used to transfer treated waste from the MST Strike Tanks at 241-96H to the 512-S Filter Feed Tank.	Tank 49 is an alternative feed source to the MST Strike Tanks at 241-96H. This option will not be analyzed at this time. Based on the current situation, Tank 49 is the most likely feed tank to 96H during Phase I.	B. Voegtlen	
11	**Line 3056** <u>(Phase I)</u> <u>(Baseline Case)</u>	*The dual use is eliminated because Tank 48 is the exclusive feed tank to 241-96H. There will still be a mutual use issue since batch transfers to Tank 49 will be through this line. Charge time (downtime) for Tank 49 will be 14 days.	When SWPF in operations, Tank 49 will provide feed to SWPF. Tank 48 is the exclusive feed tank to 241-96H.	B. Voegtlen	

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
12	**Line PCP341 and PCP4** <u>(Phase II)</u>	The two transfer lines PCP341 and PCP4 will have dual uses. * *Line PCP341* will be used in the ARP to supply feed from the 241-96H MST Strike Tank to 512-S LWPT (Filter Feed Tank). Line PCP341 also be used to supply feed from Tank 49 to SWPF. **Line PCP4* will be used in the ARP to transfer concentrate from the 512-S LWPT to the LPPP Precipitate Tank. Line PCP4 is also planned to be used to supply feed from Tank 49 to the SWPF.	For "Filter Only" case (Phase I), jumpers will be installed in the 241-96H Process Cells to allow a direct feed from Tank 48 to LWPT.	B. Voegtlen	
13	Tank 49 Tank 48 <u>(Phase II)</u>	During Phase II, there are needs to transfer wastes from Tank Farm through HDB-7 into Tank 49. Tank 49 will hold 1.0 Mgal of fresh waste. This is equivalent to 43 batches of waste to SWPF. Charge time (downtime) for Tank 49 will be 14 days.	Tank 48 batch is 1,083,000 gal. The charge time assumed to be 14 days. Transfer pump to Tank 49 is rated at 75 gpm with ~75% utilization transfer time. Time to transfer 1 Mgal to Tank 49: 1x106/ (75 * 60 * 24 * 0.75) ~ 2 weeks.	M. Mahoney	Interim Salt Strategy: CBU-PED-2004-00027.
14	SWPF Throughput Requirements	Minimum requirement: >= 3Mgal/year SWPF peak instantaneous processing rate = 9.4Mgal/year. Target rate: 7 Mgal/yr. If ARP is running, 1 Mgal/yr from ARP and 6 Mgal/yr from SWPF.	This throughput requirement does not include waste processed by ARP. (see assumption 16)	S. Blanco B. Brasel	
15	MCU Throughput Requirements	>= 1Mgal/year. Keep up with ARP		M. Geeting	G-TC-H-00041, Rev. 2
16	ARP Throughput Requirements <u>(Phase I)</u> <u>(Phase II)</u>	Minimum throughput requirement = 1.32 Mgal/yr. Operational Strategies for 2 MST Strike Tanks at 241-96H based on CBU-SPT-2004-000193. (0.1 micron Filter)	(3.36 gal/min)*(60*24*365*75%) = 1.32Mgal/yr. Provided by R. Voeglen. If MCU must keep up with ARP, then throughput for MCU shall be atleast >= 1.32 Mgal/yr (see Assumption #15)	B. Voegtlen Confirmed by R. Voegtlen (6-13-05)	Appendix J (X-CLC-S-00113) Rev. 0

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
17	Multiple intra or inter area transfers	There are **no restrictions** on simultaneous transfers between facilities for ARP, SWPF, MCU, and DWPF. Dual use line restrictions are captured in Assumptions # 10 through 12. ® The assumption that no restrictions on simultaneous transfers between facilities is valid at this time. DWPF requests that the model flag the number of times that simultaneous transfers occur.	There is currently an administrative control (non-TSR related) in DWPF that allow only one inter-area or intra-area transfer at a time. The model will assume no such limitation.	J. Owen	Refer to ®
18	ARP (Phase I and Phase II)			B. Voegtlen	
		Max Case: "Reduced Strike Case (4 hr MST strike time in ARP)" Fresh Waste processed = 3.452 MM gal/yr	Appendix L (X-CLC-S-00113); based on 100% attainment. 4 hr MST strike with 0.1 micron filter Calculated by stream 6 in Appendix L: Annual flow = 18,654 klb/hr Density = 10.81 lb/gal Fresh waste processed = 18,654*1000*2/ 10.81 = 3.452 Mgal/yr		Appendix L (X-CLC-S-00113). Rev.0
		Minimum Case: : "24-hr Strike Case" Fresh Waste processed = 1.767 MM gal/yr	Appendix J (X-CLC-S-00113); based on 100% attainment. 24 hr MST strike with 0.1 micron filter Calculated by stream 6 in Appendix J: Annual flow = 9546 klb/hr Density = 10.81 lb/gal Fresh waste processed = 9546*1000*2/ 10.81 = 1.767 Mgal/yr		Appendix J (X-CLC-S-00113), Rev.0
19	CSSX (MCU)	MCU is planning on operating "campaign style". This means MCU will operate at a flow rate based on ARP flow rate. Therefore, in the flowing assumptions the filtrate to CSSX is based on ARP flowrate directly from the ARP material balance and the MCU flow rates per		Thuy Le (took over for S. Subosits)	

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
	For "Variable – Salt Solution to CSSX (Stream #2) use values from calculation X-CLC-S-00113, Rev. 0. This variable is found in Function D.9.2. Initialization 5	the MCU material balance are adjusted by the ratio of the two initial streams from each material balance (stream #2 in MCU material balance and stream #11 in ARP material balance) to each other in order to determine the correct MCU existing flow rates. Max Case: Filtrate to CSSX = 7.431 gpm (*stream #11, X-CLC-S-00113, Appendix L, Rev. 0). Annual rate (@ 7.431 gpm = 3.9075 Mgal/yr at 5.6M. Incorporating attainment for each facility, ARP 75%, CSSX 75%, DWPF 75%, then filtrate to CSSX = 3.9075*.75*.75*.75 = 1.65 Mgal/yr Nominal batch size = 3738 gal/batch from ARP Once every 48 batches, 4424 gal batch will be sent to SSRT	Appendix L (X-CLC-S-00113) was used for this assumption. Stream 11: Batches/yr = 522.4 Stream 15: Batches/yr = 40.2 Batches between large batch = 522.4/40.2 = 13 batches Stream 13: Annual flow = 1594 klb/yr Stream 13: Density = 8.95 lb/gal Stream 13: Batches/yr = 40.2 Large Batch size = 4430.8 In Attachment A (X-CLC-H-00554, Rev. A), Maximum flow case, stream #1 (the value for Filtrate to CSSX) = 8.50gpm, stream #2 (salt solution to CSSX) = 8.50 gpm. Stream #2 is the new flowrate after Na adjustment from 6.44 to 5.6M. Stream #1 corresponds to stream #14 of X-CLC-S-00113. This value includes spent wash water (stream #13 of X-CLC-S-00113). The value to be used in the model is that of stream #11. This is the case when solids go to Tank 50, and stream #11 is the feed to MCU. Dilution in LWHT is required to bring Na concentration from 6.44M to 5.6M.	S. Campbell	Appendix L (X-CLC-S-00113, Rev. 0) Attachment A (X-CLC-H-00554, Rev. A)

