WSRC-TR-95-100-8

Savannah River Technology Center
Monthly Report

August 1995

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

Prepared for the U.S. Department of Energy under contract no. DE-AC09-89SR18035

SRTC Monthly Report August 1995

by
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DISCLAIMER

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Executive Summary

TRITIUM

- The DOE ORR is complete. There are five pre-start items to be addressed before permission to introduce tritium can be requested.
- Equations have been developed to support the ARMS system for loading of Acorn units on the mini-manifold. These were documented and delivered to tritium personnel to enable them to meet their milestones to keep the mini-manifold schedule on track towards their end of the year schedule.
- Nine reservoirs were hydraulically burst tested at SRS as part of the Round Robin tests between Mound, SRS and Kansas City Plant (KCP). The data obtained showed that all of the hydraulic burst test equipment operates satisfactorily.
- Computer models to calculate the tritium releases from hydride beds and zeolite beds in a hypothetical fire accident have been developed.
- In support of Tritium Engineering (TE) the Experimental Thermal Fluids (ETF) Group has been tasked to design, procure, and possibly test a vessel to store tritium in a Titanium matrix, called the Hydride Storage Vessel (HSV).
- Spent U-Beds from the Z-Bed recovery process are being prepared for disposal. Residual tritium estimates were calculated for waste characterization purposes. It was estimated that the U-Beds contained less than 30 Curies of residual tritium each, with the majority of that bound in the stainless steel walls of the vessels.
- In the past several months, CHTS assisted in several improvements in the operation and performance of the RTF TCAP system. These improvements include increasing the throughput of the columns, installation of an improved control sequence, a demonstration of TCAP's ability to produce a stackable deuterium stream with a low tritium feed, improvements in the TCAP operation procedure, and full integration of the column B into plant operation.
- ADS analyzed residue from a 232-H motor control panel and determined the probable origin of the residue is PVC insulation.
- ADS analyzed particles from the RTF stripper Kanne chamber and determined the high background probably came from mica or zeolite contamination inside the Kanne chamber.

- ADS analyzed the tip of an RTF earthquake valve and determined it was fabricated from ultra-high molecular weight polyethylene, as specified.

- The final report to the NRC has been completed and submitted to DOE for approval prior to release. Task 1 dealing with the analysis of older (>5 years) tritium exit signs was completed. Based on the findings of Task 1, Task 2 (analysis of newer exit signs) was not initiated. Typical personnel doses (CEDE) for three dose scenarios which were evaluated ranged from 0.047-0.077 mSv (4.7-7.7 mRem).

- EES is in the process of testing a concept for confirming that a reservoir has been successfully unloaded.

- EES and SPS have completed all work required for the new Hydraulic Burst test system. This is the first facility to become operational under the Non-Nuclear Reconfiguration (NNR) project in the DOE complex.

SEPARATIONS

- Uranium oxalate solubility experiments for the Am/Cm pretreatment development program are continuing. As expected, uranium (VI) forms soluble complexes when combined with oxalic acid and does not precipitate. Other experiments to confirm predicted behavior are underway.

- Gas is generated in the FB-Line ion exchange columns during normal operation. Each column has an ever-open vent line to exhaust these gases, thereby preventing a hazardous increase in pressure. Partial blockage and the increased pressure with both liquid and vapor was reviewed. Even with 90% pluggage, the pressure would only increase about 10%, which is within the safety envelope.

- Prior to initiation of processing post-Cassini Pu-238 in the frames waste column, solids remaining in the frames waste column feed tank and the waste receipt tank were characterized. Although some plutonium solids were found, a cleanout with boiling nitric/HF has been shown to dissolve the plutonium solids.

- In a preliminary study of the 5320 stripping package, three conditions have been considered:

  (1) Vertical upright (bottom) drop of the whole shipping container from 30-foot height;
  (2) Vertical upside-down (top) drop of the whole shipping container from 30-foot height; and
  (3) Vertical (side) drop of the whole shipping container from 30-foot height.

- The stresses in the primary containment vessel were found to be well below the yield limit in all three drops.

- An evaporation study was performed to determine the behavior of Tributyl Phosphate (TBP) and identify the formation of other organics during boiling of a nitric acid solution and help to determine the mechanism for accumulation of organics in evaporator condensate tanks.

- EES has begun fabricating supporting equipment for the Special Nuclear Materials (SNM) Vault Test Calorimeter and machine shop work is nearly complete on the test calorimeter.

ENVIRONMENTAL

The August Environmental information will be combined with the September Environmental information and may be found in WSRC-TR-95-100-9.

WASTE MANAGEMENT

- Testing of Continuous Emissions Monitors has begun at the EPA Incineration Facility.

- The Business Development Department and Interim Waste Technology have submitted a feasibility study proposal to South Carolina DHEC and three commercial clients.

- Recent testing at the TNX Kiln Seal Test Unit has provided valuable information for CIF kiln operation for system tests.

- Recent tests on the TNX Off-Gas Components Test Facility demonstrated a run strategy that will increase the CIF HEPA prefilter life from several days (highly unacceptable) to over 30 days.

- The latest Bingham Quad Volute Slurry Pump test was conducted at Sulzer-Bingham's facility during the period August 11-12 to identify hardware modifications required to eliminate the shaft/impeller/casing wear.

- The WSRC/WHC Joint Advanced Mixer Pump Development Program is a cooperative effort between WSRC and SRS to develop an advanced design slurry pump that is both reliable and effective.

- The Operational Readiness Review for In-Tank Precipitation raised a question concerning flammability hazards for sodium tetraphenylborate transport trailers. An enclosed report discusses calculations aimed at resolving that concern

- The possibility of employing alternative filters for processes at Oak Ridge National Lab (ORNL) and Hanford is being investigated.

- EES has completed electrical fabrication and testing of the Waste Tank Interior Video Inspection System control boxes.

- EES completed and delivered all four Analytical Cell control cabinets to DWPF on schedule.

- EES is continuing to work with DWPF on the Melter Pour Spout Modifications.
- EES has completed fabrication of all three Late Wash Field Termination Cabinets (FTC).

GENERAL

- SRTC has prepared a total of 42 Sitewide Baseline Change Control Packages during FY-95 and 36 of the packages have been approved by DOE.
- EES completed field installation of the electric pump power cart and submersible pump cable management system for the 105-K Basin Vacuum System.
- EES is assisting High Level Waste with the removal of lead counterweights from the 2H evaporator.
- EES implemented and tested the BARX barcode reader subsystem on SWAMI (Stored Waste Autonomous Mobile Inspector).
- EES has received all parts for the three End Effectors for the Light Duty Utility Arm (LDUA) being demonstrated at Hanford for in-tank remediation.
- EES coordinated a team meeting between SRTC, JBF Associates, and Sandia National Labs to draft the DECIDE Software Programming Specification document.
- EES Robotics and EDD visited Argonne National Laboratory to discuss collaboration on several programs for the Department of Defense.
- U. S. Patent #5,405,588 was awarded for a process for removing toxic cadmium from scrap metal and putting the cadmium in a safely disposable form.
- Temperatures predicted by a thermal model for the failed equipment storage vault system indicate that the components remain below temperature limits with a pair of full failed melters.
- The instrument poles, GC based tank vapor sampling system and data acquisition system were delivered and set up in a hut on top of Tank 48. On 9-1-95, the system was put into operation. On 9-2-95 the system successfully monitored the tank vapor space before, during and after the first chemical addition to the tank. Senior management from High Level Waste Division and DOE representatives were present to witness the first chemical addition. The successful operation of the vapor sampling system received very positive feedback.
- After waste glass canisters are filled with glass, a temporary plug is inserted in the nozzle of the canister. Prior to decontamination, the seal of the plug to the nozzle is leak checked. If the temporary plug fails to seal adequately, it is

removed from the nozzle and a repair plug is installed in its place. Repair plugs are also leak checked and three fourths of the repair plugs have failed the leak test. A probable cause for the leaks is that the tool used to hold and position the plug allows the plug to cock in the nozzle. The Experimental Thermal Fluids Group (ETF) designed and fabricated a new installation tool which is being tested by DWPF.

Progress and Accomplishments

TRITIUM

Function Test Facility (FTF) Startup Status - Y. K. Lutz, G. M. Thomas, B. Wilson, P. L. Morgan

The Function Test Facility (FTF) will be used to function Life Storage units, WR reservoirs, and other development units as specified by the Design Agencies. Tritium introduction will occur with the function test of a Life Storage Terrazzo unit.

The DOE-SR validation of the WSRC ORR was approved and the DOE ORR team began field work for the DOE ORR in mid-July. During the review, nine pre-start and one post-start items were identified along with several minor observations. Four pre-start items were resolved and several observations were addressed before the DOE ORR report was issued on August 2. The final five pre-start items involve updating safety documentation (3 findings requiring a SAR addendum) and completion of glovebox activity monitor surveillance (2 findings). The SAR addendum has been written and is in review by WSRC ESH&QA. The activity monitor surveillance is complete and the closure package is routing for approval. All pre-start items are scheduled to be closed by the end of August.

