SRTC Monthly Report July 1995

by

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Savannah River Technology Center
Monthly Report

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

WSRC-TR-95-100-7

**Savannah River Technology Center
Monthly Report**

July 1995

Executive Summary

TRITIUM

- The WSRC has declared facility readiness for the Function Test Facility and the controlled milestone has been met. The DOE ORR started on July 17, 1995.
- A Acorn Program Review was held with the Navy with good satisfaction expressed by the customer.
- A Design Agency approved unit was function tested in the fast gas function facility meeting a milestone to function test a DA approved unit before June 30.
- Palladium alloys are under investigation as candidate metal hydride materials for tritium storage and processing applications. An understanding of the effects of tritium aging on such hydrides is important for material selection and lifetime prediction. The second sample in the series was aged for 338 days fully loaded with tritium, and showed a larger degree of tritium heel formation than the first.
- SRTC/CHTS provides program coordination and Design Lab liaison for the Reservoir Surveillance Operations (RSO) mission at SRS. Recent developments include the formation of the RSO Task Team (RSOTT).
- SRTC/CHTS recommends using titanium granules manufactured by Ergenics as the form of titanium to be used in the hydride storage vessel (HSV). The testing information is documented in SRT-HTS-95-0155.
- Optimas software has recently been purchased by the site. Optimas is specifically designed to precisely measure imaged objects. Specific training in the use of Optimas is required.
- The DOE Office of Nuclear Safety (ONS) issued a technical notice, "Guidelines for Valves in Tritium Service", containing information on valve selection for tritium facilities. In a few cases, valves are being used at SRS that are questioned in the ONS Guidelines. A memorandum has been issued by MTS (SRT-MTS-95-3021) recommending that current valves should be retained at SRS, because of successful operating experience, excessive cost for insufficient benefit, and ALARA concerns for workers changing valves.
- Qualification lots of material were received from two potential suppliers of palladium.
- EES completed the design and fabrication of 35 portable tritium samplers.

- EES delivered an inspection system for the pre-pinch weld inspection of tritium reservoir fill stems.
- EES completed all as-built drawings for the Hydroburst system.

SEPARATIONS

- The Task Technical and Quality Assurance Plan for the Am/Cm pretreatment development program was completed. This program will be performed as a baseline R&D activity.
- Part of F-Canyon Phase II restart activities may include dissolution of remaining MK-31A irradiated targets. Experimentally determined decontamination factors on actual solutions confirmed our operating experience that the second uranium cycle should not be required for proposed MK-31A processing.
- A process for dissolving powdered materials in the F-Canyon could lead to canyon processing of powdered Pu-bearing residues, such as Rocky Flats incinerator ash or JB-Line glove box sweepings. Results to date have not been promising, but the stake to the DOE Complex is large since Rocky Flats has large amounts of these materials and limited treatment/stabilization facilities.
- Studies are being conducted to identify a flowsheet that could be used in canyon dissolvers for dissolution of sand, slag, and crucible (S,S,&C) material stored in FB-Line to reduce the need for start-up of a dissolver.
- Studies have identified nylon bags as acceptable and the dissolution residues have no apparent effect on F-Canyon solvent extraction.
- Mixing is key for nuclear criticality safety analyses of F and H-Canyon tanks. Typical analyses quantify the maximum safe solids mass based on complete mixing and sample measurement. Previously no documentation of mixing behavior was available. The solids suspension report WSRC-TR-95-0258 has been completed.
- In 1993, an HVAC maintenance activity in 772-F inadvertently contaminated several hundred gallons of water with traces of Freon-11 and compressor oils.
- Product from recovery operations in FB-Line is transferred back to F-Canyon by an eductor. Maintaining the proper dilution is important for nuclear safety. A concern was raised that partial pluggage of the eductor nozzle could decrease the dilution of the product. Calculations have shown that an increase in product concentration caused by foreign substance lodging in the nozzle of the eductor is very unlikely.

- The tanks in H-Area are being monitored monthly for solids for criticality control. The results for the month showed variation, but no criticality concerns.
- A test is planned using dye to detect mixing and to verify and document the basis for the ability of the on-line alpha and beta/gamma monitoring systems as well as sampling procedures in use to detect the levels of contamination claimed in the cooling water effluent.
- EES/NMP and LANL have initiated a collaborative effort to install a bagless transfer system at Los Alamos for hot testing.