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
		Minimum Case: Filtrate to CSSX = 3.803 gpm (stream #11, X-CLC-S-00113, Appendix J, Rev. 0). Annual rate (@ 3.803 gpm = 1.999 Mgal/yr at 5.6M. Incorporating attainment for each facility, ARP 75%, CSSX 75%, DWPF 75%, then filtrate to CSSX = 1.999 Mgal/yr *.75*.75*.75 = 0.843 Mgal/yr Nominal batch size = 3738 gal/batch from ARP Once every 13 batches, 4430.6 gal batch will be sent to SSRT	Appendix J (X-CLC-S-00113) was used for this assumption. Stream 11: Batches/yr = 267.3 Stream 15: Batches/yr = 20.6 Batches between large batch = 13 batches Stream 13: Annual flow = 814 klb/yr Stream 13: Density = 8.93 lb/gal Stream 13: Batches/yr = 20.6 Large Batch size = 4430.6 In Attachment C (X-CLC-H-00554, Rev. A), Minimum flow case, Stream #1 (the value for Filtrate to CSSX) = 3.50 gpm. Stream #2 (Salt solution to CSSX) = 3.50 gpm. Stream #2 is the new flowrate after Na adjustment from 6.44 to 5.6M. Stream 1 corresponds to stream #14 of X-CLC-S-00113. This value includes spent wash water (stream #13 of X-CLC-S-00113). The value to be used in the model is that of stream #11. This is the case when solids go to Tank 50, and stream #11 is the feed to MCU. Dilution in LWHT is required to bring Na concentration from 6.44M to 5.6M.		Appendix J (X-CLC-S-00113, Rev. 0) Attachment C (X-CLC-H-00554, Rev. A)
20	MST/Sludge <u>(ARP)</u>			B. Voegtlen	
		Max Case: • 155,052 gal/yr of MST/Sludge based on 100% attainment	45.5 SRAT batches/yr; 3408 gal/SRAT batch (based on 75% attainment).		Appendix L (X-CLC-S-00113)

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
	For "Variable – Batch Size MST/Sludge to SRAT (SWPF and MCU)" use values from calculation X-CLC-S-00113, Rev. 0 for gal/SRAT batch. Variable found in Function D.9.4 Initialization 7	• 116,289 gal/yr based on 75% attainment • Batch size = 3855 gal/batch (this value is related to assumption #66)	Appendix L (X-CLC-S-00113) Stream 15: Batches/yr = 40.2 Flow = 0.295 gpm Annual flow = 0.295*60*24*365 = 155,052 gal/yr Batch size = 155,052/40.2 = 3855 gal/batch		
		Minimum Case: • 79,366 gal/yr based on 100% attainment • 59,524 gal/yr based on 75% attainment • Batch size = 3855 gal/batch (this value is related to assumption #66)	45.5 SRAT batches/yr; 1744 gal/SRAT batch (based on 75% attainment). Appendix J (X-CLC-S-00113) Stream 15: Batches/yr = 20.6 Flow = 0.151 gpm Annual flow = 0.151*60*24*365 = 79,366 gal/yr Batch size = 79,366/20.6 = 3855 gal/batch		Appendix J (X-CLC-S-00113)
21	DSS For "Variable – (MCU DSS to DSS Decanter (Stream #10)" use	Max Flow Case: DSS to Hold Tank = 4.053 gpm. This number is calculated by multiplying Stream #10 (3.73 gpm) of calculation X-CLC-H-0554, Rev. A by ratio of MCU material balance flowrate for Stream #2 (3.5 gpm) to ARP flowrate for stream #11 (3.803 gpm). 3.73 gpm * 3.803/3.5 = 3.73 gpm *			

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
	values for DSS to Hold Tank. This variable is found in Function X.9.5 MCU Initialization	1.08657 = 4.053 gpm.			
		Min Flow Case: DSS to Hold Tank = 7.9206 gpm. This number is calculated by multiplying Stream #10 (9.06 gpm) of calculation X-CLC-H-0554, Rev. A by ratio of MCU material balance flowrate for Stream #2 (8.5 gpm) to ARP flowrate for stream #11 (7.431 gpm). 9.06 gpm * 7.431/8.5 = 9.06 gpm * 0.87424 = 7.9206 gpm.			
22	Cesium Strip to SRAT <u>(MCU)</u> For "Variable – (MCU SE to SE Decanter (Stream #14)" use values for Cs-strip. This variable is found in Function X.9.5 MCU Initialization	Max Flow Case: Cs-strip = 0.56825 gpm. This number is calculated by multiplying Stream #14 (0.65 gpm) of calculation X-CLC-H-0554, Rev. A by ratio of MCU material balance flowrate for Stream #2 (8.5 gpm) to ARP flowrate for stream #11 (7.431 gpm). 0.65 gpm * 7.431/8.5 = 0.65 gpm * 0.87424 = 0.56825 gpm.	45.5 SRAT batches/yr; 4923 gal/SRAT batch. Gal per year calculated by: 0.56825 gpm*525,600min/yr*0.75 = 224,004 gal/yr 224,004 gal/yr * 1/45.5 SRAT batches/yr = 4923 gal/SRAT batch.	S. Campbell Calculation by Robert Gordon has flow rates for existing tanks.	X-CLC-H-00554, Rev. A.
		Minimum Case: Cs-Strip = 0.2281 gpm. This number is calculated by multiplying Stream #14 (0.21 gpm) of calculation	45.5 SRAT batches/yr; 1976 gal/ SRAT batch Gal per year calculated by: 0.2281 gpm*525,600min/yr*0.75 = 89,917 gal/yr		X-CLC-H-00554, Rev. A.

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
	For "Variable – Batch Size for SEFT Transfer (SWPF)" use value for gal/SRAT batch. This variable is found in Function D.9.4 Initialization 7	X-CLC-H-0554, Rev. A by ratio of MCU material balance flowrate for Stream #2 (3.5 gpm) to ARP flowrate for stream #11 (3.803 gpm). 0.21 gpm * 3.803/3.5 = 0.21 gpm * 1.08657 = 0.22821 gpm.	89,917 gal/yr * 1/ 45.5 SRAT batches/yr = 1976.198 gal/SRAT batch		
23	Washed sludge (DWPF)	Washed sludge will be transferred from LPPP-ST to SRAT through a dedicated line SDP-24.	This is the current sludge feed to DWPF, not MST/Sludge feed.	M. Norato	H. Shah and "Vitrif/Interarea Process Lines P&ID" W750259.