Current punchlist status:

Punchlist	WSRC RSA	WSRC ORR	DOE-SR ORR	Total
'A'	Closed	Closed	5	5
'B'	14	3	1	18

'A': Pre-start
'B': Post-start

Mini-Manifold Support - D. L. Fish, W. J. Rogier, T. J. Warren

A set of load equations has been developed and documented in WSRC-RP-95-859 for the mini-manifold to enable the ARMS program to be developed for units to be loaded on this system. The equations were written in a generic form which will allow different types of Acorn reservoirs to be loaded by simply supplying different input parameters without requiring rewrites of the loading equations. The methodology used for loading on the mini-manifold and the equations involved were reviewed with Bob Alexander and Tritium ARMS personnel. Tritium personnel have input approximately half of the equations to-date and preliminary reviews of the numbers generated appear to be good.

Upset Weld Development for Reservoir Fabrication - W. R. Kanne

The Test Authorization was approved and other arrangements were made for loading twelve vessels fabricated earlier by upset resistance welding as part of the program to develop resistance welding technology for fabrication of reservoirs. Tritium loading of the vessels is anticipated during September or October, 1995. All twelve vessels were made from High Energy Rate Forged (HERF) stainless steel, half from type 304L and half from type 316L. Prior to upset welding, half of each type were cleaned by the Nitradd process, previously used to clean all reservoir components before welding, and half were cleaned by the Oakite process, recently established by Los Alamos for cleaning their reservoir components prior to welding.

Additionally, SRTC provided a cost estimate to Los Alamos National Laboratory for upset welding discs into the bodies of special vessels. These vessels will be used for tritium storage tests at Los Alamos. The storage tests will demonstrate the long-term integrity of the vessel itself as well as the integrity of the upset weld. Discs will be joined to the bodies using plug welds about two inches in diameter. The configuration of this weld is similar to both the five inch diameter plug weld used to close the defense waste canisters in DWPF and the 1/4 inch diameter tube attachment welds used for

reclamation in the Tritium Facility. Funding for this program should be available in fiscal year 1996.

W76 PRT - D. L. Fish, O. S. Crout

A classified video conference was held with Brad Meyer of LANL to review the design of the SRS Acorn cleaning facility. Changes have been made to the system which will enable measurement of the amount of gas used in each step. The design was revised and then reviewed with the Acorn technology task team at the July PRT meeting. A number of recommendations were received as a result of this review. The primary recommendation was that SRS reconsider our position and fully automate the cleaning system. This will reduce errors as well as provide assurance that the process is reproducible. The DA's also reminded us that we need to be sure that we use at least research grade level gas for the cleaning. It was also recommended that we install U-traps on the gas inlet line as well as in the lines to the units to reduce the probability of contaminants reaching the units during cleaning. Brad Meyer and I will continue to run some tests to define the finer details of the cleaning procedure such as the final pumpout time.

Data Evaluated From Hydraulic Burst Test Facility - K. A. Dunn, J. V. Cordaro, W. D. Thompson

Nine reservoirs were hydraulically burst tested at SRS as part of the Round Robin tests between Mound, SRS and Kansas City Plant (KCP). These nine reservoirs consist of three reservoirs from each of the 1K, 2M, and 3E types. All of the reservoirs from each type used in the Round Robin testing were fabricated from the same heat of metal.

Once the reservoirs were burst tested the data was transferred to a Microsoft Excel format. Plots were made of pressure versus time for three different pressure transducers (two paroscientific and one precise) as well as volume expansion versus time. Data from each pressure transducer includes maximum pressure and burst pressure as well as the pressure where the curve deviates from linearity. Volume ductility as well as the time where the curve deviates from linearity can be obtained from the volume expansion versus time curve. The time can then be used to measure the pressure of "yielding" on the pressure versus time curves. Data provided from the pressure transducers did not vary considerably from one to another. These results were consistent with each burst test conducted. The volume expansion curves also correlated well with the pressure versus time curves with respect to the pressure at yielding. All of the data was transmitted to LANL on Thursday, July 27, 1995. SRS is expecting a letter from LANL stating the readiness of the hydraulic burst test facility for WR testing.

Review Of 2Y Document With LANL K. A. Dunn, S. L. Murphy

A meeting with LANL personnel was held on July 27, 1995, to discuss the 2Y document for the W88. The 2Y is a document from LANL which provides the requirements for the Reservoir Surveillance Operations (RSO) testing that will be done at SRS. The first system which will be function tested as part of RSO at SRS will be the W88. A 2Y document for the work Mound conducted on the W88 was obtained by SRS personnel through the Non-Nuclear Reconfiguration (NNR) document transfer. A new 2Y document must be written by LANL to provide guidance to SRS on each Weapon system.

SRS personnel from SRTC and Tritium Department met to discuss the content of the Mound 2Y document and had several questions for LANL. The meeting was held with LANL to convey the questions and request a 2Y document, specific to SRS, for the W88. SRS will be receiving a W88 assembly in late September for RSO testing. A follow-up meeting will be held on August 16, 1995.

Reservoir Surveillance Operations (RSO) - S. L. Murphy, A. F. Riechman, K. A. Dunn

SRTC/CHTS provides program coordination and Design Lab liaison for the RSO mission at SRS. Recent tasks accomplished in concert with Tritium personnel include: the establishment of storage facilities for RSO-related WR parts, procedure development for receiving, special inspection, disassembly and

re-assembly activities required for RSO units, utilizing ARMS to separate and track RSO reservoirs and associated parent weapon parts, and the presentation of an overview of RSO related testing at the Non Nuclear Reconfiguration (NNR) Program Review.

Storage cabinets have been set-up for storage of RSO-related WR parts. The Field Procurement Engineering Group has agreed to maintain the storage cabinets including inventory tracking. This shipping address has been given to Pantex and we await the arrival of several hundred W76 test bed parts from Pantex stores.

Many of the special inspections, disassembly and re-assembly activities required for surveillance testing will be performed by Packaging and Finishing. Procedure development by Tritium Engineering has begun for these operations and will be a critical path function to the successful completion of the Test Program Validation (TPV) prior to the W88 surveillance testing to begin in December 1995. The Automated Reservoir Management System (ARMS) will segregate RSO reservoirs from production related reservoirs by a unique identifier. Associated parent weapon parts, such as actuators, will also be identified in ARMS to ensure proper re-assembly after inspections and prior to function testing.

The RSO overview at the NNR Program Review included test capabilities (present and future) and schedule for weapon system testing. DOE/AL was generally satisfied with the progress, in spite of their imposed delays on the projects. The Weapons Quality Division (DOE/AL/WQD) requested that SRS make every effort to bring environmental conditioning and additional function test capability on-line ASAP to minimize impact on weapon system reliability. Action items resulting from the testing discussions were assigned for resolution.

Metal Hydride Isotherms with High Pressure Conditions - W. J. Rogier, J. W. Johnson

The performance of metal hydrides can be characterized by the examination of absorption or desorption isotherm curves. Several gas handling manifolds in CHTS are used for the acquisition of isotherm related data. However, existing isotherm manifolds in CHTS are typically rated to 500 psi or less.

The high pressure manifold in Cell 2 of building 774-A has recently been modified to allow the performance of isotherms at pressures up to about 8000 psi. Modifications include the addition of a Paroscientific 0-10,000 psia high accuracy pressure transducer, installation of a new rupture disk, and the use of either off-the-shelf Autoclave Engineers fittings rated for at least 20,000 psi or customized Cajon-Autoclave adapters proof tested at 9,000 psi. The test bed is made of larger diameter Autoclave Engineers fittings rated for 10,000 psi, and has enough capacity for 5-6 grams of metal hydride material. A water bath with a Neslab chiller/heater provides temperature control for the test bed. Thermocouples are available for attachment to the unit as well as various positions in and around high pressure calibrated volumes. A lower pressure section equipped with an MKS 10,000 torr baratron is available for use if more accuracy is needed during steps requiring low pressures. This section is double-valved off when not in use.

Some initial isotherms have been taken near room temperature on pure palladium using both hydrogen and deuterium. Palladium was chosen because of its well behaved hydride properties and broad understanding of its characteristics at lower pressures. Several runs have been conducted to date which have helped to identify needed slight modifications to the test setup and several precautions needed to assure accurate data. Important changes have included, modification of the test bed size to its current 5-6 gram capacity, definition of volume sizes needed to allow proper size aliquots of gas to be moved, and identification of steps needed to accurately measure temperatures in Cell 2 (which does not have climate control). Plots will be presented in future monthly reports.

Tritium Facilities Accident Analysis Support - L. K. Heung

To support the Safety Analysis of the "existing" Tritium Facilities, CHTS has been requested by

SARN/FPW to develop computer models to calculate tritium releases from the zeolite beds and the metal hydride beds in a hypothetical fire accident. The models have been developed and documented in E7 Calc-Notes.