ENVIRONMENTAL

- The Ecology Electronic Data Atlas has been transferred to the WSRC-EPD Unix computer server (FALCON). This transfer was done in an effort to further increase the availability of this spatial data tool and centralize WSRC Geographical Information System data.
- The "Radiological Impact of 1994 Operations at the Savannah River Site" report was issued on June 12, 1995. Site radioactive releases continued their downward trend and the 1994 air pathway dose was 18% less than the 1993 dose.
- A program of underwater coring was initiated to provide data on sediment contamination in the sediments of Par Pond/Pond C and L Lake. Preliminary results of analyses are expected in September with validated results received in October.
- The refilling of Par Pond during 1995 has established conditions for the shorezone plant community to redevelop in the reservoir. Initial results indicate that extensive beds of maidencane are persisting and waterlily, lotus, watershield and spikerush are becoming reestablished.
- On June 16, 1995, 10,700 Curies of elemental tritium were released from H Area at 9:30 am. The TRAC van was dispatched to monitor for tritium oxide. Over 30 samples were collected near the Georgia cities of Louisville and Waynesboro.
- Work began on scenario development for the 1995 DWPF series of emergency response drills and exercises. Three general sets of scenario meteorological conditions were developed and used to perform calculations of environmental consequences from an accidental release.
- A study is being conducted on the effects of rainfall on bi-directional wind vanes. Preliminary results indicate that the elevation (vertical) angle measurement is significantly affected during rainfall at low, near-threshold wind speeds.
- The SRS Citizens Advisory Board, DOE, EPA, and SCDHEC have asked for an analysis of risk from drinking water contaminated with F- and H-Area

Seepage Basins (FHSBs) tritium in Fourmile Branch and Savannah River. WASP5 was used to simulate surface water transport for tritium releases from the F- and H- Area Seepage Basins.

- Seedlings of the native tree species (*Nyssa sylvatica*) were planted in the impacted areas along the F and H area Seepage Basin seepine in winter 1994. Survival of these seedlings was exceptionally high at the end of the first growing season and over winter survival was also high, although signs of vegetation stress were higher than during the previous fall sampling. These seedlings were resurveyed during July to evaluate survival mid-way through the growing season. Tupelo seedlings showed a substantial increase in stress indicators.
- Preliminary results from a detailed, three-dimensional tritium transport model of the Old Burial Ground (OBG) have been generated. The peak amount of tritium in the groundwater occurred in 1972 (600,000 Ci) and has declined to 41% of this maximum in 1995. The tritium flux to Fourmile Branch is estimated to have peaked at about 4500 Ci per year in 1990. The transport model will be used to predict future tritium discharge to Fourmile Branch and assess remediation alternatives at the Old Burial Ground, such as capping.
- Environmental Sciences Section was requested by ER to conduct a scoping study to evaluate the applicability of dialysis sampling for groundwater monitoring. The potential benefit of dialysis sampling is the elimination of investigative derived waste (IDW) that results from the purging of a groundwater monitoring well prior to sampling. Results suggest that the dialysis technique is behaving as expected and that a sampling method can be employed at water table wells in which the bags are kept in the well for a period of from one to three days.
- A program to evaluate the status of current and emerging aqueous detritiation methods and develop a practical assessment of potential viability will be conducted to support the Environmental Restoration efforts in the remediation of the F & H Area Groundwater Plume.
- The Institute of Environmental Solutions (IES) convened a meeting of the DOE laboratories to discuss mechanisms for accessing laboratory technical resources and the types of support that could be provided to the California Land Reuse Initiative. Laboratory technical resources for this program will primarily be provided by SRTC, ANL and ORNL until better definition of resource availability can be resolved for the other laboratories.
- A second English China Clay contract for evaluating radiation affect on biological materials within the clays has been approved.
- A Joint Work Statement for a CRADA between Sun River Innovations, Ltd. (SRI, a small business located in Coconut Grove, FL.) and SRTC has been approved by DOE. The purpose of this work is to field test a mobile advanced oxidation system (UV/ozone) for the treatment of hazardous, toxic organic compounds in groundwater and process water.
- Scientists and technicians from Guided Systems Technologies (GST), Atlanta, and from SRTC conducted a series of demonstration tests at SRS using the GST unmanned aerial vehicle (UAV) to survey selected sites. These

experiments were part of the DOE/MTI-funded project to evaluate the ability of a hovering UAV to perform low-level surveys in remote areas while carrying a suite of sensors developed by SRTC.