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
24	Line Flush Requirements	*After each transfer of MST/Sludge from SSRT (SWPF) to LPPP-PT, the line PCP18 will be flushed with 400 gal of Cs strip effluent. (Phase II) * After each transfer from LWPT to LPPP-PT, the PCP4 will be flushed with 1200 gal spent chemical cleaning solution. (Phase I and Phase II). * After each transfer from Tank 49H to AST-A, the PCP341 will be flushed with 360 gal of IW. (Phase II) * Tank 49H will feed to 241-96-H while MCU is in operations. There is no need to flush the line per CBU-SPT-2004-00205, Rev. 0. * For "Filter Only" case (Phase I), Line PCP341 is used to transfer Tank 49H to LWPT. No flush requirements for this line (per Subosits). * A bigger heel will be left in LPPP-PT after each batch transfer from LPPP-PT to PRFT so that, after addition of trapped 800 gal, LPPP-PT will reach the 4000 gal threshold level to start pump transfer. * 1 hour to flush Line PCP341. 2 hours to flush both PCP341 and PCP4.	After a transfer is made from Tank 49 to SWPF, PCP341, PCP4, PCP19 will be flushed. The volume is ~1300 gal. (per Fatina) However, the flush water will be trapped in the line after flush because LPPP-PT is the low point. After flush line is valved between PCP341/PCP4 & PCP4/PCP19. The flush volume in PCP4 will drain to the Low Point. Volume = 840 gal. Heel = 1300 gal. Flush = 803 gal. Batch = 3875 gal. The final volume = 5978 gal > "The max working volume" 5600 gal. As a result, "Engineering Position on Flushing Requirements for Transfer Lines PCP341 and PCP4" was developed to deal with the problem. Note: The LPPP-PT pump can't start until the tank level reaches 4000 gal.	B. Ervin (P) J. Owen	CBU-PIT-2004-00017
25	SSRT and SSFT operations strategy <u>(MCU)</u>	**Assumptions:** (1) Each batch size produced in LWHT = 3738 gal (+- how much?). (2) After 48 ~~#~~ batches for Max. Case, a larger batch size (solids wash) will send to CSSX (4424 gal, based on Subosits's calc) (3) After 13 batches for Min. and Intermediate cases, a larger batch size (solids wash) will send to CSSX (4431 gal,	Operations strategy will be provided by Mark Geeting and Seth Campbell. *Baseline: It is to assume for "filter only case" (Appendix M), the fresh batch to ARP will be 3300 gal (instead of 3800 gal as shown in X-CLC-S-00113). The 3300 gal batch will be diluted to 5.6 M Na and become a 3800 gal batch.	M. Geeting	

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
		based on Subosits's calc). (4)The 13 # batches will vary from 13 to 50 batches. For Max. Case there will be 48 batches. For intermediate case there will be 48 batches. (5) CSSX has to know when the large batch is coming about 60 hr ahead in order to empty all process tanks for preparation to receive filter flush from ARP. Based on Steve's email and conversation with E. Harrison, ARP will not sample content in LWPT to confirm 5 wt%. It will be done by calculation). **Known constraints:** (6)Transfer from LWHT to SSRT (MCU) will have 300 gal of drain-back. (@steady state, the batch size should be close to 3738 gal) (7)The larger batch (4431) will has 1.8 M Na. Therefore, it must be blended with two batches of 3738 gal batch. (8)SSHT and SSFT will have the same tank size. SSFT is running continuously, therefore, SSRT will transfer a batch after SSFT reaching 800 gal tank level. (9)For "no MST strike" batches will have 6.44 M Na. Solutions will be diluted in 512-S to 5.6 M Na. In this case, the batch size to SSRT will be 4423 gal. Per Mark Geeting, dilution should be done prior to filtration, so the batch size will not change. This will affect ARP throughputs.	* In what-if, it is to assume for "filter only case" (Appendix M), the fresh batch to ARP will be 3800 gal (as shown in X-CLC-S-00113). The 3800 gal batch will be diluted to 5.6 M Na and become a 4233 gal batch. SSHT will hold one batch and then transfer to SSFT. Batch size will remain the same.		
26	ARP Transfer pump	Transfer pump from 96-H to 512S = 100 gpm	Per B. Voegtlen	B. Voegtlen	

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
27	CSSX transfer pump <u>(MCU)</u>	Transfer pump from SEHT to ASRT = 17.5 gpm.	Is the pump rated @ 100 gpm At 708 gallons in SEHT, then at 17.5 gpm, the transfer would take 0.674 hr	M. Geeting M. Norato C. Aponte Paul Weller	M-CLC-H-02613, Rev. A
28	SEFT (Strip Effluent Feed Tank) <u>(DWPF)</u>	Maximum working volume = 9600 gal Heel = 2000 gal loss of prime (per Norato) ASRT has been renamed to SEFT. 10657 gal to overflow. ® Email from S. G. Phillips 11/4/2004 08:50 and Overflow from S-CLC-S-00070, Rev. 6. Availabilities are estimates.	Same availability as SRAT and SME. Need to maintain a minimum of one SRAT batch-worth of inventory (Phase I only).	M. Norato	Refer to ® at left. S350-ZZZL-4063
29	PRFT <u>(DWPF)</u>	Maximum working volume = 6500 gal Heel = 500 gal (per Norato) 8310 gal to overflow. ® Email from S. G. Phillips 11/4/2004 08:50. Availabilities are estimates.	Hold 4.5 SRAT batches of MST/Sludge. Same availability as SRAT and SME. Need to maintain a minimum of one SRAT batch-worth of inventory.	M. Norato	Refer to ® at left
30	LWPT <u>(512-S)</u>	Maximum working volume = 5400 gal; 3800 gal working volume and a 1600 gal heel. The non-transferable amount of the LWPT heel is 650 gal. ® S. G. Phillips and S511-ZZZL-7186, Rev. 5. Availabilities are estimates.	Same availability as SRAT and SME.	M. Norato	Refer to ® at left
31	LWHT <u>(512-S)</u>	Maximum tank working volume = 5000 gal Heel = 700 gal. 300 gal drain back. So a solids wash batch, the batch size = 4431 ~~4512~~ gal. The total tank volume = 4431 ~~4512~~ + 700 + 300 = 5431 ~~5512~~ gal. The tank will have adequate space to handle any batch of filtrate from LWPT concentration batches and spent wash water from the LWPT solids heel washing cycle.	Same availability as SRAT and SME. ® S. G. Phillips and S511-ZZZL-7043, Rev. 1. Availabilities are estimates.	M. Norato	Refer to ® at left S511-ZZZL-7043
32	LPPP-PT	Maximum working volume = 5600 gal Heel = 1150 gal for transfer to PRFT (includes 500 gal of drain-back to the LPPP-PT from the ASRT in 221-S)	Same availability as SRAT and SME. Normal working volume for the LPPP-PT will be 3400 gal as it will receive 900 gal of the 5wt% MST sludge solids heel and ~2975 gal of spent filter	M. Norato	Refer to ® at left

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
		Heel = 1550 gal for transfer from LWPT. ® Email fro H. Shah 11/4/04 11:15. Availabilities are estimates.	cleaning chemicals from the LWPT and subsequently transfer this volume to the PRFT.		
33	MST Strikes <u>(ARP)</u>	One strike. (Note: Phase II: Use 3120 gal as an average. The 360 gal flush should only impact one ARP batch if there is a flush after SWPF transfer. This would require proper schedule.) However, it was assumes ARP batch size = 2988 gal in the current model. This inconsistency need to be fixed in the future.	In ARP ops, 3,300 gal of fresh waste batch is transferred to the strike tank in 241-96H. 3795 gal after striked and dilution.	B. Voegtlen	CBU-SPT-2004-00193, Rev. 0 CBU-SPT-2004-00269
34	MST Strikes <u>(SWPF)</u>	79% one MST strike. 20% two MST strikes. 1% three MST strikes. One strike: AST-A Cycle Time = 21.6 hr. Two strikes: AST-A Cycle Time = 15.6 hr. AST-B Cycle Time = 19.5 hr. 3 strikes: cycle times 16.9/16.9/19.57 hr. To simplify the logic, the current model is to assume 79% one Strike and 21% two Strikes because, based on engineering judgment, 1% of three strikes (1%) will not impact result.	If three strikes are required, the second strike will be in AST-A. 76 gal of MST will be added, no NaOH & wash water.	B. Brasel	Three strikes cycle times per Email dated 11/05/2004 06:34PM, from Bill Brasel
35	AST-A <u>(SWPF)</u>	Working volume = 28,530 gal. Total tank volume = 40,000 gal. 34236 gal to overflow. Heel = 238 gal. After adjustment, batch size = 28,300 gal. Batch size = 23,200 gal/batch. (Includes 300 gal from flush water in PCP19.) Feed from Tank 49H. Feed rate (in) = 130 gpm. Pump out rate = 300 gpm (94 minutes per batch) **The model assumed strike tank can process 22700 gal every 21.6 hours (for One MST Strike).** Since no heel information is given in BOD (P-DB-J-00001), we are to assume "the working volume" has	Cycle time = 21.6 hr. For 2 strikes = 19.57 hr *Receipt of one feed batch. *Addition of wash water and dilute caustic to adjust the Na concentration from 6.44 Molar sodium ion to 5.6 M Na. *Addition of MST (0.4g/L) * IST tank maximum working volume = 29,500 gal (per S. Campbell)	B. Brasel	"Heel = 0" per Email dated 11/05/2004 06:24 PM from Bill Brasel. P-DB-J-00001, Rev. C