The computer models included the 4-inch and 6-inch diameter zeolite beds, the cryogenic still feed bed, the hydride transport vessel (HTV) and the hydride storage vessel (HSV). The zeolite beds are used in the tritium stripper systems to adsorb tritiated water. The cryogenic still feed bed is a Pd/k (palladium deposited on kieselguhr) bed used to purify and pump hydrogen isotopes into the cryogenic still for isotopic separation. The HTV is a uranium bed used to transport tritium in a solid form, and the HSV is a titanium bed for long term safe storage of tritium. All these beds store tritium (tritium oxide in the case of zeolite beds) in a solid form, but can release the tritium when heated in a fire. The hypothetical fire is a 60-minute fire which reaches a maximum of 900 °F in 60 minutes. The fire then dies and cools down to room temperature in another 120 minutes. The fire heats up the beds which desorb the tritium as the temperature increases. The accident will also breach the containment of the vessels so that the tritium gas or water vapor can be vented to the ambient.

Under the assumed conditions the potential tritium releases from the beds cover a range from insignificant ($<10^{-6}$ mole %) to near completion (>99%). The order from the least release to the most release is HSV, zeolite bed, HTV, then cryogenic still feed bed. The HSV is the most stable in a fire accident.

Long Term Tritium Storage - J. E. Klein, K. L. Shanahan, J. R. Wermer, L. K. Heung

Due to the reduction of the nuclear weapons stockpile, the excess of tritium returned from the field will exceed facility process storage capacity. A hydride storage vessel (HSV) using titanium is being designed to store the excess tritium while it awaits reuse. CHTS/PTG has been asked to develop an experimental program to evaluate HSV absorption and desorption conditions needed for plant operations.

Ergenics Hy Stor-106, titanium "sponge" was recommended to Tritium for use in the HSV instead of 1/4 inch diameter by 1/4 inch titanium rod due to the relative ease of activation of the Ergenics material. 3 kg of material have been received for bench scale testing with another 10 kg ordered for the full-scale prototype vessels: CHTS is facilitating the procurement of the titanium for the plant vessels by defining the procurement specifications for the material. Difficulties encountered in activation of the material have been traced to impurities introduced by a leaky pressure regulator. Flushing and evacuating the system piping before hydriding the material has eliminated problems with hydriding the material at room temperature. An experimental design will be initiated to determine activation conditions need to load the HSV at room temperature.

Currently, vacuum evacuation at 600°C over night, hydriding at 600°C, and vacuum evacuation over night at 600°C are sufficient to allow room temperature hydriding of the material. Tests will be conducted to determine how lower temperatures and shorter evacuation times can be performed to obtain the same ambient temperature hydriding performance.

Hydride Storage Vessel - M. R. Duignan

In support of Tritium Engineering (TE) the Experimental Thermal Fluids (ETF) Group has been tasked to design, procure, and possibly test a vessel to store tritium in a Titanium matrix, called the Hydride Storage Vessel (HSV). The prototypic vessels were completed, including recent modifications requested by the customer. The procurement specification was completed and awaits a final decision on the form of Titanium to be used, after which the procurement process will continue.

Spent U-Bed Residual Tritium Estimates - J. S. Hölder, E. A. Clark

Uranium containing vessels (U-Beds) are employed in the regeneration of water scavenging strippers (Z-Beds). The "Z-Bed Recovery" process results in the removal of water from the Z-Bed, the oxidation of the U-Bed, and the formation of elemental hydrogen isotopes in the gas phase. During this process,

the U-Bed is maintained at elevated temperatures under varying gas compositions and pressures. Operating experience has shown that U-Beds become inactive after 80% of the elemental uranium has been oxidized and moisture breakthrough is observed down stream of the spent U-Bed. In order for the spent U-Bed to be disposed, a realistic estimate of the tritium remaining in the U-Bed must be made for waste characterization purposes. Two U-Beds are considered in this discussion; Z-Bed "A" was in service from August to December, 1994; Z-Bed "B" was in service from January to June, 1995.

Generally, residual tritium in a spent process U-Bed may be tied up in three locations: the bulk stainless steel in the walls of the vessel, the unreacted uranium, or the oxide layers on the surfaces of the vessel walls and the oxidized uranium. The issue of residual tritium in the vessel walls was addressed by Elliot Clark of the Materials Technology Section of SRTC in the memorandum SRT-MTS-953022. Dr. Clark's calculations show that the vessel walls contain on the order of 25 Ci of residual tritium. Values for the other two types of residual tritium were addressed in the memorandum SRT-HTS-95-0177.

For the U-Beds under consideration here, the major source of residual tritium may be found in the stainless steel walls of the vessels. A minor contribution is from tritium dissolved in unreacted uranium. No residual tritium is attributed to surface oxides. These conclusions were based on the process history of these U-Beds as related by Tritium Engineering. All calculations are specific to these two U-Beds and are not meant to be applied to waste characterization of U-Beds in general.

The two U-Beds were estimated to contain 29 ± 25 and 19 ± 15 Curies of residual tritium. The large degree of relative uncertainty is attributed to the vessel wall estimates which encompass a large range of operating parameters. The contributions from unreacted uranium were based on the terminal solubility of hydrogen in alpha phase uranium and are maximum or high estimates. See the authors of the cited reports for more details.

RTF TCAP Improvements and Performance - John Scogin

During the week of March 6, TCAP column A was run at a series of increasing reflux ratios. The data generated during this test was used to set a higher reflux ratio and a correspondingly high feed rate. Although the TCAP cycle is now slightly longer, the increase in feed rate should realize an 11.5% increase in throughput while maintaining the current product purity.

A six week campaign to verify the TCAP sequence modifications was completed on June 30. Excellent results were obtained in the stackable run, and the new sequence performs well, with only a few minor problems which will be corrected by August. Additionally, the operating procedure has been modified and improved.

Improvements in the control sequence include: improved operation of calibrated volumes (CVs), allowing operation to begin with any pressure in the CVs; easier transitions from reflux mode to on-line mode, which improves operations; and the addition of several alarms, which will prevent on-line operation with empty feeds beds or full storage beds. These improvements were thoroughly tested both off-line and in inplant operation. These modifications allowed TCAP to process low concentration feed, a requirement for producing stackable deuterium.

[NOTE: Stackable deuterium is not determined by a simple purity level, but by the stack limits of the building. As a rule of thumb, there are 2.6 Ci per 1000 STPL / ppm. (e.g., 1000 STPL of 6 ppm D2 would contain 16 Ci, 2000 STPL of 4 ppm D2 would contain 21 Ci.) For example, if a building had a 30 Ci/day limit, then, on a day with no detectable releases, ~20 Ci could be stacked at 2345 without causing an incident or occurrence.]

In addition to verifying the sequence modifications, this campaign tested the ability of TCAP to strip tritium from deuterium. A feed of 0.85% was introduced to column B, which had never been exposed to high levels of tritium, and also to column A, which had been in production operation for a year.

The stackable results were quite good: both RTF TCAP columns produced clean D2 that slightly exceeds the purity of what the still produces on a stackable D2 run, though at a slightly lower throughput. The most surprising result is that Column A produced gas that contained only about 50% to 75% more tritium as that produced by column B. This demonstrates that it is not necessary to devote a TCAP unit to the production of stackable D2; a column with high tritium exposure can be used after a transition period.

It is evident that it takes several days for a used column to begin to deliver this ultra-high purity raffinate. During this run, the TCAP system parameters were more like those used for Advanced Hydride Laboratory H-D runs than those typically used in the RTF for D-T separations.

The sequence modifications will have a tremendous impact on RTF operations, as TCAP will now have a much higher throughput. Both columns may now be used, beds can be switched while the columns are ONLINE, and the modes may be switched from ONLINE to REFLUX and back to ONLINE without numerous cycles of REFLUX. The sequence graphics are now more informative, and alarms have been installed to warn of empty feed beds and full storage beds.

Recently, the operating procedure was modified to not only run both columns, but to improve the conduct of operations for TCAP. Many unnecessary steps and signoffs were eliminated, and record keeping was greatly simplified. TCAP is now fully integrated into the RTF operation.

Guidelines for Valves in Tritium Service - E. A. Clark

In September 1994, the U. S. Department of Energy Office of Nuclear Safety (ONS) issued a Technical Notice entitled "Guidelines for Valves in Tritium Service," which provides guidelines for selecting valves for tritium service. Most of the ONS Guidelines are consistent with SRS experience, and help ensure the safest choice of valves. Valves for tritium service at the Savannah River Site are selected using the vast service experience in the Tritium Facilities. Some valves used in the Tritium Facilities at the Savannah River Site (SRS) do not follow one or more of either the "Strongly Recommended Practices" or "Other Recommended Practices" listed in this Notice.

A telephone conversation with the author revealed that the Technical Notice was meant to publish and exchange information about valves in tritium service only, not to control or regulate the choice of valves in any particular tritium facility. He emphasized that valves should be evaluated based on the consequences of a failure, and the degree of exposure of the valve to tritium.

Based on this telephone conversation and currently used valve specifications, it is recommended (memorandum SRT-MTS-95-3021, 7/10/95) that valves continue to be selected at Savannah River Site Tritium Facilities using the Site's experience and other appropriate technical factors and required codes. The ONS Guidelines are generally sound and should be followed where appropriate. However, based on the intent of the ONS Guidelines as discussed with its author, it is recommended that the Tritium Facilities continue to use particular valves that may not follow one or more of the Guidelines, when Tritium Facility experience shows that the valve is acceptable. The cost of immediately changing all valves to strictly follow all of the Guidelines is prohibitive and unnecessary, and would expose workers to radioactivity without reason. A new program could be established to gather information about tritium valve performance and exchange this information among DOE tritium facilities, however funding for this activity is not currently identified in out-year budgets.

RTF Material Procurement
R. A. Malstrom

Qualification lots of material were received from two potential suppliers of palladium. Large quantities of material are needed for hydrogen storage in the RTF. These qualification lots, along with round-robin samples from LANL, are being analyzed for chemical impurities and physical properties at SRTC and LANL. Most analytical results have been reported and only one supplier meets all the specifications.

Purchasing is proceeding with a single source procurement.

Analysis of Motor Control Center Residue - R. A. Malstrom, A. R. Jurgensen

A greenish residue was discovered coming from electrical conduit in the Tritium Facilities. This residue was analyzed using X-ray fluorescence. Based on these results, the probable cause of the residue was breakdown of the wire's PVC insulation. These results were reported to Tritium personnel within hours of sample receipt.

Analysis of Material from Kanne Chamber - M. E. Summer, R. A. Malstrom

A Kanne chamber attached to the RTF stripper system had an elevated background. Disk smears were taken of the chamber and analyzed by electron microscopy. Results showed the presence of phosphorous (probably from the soap used to clean the chamber), several metallic impurities (silver, tin, steel) and a residue which could be mica or zeolite. The mica, which is present in the SRS ground water, could be introduced during the cleaning of the chamber. The zeolite would come from the zeolite traps used to trap water. ADS offered to do additional work to determine whether the particles are zeolite or mica, however, the facility elected not to pursue further analysis.

RTF Valve Material Identification M. A. Hutchens, R. A. Malstom

As part of a failure evaluation, ADS analyzed the tip of a valve used in the RTF. There was a concern that the tip was fabricated from Vespel instead of the specified ultra-high molecular weight polyethylene. The tip was analyzed using a Fourier-Transform Infra-red spectrometer and the results showed that the material was correct.

Analysis of Tritium Exit Signs for the NRC - J. R. Wermer

Analysis of data collected in Task 1 was completed and a final report was submitted to WSRC publications. It will be released to the NRC as soon as the WSRC/DOE review is complete. The report details the analysis of tritium exit signs from five U. S. manufacturers which license signs through the U.S. Nuclear Regulatory Commission. The gaseous contents of 51 source tubes removed from these signs were analyzed to determine the ratio of elemental tritium to tritium oxide (HT/HTO) in these devices. The sample chamber was then flushed with room air to determine the tritium removed from the solids (as HTO) through air exposure.

The results of these tests generally showed that the gaseous contents of the tubes contained very little tritium oxide (HTO). The bulk of the tritium oxide was evolved from air exposure to the broken tube fragments. Three dose scenarios were developed which attempted to simulate accidents in places such as a large warehouse where a carton of tritium exit signs was damaged, or an office or dorm room in which a single source tube was broken. The analysis showed that the doses were quite small. Typical personnel doses (CEDE) for the three dose scenarios which were evaluated ranged from 0.047-0.077 mSv (4.7-7.7 mRem). In contrast, the annual dose from background radiation (both natural and man-made sources) averages about 3 mSv (300 mRem).

Based on the results of Task 1, the NRC decided not to pursue additional studies.

Tritium Support - Joe Cordaro

EES is continuing to support the new Function Test Facility. Permanent installation of the following hardware was completed: rotameters into the glove box ventilation system, simulation line piping and instrumentation in glove box A, and a new balzer pump demister. DCFs for all of the work have been submitted to document control.

EES delivered four receiver station unloading inserts for the 16004 units on schedule. These inserts are used to assist in laser unloading of the tritium units and are key to production milestones.

EES is in the process of testing a concept for confirming that a reservoir has been

successfully unloaded. A differential thermoelectric calorimeter has been prototyped and initially tested for checking the units. The design insulates the unit with one heat removal path. In the heat removal path, there is a thermoelectric cooler which produces a voltage proportional to the temperature differential. Two calorimeters were assembled, one for unit measurements and one for reference. Initial results demonstrated a standard deviation of 500 curies, and further testing in the tritium area is currently being planned.

EES has completed the software for the replacement Data Acquisition System for the pneumatic burst test facility. Installation into will begin the first week of September.

EES received approval to begin work on a new stripper system ion chamber from Tritium Projects. The first step of the project is to develop a spool piece that will divert a small amount of flow into the new smaller ion chambers. The advantages of the new chambers include easy installation and disassembly for decon. The spool piece with new ion chamber will directly replace the existing Nuclear Research Corporation chamber which is difficult to decon.

Non-Nuclear Reconfiguration - Joe Cordaro

EES and SPS have completed all work required for the new Hydraulic Burst test system. This is the first facility to become operational under the Non-Nuclear Reconfiguration (NNR) project in the DOE complex. EES was requested to expedite the schedule by eight months to shorten the gap in testing caused by an early closing of EG&G Mound Labs. The expedited schedule was met with no overtime charged by the engineering team. The work completed this month includes the successful strain gage burst test of a 2J reservoir and the volume ductility test of a fourth 3E unit. Software upgrades were made that will allow for easy zeroing of the Paroscientific pressure transducers, and all punch-list items are complete. Both Los Alamos and DOE SR have given approval for production operations.

EES is in the process of ordering material for the new Flow Tester. The Flow Tester is required to support Reservoir Surveillance Operations. The draft design review report has been prepared from the Sandia meeting and should be issued by August 30.

EES has completed the design of the receiver tanks for all weapon systems to be functioned in the Function Test Facility. The tanks will be ASME stamped vessels fabricated by an offsite vendor.

EES has begun fabrication of the Ion Chamber Current Measurement instrumentation, and 90% of the material has been received. The hardware will be used to sample secondary containers that contain tritium vessels. The work is associated with the new Environmental Chambers for NNR

In response to a Los Alamos request, EES has developed an easy method to measure a deuterium leak rate in the presence of helium. A slight modification to an existing leak testing system in tritium can be made to accommodate this test.

EES and SPS completed all work associated with the transfer storage/secondary containers for NNR. The final shipment of containers to EG&G Mound was completed July 31. All schedule milestones were met, and the project was completed under budget. At this time, the containers will be used to ship tritium development units from EG&G Mound to Los Alamos.

SEPARATIONS

Pretreatment Development Program for Americium/Curium Vitrification
(T. S. Rudisill)

Approximately 15,000 liters of solution containing isotopes of americium (Am) and curium (Cm) are currently stored in F-Canyon. An analysis of disposition alternatives has resulted in the recommendation to stabilize the Am/Cm in a borosilicate glass. NMSP Planning has requested CHTS assistance to define the pretreatment flowsheet for the proposed vitrification process. Pretreatment operations include adjusting the nitric acid (HNO_3) concentration of the solution to <1M, precipitating the actinides and lanthanides as oxalates, washing soluble metallic impurities from the precipitate slurry, solubilizing the precipitate, and adjusting the HNO_3 concentration prior to vitrification. The proposed flowsheet for these operations is based on previous development work and plant operating experience. Specific experimental needs include demonstration of the oxalate precipitation to measure the solubility of metallic impurities which have an impact on the glass formulation and measuring the settling rate and specific volume of the precipitate slurry to allow design of the solution transfer equipment.

Uranium oxalate solubility experiments were performed for the Am/Cm pretreatment development program. As expected, uranium (VI) forms soluble complexes when combined with oxalic acid and does not precipitate. The experiments were performed, by adding 0.9M oxalic acid to an uranyl nitrate solution (0.6 gram/liter uranium) until excess oxalic acid concentrations of 0.3 and 0.6M were obtained. The oxalic acid additions were made at 60°C followed by a 4 hour digestion period at 45°C.

An additional uranium solubility experiment was performed to determine if uranium will co-precipitate in the presence of the lanthanides and other actinides which form insoluble oxalate compounds in dilute nitric acid. The molar ratio of uranium to lanthanum was prepared to simulate the ratio of uranium to all insoluble oxalate species in tank 17.1. The oxalic acid addition was made at 60°C followed by a 4 hour digestion period at 45°C. As expected, these conditions resulted in a (lanthanum) precipitate in the reaction vessel. The extent of uranium precipitation will be determined from analysis of the precipitate supernate.