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
		taken heel into account.			
36	SSFT (Salt Solution Feed Tank) <u>(SWPF)</u>	Max working volume = 41,250 gal Nominal working volume = 20,611 gal. Continuous feed rate to CSSX = 17.0 gpm (Case 1)	Batch in. Continuous out. Case 6: 21.29 gpm CSSX processing rate	B. Brasel	P-DB-J-00001, Rev. C
37	CSSX <u>(SWPF)</u>	The optimal feed rate to CSSX is 80% of the peak throughput. **The model is to assume CSSX will process @ 17.0 gpm rate.** There is no interruption for sending, receiving, or sampling in the DSSHT or SEHT. WAC compliance for the downstream facilities is accomplished by other means so as not to interrupting processing.	For 9.4Mgal/yr, the feed rate to CSSX is 21.29 gpm. (to be studied as Case 6 – baseline case) **The optimal feed rate to CSSX = 17.0 gpm (not baseline)**	B. Brasel	P-DB-J-00001, Rev. C
38	FFT (Filter Feed Tank) <u>(SWPF)</u>	One MST strike: Batch size transfer from FFT-A to SSRT = 400 gal at 5% wt% solids. Two MST strike: Batch size transfer from FFT-B to SSRT = 192 gal at 5 wt% solids.	FFT-A and FFT-B are same tank size as AST.	B. Brasel	P-DB-J-00001, Rev. C
39	SEHT (Strip Effluent Hold Tank) <u>(SWPF)</u>	Max working volume = 16,603 gal. 19924 gal to overflow. Total tank volume = 20,000 gal. (heel = 0) Continuous feed into the SEHT = 17.0 * 1/15 = 1.13 gpm.	Continuous in. Batch out. Case 1 (Baseline Case)	B. Brasel	P-DB-J-00001, Rev. C
40	SSRT Sludge Solids Receipt Tank <u>(SWPF)</u>	Max working volume = 5,000 gal. 6,000 gal to overflow. Heel = 42.6 gal. For 1 strike, one batch to SSRT = 400 gal/batch. For 2 strikes, one batch to SSRT = 592 gal/batch. MST Sludge will be washed to reduce Na concentration from 5.6M to 0.5M. The filtrate goes to WWHT. Cycle time of the process < 19 hr. After each transfer, flush transfer line with 400 gal Cs strip effluent from SEHT. The WWHT contents (wash solution) to be	Once 5 waste feed batches have been received, the accumulated MST/Sludge in SSRT will be washed. It would take 17 hours to complete washing. Cycle time: SSRT contents transfer to DWPF once every 132 hr. DWPF SRAT cycle time = 149 hr/batch. 2.4 gal of PW used to wash 1 gal of MST/Sludge.	B. Brasel	P-DB-J-00001, Rev. C

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
		split into equal volumes (5*960 gal) and fed to the AST as dilution water.			
41	MST/Sludge Transfer tank (TK-224) (SWPF)	Tank volume = 1000 gal. Working volume = 800 gal.	Concentrated MST/Sludge from FFT-B is transferred to TK-224 and subsequently transferred to SSRT for sludge wash.	B. Brasel	P-DB-J-00001, Rev. C
42	Cross-Flow Filter (SWPF)	Filtrate flux rate = 0.06 gpm/ft2. Filter surface = 213 x 2 ft2. The model to use the filtrate flow rate = 21.29 gpm.	According to Brasel, the filter surface area is now 225 ft^2 each. Filter flux capacity = 27 gpm. (Not baseline)	B. Brasel	P-DB-J-00001, Rev. C
43	Cross-Flow Filter Cleaning (SWPF)	It is assumed that each duty filter will have to be cleaned once in 28 days, the time required to process approximately 31 batches.	Filter cleaning has no impact to the cycle time. There are three filters, two filters operating in parallel and one in standby.	B. Brasel	P-DB-J-00001, Rev. C
44	DSSHT (Decontaminated Salt Solution Hold tank) (SWPF)	Feed input to DSSHT = 17.0 * 16/15 = 18.13 gpm. (Case 1) Working volume = 35800 gal. Max working volume – heel = 35,000 gal. Tank volume = 49,640 gal. 43371 gal to overflow Make a transfer once every 24 hours. (not used in the model) Transfer rate to Tank 50 = 100 gpm (pump rated 200 gpm) Make a transfer after 30,000 gal batch accumulated.	Continuous in. Batch out. Transfer out to Tank 50 or SPF (Saltstone Production Facility).	B. Brasel	
45	SSRT (MCU)	Salt Solution Receipt Tank (2): 8000 gallon Storage Tank (Carbon Steel). Working volume = 5808 gal. Heel = 7.4 gal. Therefore, True	In the model the resource “Variable- SSFT Tank Level to initiate a transfer from SSRT” should be changed from 0.8 (800 gallons) to	M. Geeting	M-CLC-H-02580, Rev. B

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
		Working Volume = 5808 – 7.4 = 5800.6 gallons.	1.1 (1100 gallons). This resource is produced in Initialization 5.0.	C. Aponte	
46	SSFT <u>(MCU)</u>	Salt Solution Feed Tank (1): 8000 gallon Storage Tank (Carbon Steel). Working volume = 5808 gal. Heel = 1.1 gal. Therefore, True Working Volume = 5808 – 1.1 = 5806.9 gallons.		M. Geeting	M-CLC-H-02580, Rev. B
47	DSST <u>(MCU)</u>	8000 gal, carbon steel tank. Working Volume = 6139 gal. Heel = 28 gal. Therefore, True Working Volume = 6139 – 28 = 6111 gallons.	Assume 100% of DSS is acceptable for Tank 50. No recycle to SSFT.	M. Geeting	M-CLC-H-02580, Rev. B
48	Ba-137 Decay Tank <u>(MCU)</u>	Deleted			
49	SEHT (Strip Effluent Hold Tank) <u>(MCU)</u>	1000 gal, stainless steel. Working volume = 720 gallons. Heel = 11.7 gal. Therefore, True Working Volume = 720 – 11.7 = 708.3 gallons.		M. Geeting	M-CLC-H-02580, Rev. B
50	Miscellaneous tanks <u>(MCU)</u>	Solvent Hold Tank: 212 ~~250~~ gal (SS) Contactor Drain Tank: 437 ~~1000~~ gal (SS) Caustic Wash Tank: Existing 62 ~~70~~ gal ETF tank (SS) Solvent Recovery Tank: Strip Decanter (organic reservoir) is doing double duty for this tank DSS Decanter: 2442 * .75 = 1832 gal ~~3000~~ gal (CS) DSS Decanter aqueous reservoir = 183 gal Strip Effluent Decanter: 477*.75 = 358 gal ~~50~~ gal (SS) SE Decanter aqueous reservoir = 36 gal Scrub Feed Tank: 10,000*.80 = 8000 gal Strip Feed Tank: 5300*.80 = 4240 gal Tanker refill Capacity = 5,000 gal	Per Vincent LeDonne email dated 6/4/2004 As part of decanter design, it is serving as a solvent recovery tank. Per Celia Aponte (6/16/2005). There will be no make up tanks in the MCU process. The working volume for decanters = 75% of the decanter volumes to account for pumps, weirs, etc. per email from C. Aponte (7/18/05). The working volume for the decanter aqueous reservoirs is 10% of the decanter volume. The working volume for feed tanks = 80% of feed tank volume.	M. Geeting C. Aponte	G-TC-H-00041, Rev. 1 M-CLC-H-02580, Rev. B