Spectrometer Upgrades - L. C. Baylor

ADS was contacted by Ron Livingston of F-area labs to replace an old HP-8451 spectrophotometer used for plutonium analyses with a newer HP-8452A unit and updated software, while maintaining the current operator interface (a TransTerm keyboard).

The old HP software code has been translated into QuickBasic and now exists as a module inside the standard ADS SPECTRO software package. The last major logistical problem with the code - handling of the chemometric models - has been worked out and testing and debugging of the code is in progress on the actual computer that will go to F-Area. Sets of "uranium" and "plutonium" samples have been prepared using yellow and blue food color to allow for extensive testing and evaluation in a cold lab in 773-A, before transport of the system to F-Area.

FB-Line Ion Exchange Column Vent Lines - N. M. Askew

Gas is generated in the FB-Line ion exchange columns during normal operation. Each column has an ever-open vent line to exhaust these gases, thereby preventing a hazardous increase in pressure. These vent lines have been shown to be adequate during normal operation. A partial blockage in a vent line would increase the flow resistance, leading to an increase in column pressures for a given amount of gas generation.

An actual partial blockage would probably be due to an accumulation of solid material in the line. While it is impossible to calculate the actual loss coefficient for every possible accumulation of material, a hypothetical blockage can be considered in order to determine its effect on vent line flow resistance. The blockage considered here is that due to an

orifice plate that blocks 90% of the flow area (approximately 81% of the diameter) of the vent line. Such an orifice has a loss coefficient of 245. This is a significant flow resistance, especially when compared to the sum of the flow resistances for the anion and cation vent lines, which are 174 and 62, respectively.

The worst case (highest) pressure drop would occur if the vent lines should be filled with liquid. The pressure drop was calculated for the flow of 8M nitric acid through the vent lines assuming a density of 81 lbs per cu. ft. and a viscosity of 1 centipoise. The pressure drop for the anion and cation vent lines was found to be 16.8 psi and 15.7 psi, respectively. 14.6 psi of this is due to the static head created by the 26 foot vertical rise. The hypothetical partial blockage described above increases the pressure drop across these lines by another 4.2 psi. Therefore, the additional resistance would increase the pressure drops to 21.0 psi and 19.9 psi. The ion exchange columns can easily withstand the added pressure.

For lines that are clear of liquid, i.e. for flow of gas only, the pressure drop through even a partially blocked line is a negligible 0.03 psi, with 0.006 psi of this due to the blockage.

FB-Line Waste Certification Smear Results - R. A. Sigg and D. P. DiPrete

The low level waste certification plan requires that process knowledge of potential radioactive contaminants in waste be substantiated by analysis of smears taken from the appropriate process areas where the waste was generated. Some FB-Line smears analyzed by an off-site laboratory showed Tc-99 values that were about 5 orders of magnitude too high relative to Pu-239 based on process knowledge. Analytical Development Section was asked to analyze other FB-Line smears that were collected concurrently with the samples for the commercial laboratory to verify the results.

ADS developed the protocol below to examine the smear samples. This procedure determined that Tc-99 to Pu-239 ratios were less than about 1×10^5, which is consistent with what would be expected.

-Add appropriate tracers to the samples for yield determinations. Six hour Tc-99m tracer was prepared by activation of an ammonium molybdate target in the ADS Californium Neutron Activation Facility.
-Digest the smears.
-Radiochemically separate Tc and Pu from separate fractions of the digest solution using Eichrom extraction chromatography columns.
-Apply liquid scintillation counting (LSC), and alpha and gamma spectrometry to the separated samples.
-Add NIST traceable spikes (standard addition method) to the samples and recounting to determine counting efficiencies.

In examining the LSC spectra, some alpha activity was in the Tc samples. Tc values were then determined by integrating counts in interference-free regions of the spectra. Tc counting efficiencies were determined by integrating counts in the same regions on the NIST traceable standards.

If ADS had used an LSC counter that did not provide an output spectrum or had accepted LSC results without examining the spectrum, some alpha activity would have been misassigned to Tc-99. This would have resulted in a significant overstatement of the Tc-99 activity.

FB-Line Fissile Material Hold-up Monitoring - R. C. Hochel and F. S. Moore,

FB-Line performs an annual survey of ventilation system duct- work for accumulation of fissile material. This survey has not been performed while the facility was not in operation. FB-Line requested ADS assistance in performing the survey, which is a requirement for startup.

ADS is in the process of developing a procedure that can be used to perform this survey and can be used in the future by FB-Line personnel to meet the annual requirement.

Simulation And Analysis Of The Plutonium Shipping Container Subject To 30-Foot Drops -
C. Gong and N. K. Gupta

Finite element simulation and dynamic impact analyses of the 30-foot drops of a 5320 shipping container are performed. The new ABAQUS / Explicit dynamic program is used for the calculations. The results are comparable with observed test data.

The structure of the shipping container 5320 consists of more than 20 different structural components and seven different materials. Between the various structural components, there are at least six contact interfaces. A few important mechanical factors in this dynamic analysis that cannot be neglected are:

- Material nonlinearity, elastic-plastic responses.
- Geometric nonlinearity, large deformation and finite strains.
- Wave propagation through the entire structure.
- Discontinuities between the interfaces of several structural components.

In order to analyze the effects of impact from 30-foot drops upon the integrity of the shipping container, a comprehensive dynamic simulation and analysis of the entire structure is indispensable.

In this preliminary study, three conditions have been considered:

(1) Vertical upright (bottom) drop of the whole shipping container from 30-foot height;
(2) Vertical upside-down (top) drop of the whole shipping container from 30-foot height; and
(3) Vertical side) drop of the whole shipping container from 30-foot height.

The interfaces between the structural components of this container system have various connectivity conditions. The characteristics of the interfaces will influence the dynamic behavior of the system. The mathematical models of the interfaces provide physically sensible effects to the analysis.

The initial condition of each of the three drops is at the moment when the container just touches the ground at an initial velocity of 527.5 inches per second. In each of the attachment bolts, 4 ksi initial tension is applied. The unyielding ground in each case is simulated with a rigid surface in each location.

The overall deformation of the container in the three drop analyses are comparable to the deformed configurations of the test samples. The stresses and kinematic results are to be extracted from the computer output.

The stresses in the primary containment vessel are well below the yield limit in all the three drops. The accelerations in the direct impacted areas are above 3,000 g (the acceleration of gravity). However, the acceleration in the second and primary containment vessels are below 750 g.

Plutonium-238 Processing Support - J. H. Gray, K. J. Kalbaugh

Prior to initiation of processing post-Cassini Pu-238 in the frames waste column, solids remaining in frames waste column feed tank 16.4 and waste receipt tank 16.2 were characterized. Issues involved with determination of Pu-238 content in solids include accountability, column loading, tank 16.4 heel content following recycling, and tank 16.2 inventory before transfer to waste.

Two sets of four solution samples containing solids were received from tanks 16.2 and 16.4 for characterization. The volume of solids in solution samples from 16.2 was well below volumes normally found in 16.4 solutions. The average Pu-238 content after blank correction was only 1.1 micrograms. Most of the solids were iron, chromium, nickel corrosion products, with trace amounts of zinc, palladium, gold, thorium, silicon, aluminium, and calcium. No Pu-238 remained after boiling in HNO_3-HF solutions.

The volume of solids remaining in the heel solution in tank 16.4 was typical for 16.4 feed solutions. The Pu-238 concentration was high, with an average value of 71.4 micrograms. A few specks of Pu-238 remained in some of the

16.4 solids after boiling in HNO_3-HF solutions. Most of the solids contained the usual stainless steel corrosion products, silicon, aluminum, and titanium. A few of the more unusual elements identified included tantalum, platinum, iridium, and tungsten.

Tributyl Phosphate Behavior During Evaporation - J. H. Gray, K. J. Kalbaugh, and S. J. Crump

One mechanism postulated for accumulation of organics in H-Area outside facility tanks, is collection of condensate from evaporation of nitric acid solutions containing tributyl phosphate (TBP)-n-dodecane. Until samples of these organics are collected and analyzed, the assumption has been the organics contain TBP. However, because TBP has a high boiling point, greater than 180°C, an evaporation study was performed to determine the behavior of TBP and identify the formation of other organics during boiling of a nitric acid solution.

The laboratory study consisted of boiling a one molar nitric acid solution containing 0.5 volume % TBP-n-dodecane. The condensate was collected until the nitric acid molarity in the heel solution reached ~8 molar. Both heel and condensate were then analyzed by gas chromatography/mass spectrometry (GC/MS) analysis.

The final nitric acid concentration was 8.9 molar in the heel and 0.15 molar in the condensate. A nitric acid material balance confirmed greater than 99% of the nitric acid remained in solution.

Three organic compounds were identified; one in the condensate and two in the heel. TBP was the only organic compound found in the condensate. The 70mg TBP found represented approximately 16% of the original TBP in the evaporator. Steam stripping of a portion of the TBP could account for TBP in the condensate.