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
51	Mott Filter (ARP)	0.1 micron Mott filter (Filter Time Only – does not include other process time) Cross flow filter flux is 0.057 gpm/ft2 for the 210 ft2 cross filter. A filtrate flow of 11.3 gpm and 5 hours of filtration time for a 3800 gallon batch.	Filtration time is about 5 hr for 3800 gal solution.	B. Voegtlen	
52	DWPF Bottlenecks	SWPF project has assumed DWPF cycle time is 149 hours. In the model, we assumed DWPF pour time is 26 hr per canister and the melter is the bottleneck. However, in the future, SRAT might become a bottleneck since it is used to evaporate excessive water from Cs strip and MST/Sludge. ® P. Patel calculation and G-ESR-S-00014, Rev. 0.	SRAT will be studied in detail in the planned Integrated LRW COREsim model, not in the current model.	M. Norato	G-ESR-S-00014, Rev. 0 Refer to ®
53	Melter Offgas System	SAS (scrubber) will be turned on for both MCU and SWPF. Net water accumulation rate in OGCT = 1.5 gpm. ® V. Buch email 3/8/2004, 0922 A.M.	(Not used in the current model)	M. Norato	Refer to ®
54	SRAT	SRAT boil off rate = 430 gal/hr during SRAT concentration step. One strike: sludge size = 600 gal. 6.5 hr additional cycle time. Two strikes, batch = 5600 gal. 9 hr additional cycle time.	Fatina used 384 gal/hr. According Pete Patel's calc, the boil up rate is 430 gal/hr.	M. Norato	P. Patel calculation
55	General Assumptions	• If a facility failed during processing a batch of waste stream, the current model assumed operations will proceed to complete the step. For example, for the 24 hour strike time case, 12 hours after NaOH and MST addition to Strike Tank, the ARP facility failed. The model will assume striking reaction will complete the reaction even if there is a failure in the ARP facility. Assume the downtime for			

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
		this outage is 24 hours. After the ARP facility is back online, the strike tank will be ready to transfer to LWPT.			
56	RCT to HTF With Alt Salt Feeds (Phase I)	Assume 250 canisters a year production, various waste water transfer to RCT: Total Recycle without SAS = 1,175,490 gal/yr SAS to OGCT = 788,400 gal/yr.	Total Recycle with new WAC/WCP Inhibitor requirements = 1963890 gal/yr (Not used in the current model)	M. Norato	Email from H. Shah to J. Barnes 5/13/2004, 16:35.
57	Cs Strip and MST Sludge Batch size (SWPF)	Case 1: @7.52 Mgal/year of salt processed by SWPF, Cs strip is 597,082 gal/yr. 44 SRAT batches a year. Cs-Strip batch to SRAT = 13570 gal / SRAT batch. Case 6: Cs SRAT batch size = 16962 gal/batch. Case 1: One strike: MST Sludge = 129,276 gal/yr. 2938 gal / SRAT batch. Case 1: 2 strikes: MST sludge = 190,836 gal/yr. Case 1: 3 strikes: MST Sludge = 250,128 gal/yr	Dilution factor from 6.44M Na to 5.6M Na = 1.22 MST added at 0.4 g/L. sludge specific gravity = 1.25 23213 lb MST/yr for 1st strike.	B. Brasel	
58	New Cycle Time – RCT to HTF Continuous transfer	RCT to HTF Cycle Time: Normal = 6 hours (90%) With HTF delay = 8 hours (10%)	6 hrs includes 2 hrs to process the RCT with NaNO3 and NaOH and 4 hrs to physically make the transfers. Transfer is essentially continuously by maintaining the LPPP-RWT at a constant level. (Not used in the current model)	M. Norato	G-ESR-S-00014, Rev. 0
59	With Alt Salt Feeds: Vitrification Building	Lag storage space (temporary parking) for incomplete canisters inside vitrification building: Melter cell = 5 CDC/Smear Test Station = 4 Weld Test Cell = 4	Total hiding space for canisters = 13 due to dose rate increase. (Not used in the current model)	M. Norato	G-ESR-S-00014, Rev. 0
60	DWPF production rate	Each SME batch fills 6 canisters. 44 SRAT /yr. Canister production rate = 264 canisters/yr. (discrete cans) Cycle time to assume a batch of Cs-Strip = 365 * 24 * 0.8 / 44 = 159 hours / batch	Melter attainment = 80% If SRAT becomes bottleneck, DWPF will not be able produce 44 SRAT/yr. Need further detail DWPF study to confirm this assumption!	M. Norato	G-ESR-S-00014, Rev. 0

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
61	ARP (Phase I and Phase II)	For Phase I, X-CLC-S-00113 used 3,300 gal as the waste batch size to strike tanks at 241-96H. For Phase II, however, if there is 360 gal flushing water in PCP341, it will cause overflow to LWPT. The waste batch size should be 2988 gal instead. This change will impact ARP and MCU.	Note: The model assumed the ARP batch is 2988 gal whether there is flushing or not.	S. Subosits	X-CLC-S-00113
62	Facility Availability WSB Project (for reference only)	Major outage = 10 weeks a year; unplanned outage = 6 days a month	Based on WSB Project		
63	Facility Availability HB-Line (for reference only)	10 month/year; 4 weeks/month; 5 days/week. The net availability = 54.8%	Based on HB-Line		
64	Facility Availability H-Canyon (for reference only)	10 weeks/year planned major outage. Use 32% unplanned downtime for complex systems and 16% unplanned downtime for other system like vessels. The percentages are based on 42 weeks a year (52 less 10 weeks planned outage)	H-Canyon		
65	Facility Availability DWPF (for reference only)	• Melter – 80% • CDC - 12 hrs downtime per event. Average downtime per year = 240 hrs • SME – Total 7 down days a year. If a support system like GC's failed, the outage is 12 to 24 hrs. If it is actual system failure, like a failed coil, it can be a 7 days delay. • ASRT (SEFT) and PRFT have same availability as SRAT and SME	DWPF	M. Norato	G-ESR-S-00014, Rev. 0
66	Flush Requirements (Known deficiencies	* Phase II: PCP-4 has too high radiation rate after transfer from Tank 49H to SWPF. Therefore, before a transfer from 241-96H to 512-S, Lines 3056, PCP341	Assumption not incorporated		

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
	need to be fixed in the future)	PCP4, PCP19 need to be flushed. The waste goes to AST-A.			
67	MST/Sludge Solids wt%	Assume 5wt%. For one strike: 4.2 wt% Two strikes: 4.4 wt% ARP: 2.1 wt% This is a change in resource “variable – MST/Sludge wt% (e.g. 4 wt%, enter 0.04)” from 0.0096 to 0.021. This resource is found in Initialization 7.	Per discussion with Arron Staub there are two transfers from ARP tank LWPT to DWPF tank PRFT. The LWPT starts at a heel of 1600 gallons at a 0.5wt% solids. 96H sends 3800 gallons into LWPT with negligible solids. When filtering is complete the solids remain in the LWPT. When the concentration of the slids gets to 5wt% then transfer to DWPF. This first transfer is 900-950 gallons at 5 wt%. This leaves ~ 650 gallons heel at 5wt% in LWPT. The filter is then washed by transferring 2500 gallons at 0 solids in LWPT. The LWPT is diluted down to 1.1 wt%. Now the second transfer is made from LWPT to DWPF. The second transfer is approximately 2500 gallons at 1.1 wt%. The resulting solids wt% in DWPF is 2.1wt%.		
68	SRAT	Each SRAT will fill on average 5.6 canisters. The Model assumes each SRAT batch will fill 6 canisters.			
69	SRAT	Bring washed sludge up from LPPP. Start SRAT boiling. Once boiled off extra volume, meter @ 10 gpm MST sludge solution from PRFT (~150 hrs, 15 batches, ~1500 gallons) into SRAT. Add Nitric and Formic acid to SRAT. Boil up. Meter in SE from SEFT @ 10 gpm, at least 3000 – 5000 gallons per SRAT batch. Meter in until boil off 3000 – 5000 gallons. Then continue SRAT cycle as normal, 12 hours refluxing.			
70	Heat	Do not include in model. Duration is		C. Aponte	

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
	Exchangers (MCU)	insignificant to process operations.			
71	Filter only case (MCU)	Na is diluted in ARP (6.44 → 5.6M), prior to transfer to MCU		C. Aponte	
72	Permission for transfers (MCU)	Sending facility has responsibility for controlling transfer. Permission from receiving facility must be received and maintained by sending facility. Loss of permission means transfer is terminated by sending facility.	Permission for transfers from DWPF is controlled by 3H. Permission from 3H-admin. Controls for Tank 50 must be satisfied, controlled by 3H. H-area tank farm requests and initiates transfer from SEHT to DWPF. H-area tank farm initiates transfers from DSSHT to Tank 50. DWPF responsible for requesting and initiating transfers from ARP to MCU. LWHT asks if MCU can take material.	C. Aponte	
73	CWT (MCU)	CWT change out is completed every 30 days. CWT is physically located in contactor enclosure.	Per S. Campbell, CWT is changed out every 100 turnovers.	C. Aponte	
74	Liquid transfers (MCU)	All liquid transfers that do not receive specific flows, complete in less than one hour.		C. Aponte	
75	MCU Planned Outages	Maintenance for planned outages includes the following activities: - Contactor chemical cleaning (in place) - Flush due to solids - Change equipment. i.e. pumps, valves, etc. Contactor Enclosure might not be entered during a planned outage. Therefore, contactors not drained to CDT. Assume 144 hours to repair if process cell	During a planned outage all process tanks are emptied and flushed. During a planned outage all cold chemical tank levels stay the same. They are unchanged during the outage. When restart, fill cold chemical tanks to original start level, which is full working volume.	C. Aponte	

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
		is entered. Assume 192 hours to repair if contactor enclosure is entered.			
76	MCU Unplanned Outages	Maintenance for unplanned outages could include the following activities: - Contactor failure - Contactor chemical cleaning (in place) - Draining of contactors to CDT (contactors are emptied). It takes 24 hours to stabilize and drain contactors. This time is included in the RAMI analysis hours to repair contactors. - Contactor Enclosure is entered (8 days are lost if contactor enclosure is entered). - Change internal parts of contactors - Process Cell to include SSRT(s), SSFT, DSSHT, and DSSD. Also replace pumps or agitators. Assume 144 hours to repair if process cell is entered. Assume 192 hours to repair if contactor enclosure is entered.	During an unplanned outage all process tanks are emptied and flushed. Details will be determined in RAMI analysis There can be no transfers into the SSRT(s) during an outage for contactor or process cell failure.	C. Aponte	
77	Unplanned Outage – additional time due to CDT (MCU)	1 hour will be included in outage time (3 weeks/year for long unplanned outage; mean time = 72 hours) in order to account for empting CDT contents back into MCU process.	Based on the worst case transfer from CDT to SSFT. The flow rate of the SSFT is 8.5 gpm. It could take a little less than 1 hour to empty CDT true working volume (435.1 gallons) back into MCU process. CDT true working volume provided by C. Aponte.		
78	CDT (MCU)	Only if entering Contactor Enclosure, during an unplanned outage, all contactors will be drained to the CDT for maintenance of contactors.	Tank size = 1000 gallons. Working volume = 437 gallons. Heel = 1.9. True working volume = 437 – 1.9 = 435.1 gallons.	C. Aponte	
79	CDT Samples	Tank is sampled as needed. Sampled	This tank receives material from contactors,	C. Aponte	

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
	(MCU)	whenever you need to send solution from CDT into the process. Sample taken from sample station.	cooling water, and PVV condensate.		
80	Contactors (MCU)	No solids buildup on contactors.		C. Aponte	
81	Contactor Failure (MCU)	MCU shut down for 8 days if there is contactor failure. During Contactor failure – all contactors must be drained, the SSRT(s) and SSFT volumes stay the same, the SEHT is pumped out due to contactor cleaning, and the DSSHT volume does not change.	Based on RAMI analysis The 8 days (192 hrs) does not include 65 hours to fill up the two SSRT(s) and the SSFT and the 3 hours for MCU startup.		
82	Process Cell Failure (MCU)	MCU shutdown for 6 days if there is a process cell failure. Process cell includes SSRT(s), SSFT, DSSHT, and DSSD. During Process Cell failure – all tanks are emptied through the system, the SSRT(s) and SSFT are run through MCU until they are emptied. Startup after a process cell failure would occur in two ways: 1. With caustic 2. With Hot Feed This model assumes that startup would be with hot feed.	Based on RAMI analysis The 6 days (144 hrs) does not include 65 hours to fill up the two SSRT(s) and the SSFT and the 3 hours for MCU startup.		
83	Cold Chemical System (MCU)	Cold Chemical System includes: Caustic Makeup Tote Nitric Acid Tanks (Scrub and Strip Feed Tanks) Concentrated Nitric Acid Drum Cleaning Agent Solvent Drum	Scrub and Strip Make up tanks are no longer part of MCU design.	C. Aponte	
84	Cold Chemical System (MCU)	Utilities such as DI water and domestic water are always available.		C. Aponte	
85	Cold	Concentrated Nitric Acid Drum, Solvent		C. Aponte	