No TBP remained in the heel. The only acid hydrolysis product of TBP identified was the phosphorus ester $O=P(OC_2H_4OC_4H_9)_3$. The other organic compound in the heel was 2-pentyl nitrate, $CH_3CH\text{-}ONO_2C_3H_7$, a reaction product of n-dodecane.

Separations- Jim Wong

EES has begun fabricating supporting equipment for the Special Nuclear Materials (SNM) Vault Test Calorimeter, and machine shop work is nearly complete on the test calorimeter. Software development is continuing, and mechanical completion is expected in December.

Drawings have been delivered to the 717-A machine shop for fabrication of 25 Primary Containment Vessel (PCV) mock-up containers, and fabrication will begin as soon as the work authorization is complete.

The Vault storage rack mock-up is nearly complete in Building 305-A with some minor finishing touches remaining.

The vendor and technical information search on the Automatic Guided Vehicle (AGV) is complete, and a purchase specification is currently being prepared for the AGV.

A vendor and technical information search is continuing for gas sample analysis of the PCV. An effort was initiated for LANL to develop a laser drilling system in support of gas sampling. The LANL and SRS efforts will result in the fabrication of a prototype laser drilling and gas sampling system.

EES has completed a redesign of the Bagless Transfer system for FB-Line, and reviews are complete. Detailed drawings of the parts to be fabricated have been started. Purchase requisitions for the major components (cutter, welder) and for the weld qualification canisters have been placed.

Discussions on the collaborative effort between LANL and EES/NMP to install a bagless transfer system at LANL for hot testing are continuing.

EES is continuing work on the Americium/Curium (Am/Cu) Pilot System being installed at TNX. The frit feeder has been moved to TNX and initially tested. Designs for the dry feed equipment have been delivered to the TNX works engineering group, and the design for the solution feed at TNX is complete. Team members traveled to GAFTEC in

Nashville to discuss installation and start-up requirements of melter #1 with the vendor. An equipment list for the activity was developed, and all component, except the off-gas plenum and piping spool pieces, have been ordered.

EES has written the Constant Air Monitor (CAM) Design Qualification Testing procedure, which is currently out for review. Testing will begin following procedure approval. As an interim measure, several modifications are planned for the existing CAMs to reduce the number of false alarms. A pre-job meeting with H-Area Radiation Monitoring Equipment Maintenance personnel will be conducted August 29 in preparation for modifications scheduled on August 30. One CAM will be tested with the interim modifications, and the remaining H-Area CAMs will be modified at a later date.

EES was requested by Separations Engineering to investigate the cause of high count rate alarms in the Effluent Water Monitor System. The initial investigation determined the high count rates resulted from axial motion of the monitor's epoxy based scintillation plate. EES has performed testing on a Lexan based scintillator and demonstrated that the Lexan base reduces the axial motion and subsequently the high count rate alarms.

EES was requested by Separations Engineering to perform failure analysis on the F/H-Area hot crane shaft coupling bolts. It was determined that the bolts were failing due to overload. Further investigation revealed that the coupling manufacturer specifies a grade 5 bolt verses the failing bolts which were the equivalent of a weaker grade 2. EES, in conjunction with MTS, respecified the appropriate materials and expedited the order for new bolts. After a procurement error and a substandard bolts shipment, the new bolts were delivered to F/H-Area personnel.

EES-Robotics has designed a new generation Camera in a Drum (CID) system to provide remote video camera deployment to all elevations (bridge to floor) in H-canyon. The original CID, developed for the old canyon cranes, has been redesigned for compatibility with the new cranes. The new, fully sealed, crane control system requires a CID that will work through the main canyon video controls.

ENVIRONMENTAL

The August Environmental information will be combined with the September Environmental information and may be found in WSRC-TR-95-100-9.

WASTE MANAGEMENT

OTD Program on Continuous Emissions Monitoring(CEM) - D. B. Burns

Continuous monitoring of emissions from hazardous and mixed waste thermal treatment processes is desired for verification of emission compliance, process control, and public safety perception. A number of programs are currently being funded by DOE, EPA, and private industry to develop technologies for CEM for heavy metals, particulates, organics and radionuclides. Continued advancement and future implementation of these technolgies require pilot and full-scale demonstration tests in realistic industrial environments. The OTD and EPA have funded IWT $1M to conduct a CEM technology demonstration program that includes development of test protocols, identification of CEM prototypes ready for testing, and demonstration tests. Test protocols were written and 12 CEM prototypes for testing were selected earlier this year. During the week of July 31, testing began at the EPA Incineration Facility in Jefferson, Arkansas. Testing will be completed by September and final documentation on the results by November. Additional funding for FY96 is being sought from the Landfill Stabilization Focus Area and the Mixed Waste Focus Area to continue testing on additional technolgies and full scale demos on the most promising of the tested technolgies.

SCDHEC Swarf Proposal - S. T. Wach, J. P. Bibler, D. Leader, J. L. Siler, B. Jenkins

The Business Development Department and Interim Waste Technology have submitted a feasibility study proposal to South Carolina DHEC and three commercial clients. The work would explore the validity of major technical components of a proposed swarf reclamation system. Swarf is the residual waste from steel machining and grinding operations. Valuable oil and steel would be extracted from the waste for reuse. Initial work conducted under the Industrial Assistance Program indicated that such a system would be feasible. The commercial clients could recover their initial investment in such a system within a few years of operation.

Assistance for CIF - D. L. Fisher

Solid Waste is in the process of checking out and running systems to prepare for the CIF trial burn. During the week of August 7, problems arose with the second fuel oil burner in the CIF rotary kiln. As the burner is lit, the chamber pressure becomes positive. A safety interlock timer cuts off fuel flow to the burner once the pressure is postive for a certain time period. While lighting this burner, positive pressure was present for too long, which tripped the safety interlock. Solid Waste Engineering asked IWT(Don Fisher) to run the TNX pilot kiln seal test unit to determine the amount of escaping gases as the chamber pressure is positive. The test unit was quickly set up, and within 48 hours the required information was supplied to the customer. This information was used to support a proposal to adjust the timer interlock to allow safe operation of the burner during this system test.

Off-Gas Components Test Facility Optimizing CIF Strategy - D. B. Burns, J. P. Wood, A. Wong, B. W. Walker

The Off-gas Components Test Facility(OCTF) is a 1/10 scale pilot facility at TNX, which is being used to evaluate and optimize operating performance of the CIF off-gas system. Previous testing showed the HEPA prefilter and filter life may be only several days at expected CIF conditions. The OCTF has been on a critical schedule to test several options that will resolve this problem: increased steam and water flow to the scrubber, and cleanable HEPA prefilters. During a ten day run with these options in place, it was demonstrated that the HEPA prefilter and filter life can be extended to at least 30 days, which is highly acceptable. Subsequent tests have been conducted with reduced steam flow to the scrubber to help determine an acceptable flowrate for the upcoming trial burn(and to reduce steam

costs). A recent test of 2 weeks duration has demonstrated that HEPA filter and prefilter life will be at least 15 days with the original steam flow to the scrubber, as long as higher water flows to the scrubber are maintained and the cleanable HEPA prefilters are in place. The OCTF was shutdown on 8/23 for quench nozzle cleaning, HEPA prefilter and filter changes, and a number of preventative maintenance activities. It will be restarted the week of 8/28 to test further optimization strategies.

Tank 51H Replacement Pumps - J. P. Wood

J. P. Wood observed the latest Bingham Quad Volute Slurry Pump test conducted at Sulzer-Bingham's manufacturing facility in Portland, OR. during the period 11-12 August. The objective of these tests has been to identify hardware modifications required to eliminate the shaft/impeller/casing wear identified during pre-installation testing conducted at TNX. The latest test utilized a sand cast impeller subjected to extremely careful final machining/handworking to ensure the final product was as symmetrical as possible thus minimizing unbalanced hydraulic forces. This test utilized a pump casing with the suction eye machined to 8.55" (vs. design of 8.53" +0.01"/-0.0"), thus yielding an increased impeller/casing clearance. Previously identified modifications on the lower shaft and lowest carbon bushing were also employed. A 24-hr. test was conducted.Test instrumentation consisted of one pair of x and y proximity probes mounted near the pump casing and another pair mounted near the coupling. Runouts (TIR) measured at the lower end of the shaft near the casing ranged from 4.0 - 7.1 mils (x-probe) and from 9.0-14.5 mils (y-probe) indicating an elliptical shaft orbit. Runouts measured adjacent to the coupling ranged from 1.2-2.5 mils (x) and 2.6-3.1 mils (y). The post-test inspection of the pump, impeller and casing yielded no observable wear on any components.

Unfortunately, Sulzer-Bingham failed to develop appropriate test acceptance criteria prior to the test. Appropriate acceptance criteria (along with the supporting technical bases) have been developed by SRTC and transmitted to HLWE. This analysis indicates that shaft runout at the location of the lower proximity probes should be < 10 mils to ensure that the pump will operate properly in a liquid with specific gravity of 1.6. To provide further reduction of imbalanced hydraulic forces at the impeller, HLW currently plans to implement an SRTC recommendation to procure new impellers with extremely tight dimensional tolerances manufactured using 5-axis milling machines.