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
	Chemical System (MCU)	Drum, and Cleaning agent container will always be available.			
86	Cold Chemical System – (MCU)	Make up Tanks are no longer part of MCU design. Premixed and sampled chemicals will be received from the vendor in tanker trucks. These cold chemicals are provided by tankers. These tankers have to stage, the chemicals must be sampled, and then unloaded. There is a tanker for the Strip Feed Tank and a separate tanker for the Scrub Feed Tank. These tankers can not be received at the same time. MCU can receive material in the Strip and Scrub Feed tanks regardless if MCU is running or down.	Make up tanks are not longer part of the MCU design. Premixed chemicals will be received, sampled, and unloaded into the feed tanks from tankers.	C. Aponte	
87	Sample Stations (MCU)	Always available for taking samples from process tanks.	There are only two sample boxes available for routine sampling. Therefore only two samples can be taken at a time.	C. Aponte	
88	Routine Samples (MCU)	These include process tanks DSSHT, SEHT, CWT, & SHT. All samples of these tanks are taken when the tanks are full, before tank contents moves through process. It takes two FO's for sampling. One FO is busy for 2 hours and the other FO is busy for 3 hours. This is done in parallel. It takes 30 minutes to actually take the sample, then samples are sent to SRNL or C-lab. The other time mentioned above is for prep work.	SHT (30ml) is sampled monthly (or quarterly) CWT (10ml) is sampled weekly. Weeks do not count if MCU is shutdown. This tank is unshielded. CDT (10ml) is sampled as needed. DSSHT (this tank is unshielded) and SEHT are sampled when full (all 10ml). The SSRT(s) and SSFT are not sampled. These samples are taken from sample stations.	C. Aponte	

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
		Only two samples can be taken at a time. The CWT and DSSHT can not be taken at the same time.			
89	Cold Chemical Samples (MCU)	Cold chemicals are sampled once the tanker trucks arrive and are staged. It takes 1FO 3 hours to sample the tanker truck.	These samples are approximately 100 ml. It takes 2 hours to sample, 1 hour to transport sample to lab, and 12 hours to wait for results. Must wait for sample results from these tanks.	C. Aponte	
90	Startup (MCU)	For startup of MCU, assume SSFT and both SSRT(s) must be full (this takes 65 hrs). It takes 3 hours for MCU startup once the SSFT and SSRT(s) are filled. Assume CWT, SHT, and cold chemical feed tanks are full at initial startup. During startup after Process Cell failure, startup must occur using hot feed from ARP. If this is the case then the Cs monitor will show up as high Cs and the feed would be recycled through the DSSD into the SSFT. If this is the case then startup would take 6.5 hrs instead of 3 hours.	Once feed is gone and SSRT(s) and SSFT are empty, MCU shuts down until ARP can send batch. 3 hour startup is for pre-job briefing, valving, and getting everyone ready, etc. Some pre-operations work can be done in parallel with the filling of the receipt and feed tanks. 6.5 hour startup for hot feed, to fill the DSSD and evaluate the SHT to see if leveled out.	C. Aponte	
91	Shutdown (MCU)	For shut down DSS is recycled for 0.5-1 hr to flush tanks.			
92	DSS Recycle (MCU)	The DSS Recycle is not included in model. DSS recycle is done only during startup and shutdown. Since the model is looking at throughput to keep up with ARP material, then the model does not need to keep track of the volume recycled in the MCU, but just capture that the MCU system is waiting for	DSS is recycled through the contactors during MCU operations when there is no feed. The recycle ends when there is feed and/or when there is an outage.	C. Aponte	

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
		the ARP feed.			
93	DSSHT Heel for Recycle (MCU)	No heel is required since there is no recycle of DSS from the DSSHT.		C. Aponte	
94	Solvent Change out (MCU)	No solvent change out will occur during 30 Day run.	MCU only expects to have solvent change out once during entire MCU lifetime. MCU only has enough solvent material for one change out for lifetime of MCU. The solvent will be monitored for performance. When solvent is changed out, process is shut down. SHT is drained and flushed, solvent is collected and new solvent is put into SHT.	C. Aponte	
95	SHT (MCU)	Assume 200 gallons are initially in SHT. Tank is sampled 1 per month.	SHT WV = 2000 gallons that feed into process. 200 gallons of solvent is needed to run process. Solvent is recycled through contactors back to SHT.	C. Aponte	
96	Contactor operating conditions (MCU)	All contactor banks will meet standards for DF and temperature.	DF = 12 Temperature for extraction bank = $23^{o}C$ +- $3^{o}C$ Temperature for strip bank = $33^{o}C$ +- $3^{o}C$	C. Aponte	
97	SEHT Sample (MCU)	No problems with SEHT sample. Will always be able to send from SEHT to DWPF.		C. Aponte	
98	Liquid Transfers (MCU)	All liquid transfers that do not require specific flows complete in less than 1 hour.		C. Aponte	
99	Sumps (MCU)	Sump operations will not impact MCU processing operations.	When sumps are full, sump is emptied to CDT. The process is not stopped.	C. Aponte	
100	DSS Gamma Monitoring (MCU)	Process not stopped based on results. If high Cs, then instead of going from the DSS Decanter to the DSSHT the solution is transferred to SSFT to go back through MCU process.	These are constant online readings. No volume is needed and no time is required from the process. The process is not stopped based on results. Feed changes from going to the DSSHT to going back to the SSFT.	C. Aponte	

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
		Assume high Cs every 50 (variable) batches. A batch is when SSFT is fed 3780 gallons from ARP.			
101	DSS Recycle to SSFT (MCU)	Assume the SSFT is sized to accommodate the recycle from the DSS Decanter.	Decanter volume = 1832 gal SSFT working volume = 5800 gal SSRT batch size = 3800 gal Decanter volume plus SSRT batch = 5632 gal. This does not exceed the working volume of the SSFT. However, there must be room in the SSFT to receive the decanter volume.	C. Aponte	
102	CRO responsibilities (MCU)	There is 1 CRO/shift (this is minimum staffing). CRO has to perform inter area transfers. Only one inter area transfer is allowed at a time. Inter area transfer means ARP to SSRT, SEHT to DWPF, or DSSHT to Tank 50. Assume 0 hours for lunch, breaks, and turnover.	CRO's are responsible for anything involving the DCS, monitoring process of process tanks.	C. Aponte	
103	FO (Field Operator) responsibilities (MCU)	FO's are responsible for MCU operations. There is a minimum of 2 FO per shift. The operations they are responsible for are as follows: 1. FO Rounds – done once per shift. 1FO for 1 hour. 2. Valving for transfers in and out of MCU. 1FO for 1 hour per transfer. 3. Valving for startup (full valve alignment) of MCU. 1 FO for 2 hours. 4. Sampling of DSSHT, SEHT, CWT, and SHT. This incorporates getting truck for transporting sample to lab, dressing out, turn on sample station, taking sample, and independent verification. 1FO for 2 hours, 1FO for 3 hours. These are done in		C. Aponte	

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
		parallel (Keep in mind that only 2 samples can be pulled at the same time and not DSSHT and CWT together). 5. Shutdown – assume do not have to worry about FO's during shutdown. There is no competition for their time. 6. Chemical receipts. This incorporates meeting tanker, staging, sampling, transporting sample to lab, unloading 5000 gal from tanker and shutting down transfer. 1FO for 7 hours. Keep in mind that only one cold chemical can be received at a time. Can receive material when MCU is running or not. Assume no FO required for CWT turnover. This done during downtime. 7. Filling up SSRT(s) and SSFT. The operating time to fill up these tanks is 65 hours. The FO is not busy this entire time and can be doing other things. 1FO for 1 hour recirculation. 8. HVAC. 1FO for 1hour once per week. 9. Shift briefing. 1FO for 1 hour at change of shift. 10. Lunch. 0.5 hour between 11 and 2pm. Assume each FO has to take lunch but are done at different times.			
104	SSRT(s) and SSFT recycles between each other (MCU)	Not included in the model.	This is not normal operation. These lines were put in for flexibility in order for feed adjustments.	C. Aponte	
105	Lab for samples (MCU)	Labs will always be available for samples.		C. Aponte	
106	DSSHT	Tank 50 will have enough free board to	Samples are taken when DSSHT is full.	C. Aponte	