SRTC has also performed an independent review of Sulzer-Bingham's design calculations for the modified lower shaft. This review indicates the shaft design is adequate from the standpoint of stress and fatigue and requests that Sulzer-Bingham provide additional information relative to the assessment of critical speed. Westinghouse Electro-Mechanical Division has also been asked to provide an analysis of the current shaft design.

WSRC/WHC Advanced Mixer Pump Development Program - M. J. Dalmaso

The WSRC/WHC Joint Advanced Mixer Pump Development Program is a cooperative effort between WSRC and SRS to develop an advanced design slurry pump that is both reliable and effective. Contracts are now in place with Westinghouse Electromechanical Division (W-EMD) and Lawrence Pump to develop designs. W-EMD is developing a canned pump design, while Lawrence is developing a gas-filled column design. SRTC (TAMOSAITIS/DALMASO) attended the preliminary design review of the Lawrence design held at the manufacturing facilty in Lawrence, MA on 9 August. Final designs from both Lawrence and W-EMD are due in late September.

Flammability of Sodium Tetraphenylborate Cold Feed Material M. J. Barnes

The recent Operational Ready Review of the In-Tank Precipitation (ITP) facility raised a concern that cargo tankers of sodium tetraphenylborate (NaTPB) solution, during

unloading at ITP, will lose their nitrogen inerting atmosphere. Due to residual amounts of benzene, a decomposition product, contained in the NaTPB solution, a flammable gas mixture may form. At the request of High Level Waste Engineering (HLWE), the maximum soluble benzene concentration, capable of maintaining a vapor mixture at less than 25% of the lower flammable limit, was calculated.

Calculations defined the maximum soluble benzene concentration, capable of maintaining a vapor mixture at less than 25% of the lower flammable limit, as a function of temperature and tanker volume. For NaTPB solution at 25°C, the maximum soluble benzene concentration, capable of maintaining a vapor mixture at less than 25% of the lower flammable limit, is 97 mg/L. For NaTPB solution at 40°C, the maximum soluble benzene concentration, capable of maintaining a vapor mixture at less than 25% of the lower flammable limit, is 50 mg/L. The data suggest that a flammable gas mixture may form (if not controlled) since typical NaTPB solutions have benzene concentrations ranging from 50 mg/L to 500 mg/L. As a result, HLWE is investigating options to prevent the formation of a flammable gas mixture in cargo tankers of sodium tetraphenylborate (NaTPB) solution during unloading at ITP.

Tank Focus Area Filtration Studies
R. A. Peterson, C. A. Nash, and D. J. McCabe

Previously, testing was initiated utilizing simulants for processes at Oak Ridge National Lab (ORNL) and Hanford. The bulk of the preceding work focused on the use of 0.5 micron stainless steel Mott filters. More recent work has been investigating the possiblity of employing alternative filters for these processes. Particular filters that have been investigated include a filter produced by Grave that contains a titania coating on a 0.5 micron stainless steel filter, a 2.0 micron Mott filter and a Vacco etched disc filter. To date, the most promising of these technologies has been the Grave filter. This filter outperformed the 0.5 micron Mott filter when processing relatively dilute (<0.05 wt % solids) streams containing a significant concentration of solid fines. Additional work is scheduled to investigate other filter alternatives.

High Level Waste - Malcolm Kyle

EES has completed electrical fabrication and testing of the Waste Tank Interior Video Inspection System control boxes. The deployment cable reel is currently being fabricated with an expected delivery date of September 15. The camera housings are currently being fabricated with an expected delivery date of September 21.

EES has begun electrical fabrication for the Annulus Camera System control boxes and is approximately 70% complete. Programming for position feedback is currently being done to provide a display of position in units of inches and feet.

EES was requested to troubleshoot a problem encountered with the ITP camera system during a test in the ITP Filter Building. The problem was intermittent failure of control functions while in use in the building. All functions worked correctly when used in a location other than the filter building. Two possible causes were identified: overheating of components on the control circuit board caused by heat in the filter building combined with heat generated inside the control box or damage to the coax used to transmit the control signals. EES has requested to be called the next time the system is used to try and determine the exact cause.

Defense Waste Processing Facility - Malcolm Kyle

EES completed and delivered all four Analytical Cell control cabinets to DWPF on schedule. The following items have also been completed: fabrication of all cables for the entire system, modifications for all in-cell electrical equipment, electrical fabrication of all sixteen internal junction boxes, fabrication and assembly of cell wall mounting brackets, DCP to modify inner walls of cells, and modifications to the buret system software.

Design work is complete for the following: wall mounting brackets to provide properly spaced

mounting for the in-cell junction boxes, junction box brackets, counterweights, and bails to allow the in-cell crane to transport the boxes, five microwave oven lifting bails, remote shelving, and modifications to Lemo connect/disconnect device #1A and spacer plates.

EES is continuing to work with DWPF on the Melter Pour Spout Modifications. PAR won the contract for the Melt Cell Tele-manipulator by meeting all specifications with a price below the budget ceiling. EES will provide technical consulting to PAR and DWPF throughout the design, fabrication, testing, installation, and start-up phases. Fabrication of the melter pour stream viewing camera is complete, and the camera will be assembled and aligned in an EES lab by August 31. All development drawings have been converted into record drawings for installation. The camera system will be installed on the Canister Positioning Arm platform by BSRI Construction. Final camera checkout in the Melt Cell must be completed by the end of Melter outage, which is scheduled for October 5. All metal components for modified Adapter and Bellows have been fabricated, and fabrication for insulation blocks should be completed by September 1. Installation of the modified Adapter/Bellows is scheduled for mid-September.

EES and MTS are continuing to support DWPF in improvements to the Melter Borescope. The development of the enhanced Melter Borescope optics is proceeding with the issuance for comments of the overall final lens design to DWPF. The entire lens system has been redesigned to provide greatly improved light sensitivity and image clarity. Additional design changes have also provided for reduced lens fouling, by the usage of considerably small openings into the melter environment, while maintaining other image parameters.

EES delivered the Canister Level Detection infrared camera image processing computer and associated hardware to the DWPF Control and Production Systems Group for software development.

Late Wash - Malcolm Kyle

EES-Robotics is continuing design work for the Late Wash crane remote video system. The request has been given to a second vendor, following the withdrawal of the original winner. EES's portion of the design is nearly complete, with the shifting of various portions of the fabrication from the vendor to EES. A particular type of Hybrid flat cable, used successfully with the Hanford video work, has been defined as the best device for this application. An on-crane test is planned for the end of August to confirm proper operation of all components with the crane festoon. A test at the vendor's facility with both the EES and vendor fabricated portions will be run as a final system checkout.

EES has completed fabrication of all three Late Wash Field Termination Cabinets (FTC). The DWPF Control and Production Systems Group has performed the factory acceptance test procedure for the cabinets. Bechtel Construction transported the FTCs to the Late Wash Facility for field cable termination. EES issued record drawings and termination listings for review. EES will fabricate a power distribution panel and associated wiring for the Process Controller Module Cabinet.

EES has completed final revisions to all electrical drawings for the Late Wash Benzene and Nitrite Analyzer Systems. All three conductor cables that route between the Lab Operator Interface Station and the gloveboxes have been completed. The 717-A machine shop expects to complete fabrication of the gloveboxes by month-end, and installation of the internal components will begin.

GENERAL

Change Control Status - L. R. Chandler

The current status of the Baseline Change Proposal (BCP) packages developed by SRTC for the FY95 Annual Operating Plan is: forty-two have been prepared, none are routing in SRTC for approval; six are awaiting DOE approval; thirty-six have been approved by DOE; and twenty-five have been entered into the FY95 AOP electronic data base.

Reactor Support - Malcolm Kyle

EES completed field installation of the electric pump power cart and submersible pump cable management system for the 105-K Basin Vacuum System. An SMI 51 safety inspection was performed on the installed equipment by the Area Safety Engineer, Reactor Operations, Reactor Engineering, and EES. Action items generated as a result of the inspection have been completed, and the pump is ready for use at the next opportunity.

EES is currently working to develop a schematic diagram of the PA system remote alarm signaling box based on sketches provided by the box designer (the telephone group) and information obtained from various vendors. This box allows Reactor Operations personnel to remotely perform the daily alarm signal testing in C, P, and L Areas from the 105-K control room.

EES completed the design of the 360 degree grit blast decon tool, designed for decontamination of MK-22 internal surfaces. Fabrication is on hold pending design completion of an internal contamination monitor.

EES completed sketches for the work package to cover installation of the Cesium Activity Monitor demonstration system in the 105-L Disassembly basin. Probe housing fabrication was completed, and work continues on software modifications to the data collection system. Installation of the demo system in 105-L is scheduled for early September.