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
	Sample Results (MCU)	adjust to process upsets. Therefore, a "bad" sample result will have no affect on process.	Solution is sent to DWPF before sample results are returned. Tank 50 should have enough free board to be able to handle results being out of spec.		
107	Tank 50 (MCU)	Tank 50 will always have enough room to receive everything MCU is processing.		C. Aponte	
108	MCU flow rates and pump rates	Stream flow rates will be taken from calculation M-CLC-H-02611, Rev. B	Based on this calculation and tank diagrams, the flow rates of the streams are as follows: - from filtrate to SSRT(s) = 100 gpm - from SSRT to SSFT = 60 gpm - from SSFT to Contactors = Stream #2 on MCU material balance. - from Contactors to DSS Decanter = Stream #10 on MCU material balance. - from DSS Decanter to DSSHT = 15 gpm (900 gph) - from DSS Decanter to SSFT = 15 gpm (900gph) - from DSSHT to Tank 50 = 100 gpm - from DSSHT to Contactors (for start up) = 8.95 gpm - From Scrub Feed tank to Contactors = 0.57 gpm - From Strip Feed Tank to Contactors = 0.57 gpm (pump rate at 0.2 – 0.6 gpm) - From Contactors to SE Decanter = Stream #14 on MCU material balance. - from SE Decanter to SEHT = 1.5gpm (90 gph) - from SEHT to SEFT = 50 gpm (could be 10 gpm) - Cold feed chemicals from tanker to cold feed tanks = 30 gpm	C. Aponte	
109	Large batch for Solids Washing (MCU)	Per email from Seth Campbell, for every 0.5 gallon of the Solids Washing batch ("large batch") received into SSRT at 1.8M Na, 1 gallon of 5.6M Na must be added to		C. Aponte S. Campbell	

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
		get concentration with in CSSX range. This range is from 3.6M to 7M. These two tanks are mixed by some method in the SSRT(s) and SSFT. However, the SSRT(s) and the SSFT have a max working volume of 5800 gallons, therefore the large batch must be mixed with the 5.6M batch is some manner. This manner can vary depending on the remaining volume of solution in the SSRT(s) and SSFT.			
110	SE Decanter Transfers to SEHT (MCU)	Assume the SE Decanter transfers to SEHT when the SE Decanter reaches the true working volume of the decanter, which is 358 gallons. SE Decanter transfers the volume of its aqueous reservoir which is 10% of the SE Decanter volume. Therefore, the amount transferred is 36 gallons.			
111	DSS Decanter Transfers to DSSHT (MCU)	Assume the DSS Decanter transfers to the DSSHT when decanter is full. This is at a volume of 1832 gallons. The DSSD transfers the volume of its aqueous reservoir which is 10% of the DSSD volume. Therefore the amount transferred is 183 gallons.		C. Aponte	
112	DSSHT Transfer to Tank 50 (MCU)	The DSSHT will transfer to Tank 50 after it reaches X gallons. This volume will allow the DSSHT not to overflow when other inter area transfers are being made.			
113	SE and DSS Decanter Sampling (MCU)	SE and DSS Decanters will not be sampled.		C. Aponte	
114	SE and DSS	Since the organic reservoirs in both	Assume aqueous reservoir volumes are ~10%	C. Aponte	

Assumption No.	Category	Assumption Description	Note	Owner	Source Document
	Decanter volumes	decanters are small compared to the decanter volume and the flow rate out of the organic reservoir is small, assume the entire decanter volume goes to the DSSHT or SEHT.	of entire decanter volume.		
115	MCU Maintenance	When maintenance occurs all tanks are emptied and flushed. If all tanks are full, then it will take 2.5 days to empty MCU system.	Assume included in outage time.	C. Aponte	
116	MCU shutdown	If MCU has to shutdown because there is no feed, then MCU waits 2 days before startup (i.e. it takes two days to get feed from ARP).	Assume 2 days included in outage time.	C. Aponte	
117	ARP Batch	A batch is assumed to be a transfer of 3738 gallons from ARP.		C. Aponte	
118	ARP feed for MCU logic	Assume ARP feed of 3738 gallons is transferred every 16 hours.		C. Aponte	
119	MCU Startup after Maint.	Steps are same as regular startup. SSRT(s) and SSFT must be full. Then 10 hours to start up MCU.			

APPENDIX C
Melter Attainment Data

Melter attainment data: Data is up to date through 03/09/04.

Month	Melter (hrs)	Feed Pumps (hrs)	Other (hrs)	Monthly Attainment
April	22.0	63.7	3.2	87.7%
May	40.5	161.5	10.2	71.5%
June	25.3	1.4	6.0	95.5%
July	155.0	6.1	4.3	77.8%
August	151.4	9.7	53.1	71.2%
September	98.8	0.5	3.5	85.7%
October	36.2	13.8	37.8	88.2%
November	20.3	8.1	8.3	94.9%
December	16.7	61.6	85.1	78.0%
January	27.6	80.6	0.3	85.4%
February	45.8	0.0	36.9	88.1%
March	27.8	0.0	0.0	87.7%
Total % Losses	8.1%	4.9%	3.0%	
Total % Attainment				84.0%

Melter: Bellows and sight glass cleaning = 21 hrs, replacement of pour spout insert = 6.8 hrs.
Data is current through 04/17/05.

Month	Melter (hrs)	Feed Pumps (hrs)	Other (hrs)	Monthly Attainment	Attainment Running Average By FY
April '03	22.0	63.7	3.2	87.7%	87.7%
May '03	40.5	161.5	10.2	71.5%	79.4%
June '03	25.3	1.4	6.0	95.5%	84.7%
July '03	155.0	6.1	4.3	77.8%	83.0%
August '03	151.4	9.7	53.1	71.2%	80.6%
September '03	98.8	0.5	3.5	85.7%	81.4%
October '03	36.2	13.8	37.8	88.2%	88.2%
November '03	20.3	8.1	8.3	94.9%	91.5%
December '03	16.7	61.6	85.1	78.0%	87.0%
January '04	27.6	80.6	0.3	85.4%	86.6%
February '04	45.8	0.0	36.9	88.1%	86.9%
March '04	52.5	11.6	83.5	80.2%	85.7%
April '04	51.7	3.3	107.3	77.5%	84.6%
May'04	72.3	0.0	5.0	89.6%	85.2%
June '04	9.0	0.1	39.9	93.2%	86.1%
July '04	20.4	1.9	174.4	73.6%	84.8%
August '04	8.6	1.1	3.6	98.2%	86.0%
September '04	0.0	0.0	132.8	81.6%	85.7%
October '04	89.9	0.0	6.4	87.1%	87.1%
November '04	55.9	1.0	6.1	91.3%	89.1%
December '04	28.2	34.7	1.1	91.4%	89.9%
January '05	0.0	0.0	208.8	71.9%	85.4%
February '05	0.0	2.3	5.8	98.8%	87.8%
March '05	11.1	1.3	6.3	97.5%	89.4%
April '05	13.4	0.0	121.4	67.0%	87.5%
Total % Losses	5.9%	2.6%	6.4%		
Total % Attainment				85.1%	

Note - April '05 downtime: Melter (13.4 hrs): 11.7 hrs for cleanout of bellows and troubleshooting of over temp protection circuit on heated bellows + 1.7 hrs due to switchover to BUOG. Others (121.4 hrs): Start of outage that's required because of H-area's inability to receive water. Some activities planned for May '05 outage being performed during this outage, including 17 hrs to replace the POG SAS Pump.