Site Robotics and Remote Systems Support - Ivan Lewis

EES is assisting High Level Waste with the removal of lead counterweights from the 2H evaporator. Manual removal would result in a high radiation exposure to personnel. EES has demonstrated several options for counterweight removal including remote removal in the evaporator cell using a manipulator or improved manual removal using plasma torch technology. The counterweights contain lead and are being removed to prevent the entire evaporator from being disposed of as mixed waste.

Office of Technology Development - Robotics for Mixed Waste Operations - Ivan Lewis

EES implemented and tested the BARX barcode reader subsystem on SWAMI (Stored Waste Autonomous Mobile Inspector). At commands from the supervisor, BARX powers up the scanner, enables/disables scanning, and reports the desired bar coded inventory number as SWAMI traverses aisles of stored waste drums. The geometric sensor interface board used in scanning drums for dents, rust spots, and streaks has been designed and fabricated. Electrical connection issues for the remote SWAMI charging station have been resolved. EES and Fernald are modifying the charger and the Fernald TS-4 outlet to provide plug-in capability to Fernald's 480V single phase service. SWAMI is scheduled to be shipped to Fernald for testing in September.

Office of Technology Development - Tanks Focus Area - Ivan Lewis

EES has received all parts for the three end-effectors for the Light Duty Utility Arm (LDUA) being demonstrated at Hanford for in-tank remediation. EES is developing the Optical Alignment System, Close-up Video System, and Stereo Photography System for use with the LDUA. Electrical assembly is 50% complete. The control box, operator interface box, and test cable for the three end-effectors are complete. All three end-effectors will be delivered to Hanford by the end of the fiscal year.

Office of Technology Development - Robotics for D&D - Ivan Lewis

EES coordinated a team meeting between SRTC, JBF Associates, and Sandia National Labs to draft the DECIDE Software Programming Specification document. This document will provide the basis for developing DECIsion Definition and Evaluation (DECIDE) software and will contain a summary, general technical issues in programming, description of the hardware/software requirements, and an outline of its major features. Coded software development will start this month due to the excellent team preparation and insightful inputs during the meeting.

Office of Technology Development - D&D Focus Area - Ivan Lewis

EES completed the design of several remote tools for use with a Schilling manipulator in the decontamination and decommissioning of equipment systems. The purchase of a remote tool change device for use with the manipulator is underway.

Robotics and Remote System Work for Others - Ivan Lewis

EES Robotics and EDD visited Argonne National Laboratory to discuss collaboration on several programs for the Department of Defense. Discussions centered on coupling Argonne developed technology/sensors with SRTC's expertise in remote handling for delivery in hazardous environments.

EES Robotics met with a PNL researcher who has developed new fiber optic radiation sensors. The sensors require coupling to mobile robots, teleoperators, or crawlers for deployment in contaminated environments.

EES Robotics and EDD hosted a small robotics firm located in New York which specializes in ferret-type devices for pipe inspection. The firm has performed work for Oak Ridge National Lab and others with these devices. A discussion on technology exchange and collaboration was held.

EES and EDD met with Union Camp officials in Savannah to present remote forest engineering concepts. The presentation was well received, and additional details were requested.

Technology Transfer - Ivan Lewis

U.S. Patent # 5,405,588 was awarded for a process for removing toxic cadmium from scrap metal and putting the cadmium in a safely disposable form. When the scrap metal is radioactive, the process can also keep the scrap from being a "mixed waste" (both chemically hazardous and radioactive), greatly simplifying its disposal.

EES Robotics Chaired a Workshop on "Data Characterization - Obtaining the Data and Understanding It" during the 1995 Robotics Forum held in Albuquerque, NM. EES Robotics also made presentations on Understanding Radiation Floor Surveys, the OTD Landfill Robotics Program, and the Surveillance and Maintenance Methodology Software development.

Thermal Analysis of the Failed Equipment Storage Vault System - J. W. Jerrell, S. Y. Lee, and M. A. Shadday, Jr.

Temperature profiles in the Failed Equipment Storage Vault Structures have been generated using the FLOW3D software to model heat conduction and convection within the FESV/MSB (Melter Storage Box) system. Due to complexities in modeling radiation with FLOW3D, P/THERMAL software has been used to model radiation using the conduction/convection temperature results from FLOW3D. The final conjugate model includes heat transfer by conduction, convection, and radiation to predict steady-state temperatures.

The temperatures produced by the conjugate model indicate that the FESV/MSB system components remain below the specified temperature limits for a pair of full failed melters, each generating 3 kW, yielding a total heat generation of 6 kW for the FESV/MSB system. The glass pool and MSB remain well below their temperature limits by margins of 280° F and 490° F, respectively. The concrete common wall attains a maximum temperature of 147° F, slightly below the 150° F temperature

limit. The concrete exceeds the overall temperature limit of 150° F in only a portion of the center of the floor, where the temperature reaches 153° F. The region exceeding 150° F is localized, having a diameter of approximately 10 feet and a depth of one foot. The upper concrete temperature limit for localized regions of 200° F is not reached.

Component	Limit (°F)	Maximum Prediction (°F)
Waste Glass	824	542
MSB	650	155
Concrete		
overall	150	< 150
localized	200	153

In Tank Precipitation (ITP) Test Instrumentation - Zafar H. Qureshi, James S. Bollinger, and Mark R. Duignan

The High Level Waste Engineering Department is presently conducting Radioactive Operations Commissioning Tests on the ITP facility. The purpose of these tests is two-fold: obtain operational data and data to support computational models used by SAR. This requires upgrading of the existing tank instrumentation as well as installation of new instruments. The Experimental Thermal Hydraulics Group and the Equipment Engineering Section are supporting this activity in several areas. These are: identification of the data requirements, characterizing the existing instrumentation, design and fabrication of additional instrumentation, and provide field support.

Final assembly of the two instrument poles and the GC based tank vapor sampling system was completed. An integrated shakedown test of the system was performed in the Thermal Fluids Lab. This included proper operation of the solenoid valves, vapor transport times in sample lines, calibration of GCs and execution of six sampling strategies. The system was then disassembled and packed for shipment to Tank 48 in H area. The two instrument poles were shipped and installed prior to shipping the rest of the system. On 8-27-95 the GC system and data acquisition system were delivered to a hut on top of Tank 48 erected to house the vapor sampling system for the next 6 months. The heat traced sample lines and instrument lines from the two poles were then connected to the sampling system in the hut.

On 9-1-95 the system was operational and the first tank sample was run through the system successfully. On 9-2-95 the first chemical addition to the tank was made; a major milestone for ITP operations. The vapor sampling system was used before, during and after the 45 minute chemical (sodium tetraphenylborate) addition period. The system was calibrated for benzene detection prior to the chemical addition. As expected, no benzene release was detected by the vapor sampling system. The existing benzene monitoring system on Tank 48 was out of service due to postulated mercury contamination.

Due to the significance of the event of the first chemical addition which marks the beginning of the defense waste processing, senior High Level Waste Management and DOE representatives were present. The successful operation of the vapor sampling system was key in confirming no benzene release during chemical addition. The vapor sampling team received generous compliments for developing and deploying an elaborate system in only six months. Prior to delivering the system, the DNFSB also provided very positive feedback after witnessing the system in the Thermal Fluids Lab.

It is anticipated that the system will be in operation for about 6 months. The vapor sampling team will train test engineers who will run the system round the clock during various ITP operation.

Development of Tool to Install Canister Plug - T. J. Steeper, J. L. Steimke, and H. N. Guerrero

The temporary plug and the repair plug are cylinders 5" in diameter and 2" long with a knob at the top. The remote manipulator is used to grasp a tool which then hooks the knob. The plug, which is at room temperature, is inserted in the nozzle of the canister, which is hot. The resulting shrink fit holds the plug in place. The present tool holds the plug loosely which allows the plug to cock in the nozzle. Some plugs have been 60 mils higher on one side than the other. In response to a request by DWPF, ETF

designed, built and tested the prototype of a new tool. Initial test results show that it is easier to use and more reliable than the present tool. The new tool locks firmly to the knob, but is easy to release after the shrink fit has been accomplished. The tool automatically holds the plug at the correct elevation and flat with respect to the top of the canister nozzle. The prototype gives the operator a choice of grips for the manipulator. Gripping at one place on the tool gives the operator a firm grip on the tool and also the plug. Gripping above a 6" length of flexible cable makes the plug self leveling. The tool and a dummy nozzle were delivered to S Area and will be placed in the hot cell. After the customer tries the new tool on the dummy nozzle and on glass canisters, final modifications will be made. If the customer has a strong preference for one of the two grip locations, the other will be deleted.

ITEMS OF INTEREST

Aug. 5-8, M. A. Shadday traveled to Portland, Oregon to present a paper entitled, "A Heat Transfer Model of the Saltstone Pouring and Curing Process at the Savannah River Site," at the National Heat Transfer Conference.

Aug. 21-23, M. V. Gregory traveled to Los Alamos, New Mexico to attend a Target/Blanket Design Review, Accelerator Production of Tritium meeting at Los Alamos National Laboratory.