- This month a total of 50 non-routine samples were analyzed on different detectors in the Underground Counting Facility.
- SRTC studies have enabled recommendations to Selentec, Inc. that may considerably streamline the process chemistry of the MAG*SEP demo in D-Area. Water from a different well than had previously been considered will be used in the demo. The new well, DCB-4A has much less iron and aluminum than the previous well, DCB-1A. Water samples are being characterized and tested with MAG*SEP particles. New particles, containing highly pure magnetite from Sweden, have been tested and initial analytical results indicate that the particles are effective at decontaminating the new D-Area well.
- Bradtec Mag*Sep magnetic particles, coated with EIChrome's TEVA SPEC resin have been used to remove Tc-99 from Arctic-Ocean water. The adsorption capacity was shown to be linear with Tc-99 concentration.
- Coordination of DOE and WSRC Environmental Restoration (ER) concerns and involvement with the Landfill Stabilization Focus Area (LSFA) Technical Task Plans (TTPs) has been provided. Both DOE and WSRC ER personnel have been assigned to follow the selected TTP subtasks and work with the individual Principal Investigators (PIs).
- A draft Stabilization/Containment Systems Technical Task Plan (TTP) has been prepared to support FY96 funding requests in the FY96 PEG.
- Compressed air was injected into all the injection wells at both sites at the Sanitary Landfill. Gas Chromatography (GC) analysis of the water and soil gas during the air injection campaign have shown a marked reduction in concentrations of the contaminants, many below detection.
- The results of the gamma-ray and neutron spectra taken of waste drums containing TRU contaminated waste were analyzed. Position data were recorded with the Aerial Monitoring System during the run near Steed Pond and was georegistered onto site maps.

WASTE MANAGEMENT

- IWT witnessed a "short stack" pump test conducted at Sulzer Bingham to help determine the cause of damage observed on the Bingham VRP 3 x 11.5 pumps tested at SRS for Tank 51. Similar damage was seen on the "short stack" pump as observed during SRS testing. Sulzer Bingham recommends a larger diameter lower shaft and will fabricate one for another short stack test by mid-July.
- The TNX Off-gas Components Test Facility (OCTF) was modified to eliminate water from accumulating in the horizontal duct upstream of the scrubber. New steam/scrubber nozzles and cleanable HEPA prefilters were installed in the system.

- ADS results of Georgia Institute Technology studies show that generation rates used in safety analyses for the In-Tank Precipitation process appear conservative.
- A correlation developed for filtration fluxes as a function of absorbed radiation dose allows Late Wash Facility testing with freshly precipitated tetraphenylborate slurries. The use of this correlation eliminates the cost for irradiation of simulant.
- A Technology Development Award Fee Milestone was met by completing the CIF Health Based Risk Assessment (HRA) before June 30.
- ECC International, a major kaolin producer from Sandersville, GA, has requested SRTC perform irradiation testing on kaolin slurry.
- Testing at the Off-gas Components Test Facility (OCTF) has demonstrated unacceptable CIF HEPA prefilter life. Several scrubber and HEPA prefilter modifications have been made, tested, and shown to increase the HEPA prefilter lifetime to acceptable levels. These modifications will be applied to the CIF.
- EES completed repairs on a remote cell camera cable that was damaged during remotability testing in the New Waste Transfer Facility.
- EES is continuing work on the DWPF Melter Pour Spout Modifications.
- EES is continuing work on the Benzene and Nitrite Analyzer Systems for Late Wash.

GENERAL

- SRTC has prepared a total of 34 Site level Baseline Change Control Packages during FY-95 and 9 of the packages have been approved by DOE.
- EES fabricated a tool for the C-Area Decon Facility to improve plastic hut cleaning and decontamination methods using the Kelly Vac system.
- EES was successful in capturing a video inspection of lead counterweights on the 2H evaporator pot. This video provided invaluable information that has been used in determining the best course of action for remotely removing the counterweights.
- EES met with representatives from INEL, LLNL, and FEMP at SRS for discussions of the completion and delivery of SWAMI II (Stored Waste Autonomous Mobile Inspector) to Fernald later this fiscal year.
- EES delivered to the test facility at Hanford the Overview Video Systems developed for use within underground storage tanks (UST).

- The Mobile Automated Characterization System (MACS) was transported to Washington, DC, for a demonstration in the US Government Inter-Agency Environmental Technology Expo, held in the Hart Senate Office Building.
- ASET has entered into a SCUREF agreement with the Medical University of South Carolina to determine the feasibility of applying lens-coupled digital radiography to standard medical x-ray imaging applications.
- The transient temperature distribution in the concrete roof of the glass waste storage building (GWSB) will be calculated by a one-dimensional model of air flow through the building. The same model will be used to calculate temperatures in the glass cylinders. The model will calculate steady state conditions under normal forced convection in the building, and use them as the initial conditions for a postulated accident described as the loss of all forced convection in the building. Transient temperature profiles will be calculated for a range of proposed loading patterns and used to assess the integrity of the concrete roof during the postulated accident.
- During the month of July the Experimental Thermal-Fluids (ETF) group has focused on finalizing the design of the feed nozzle and reporting on the preliminary testing performed to date. An inter-office memorandum will be issued in early August that will discuss the design of the liquid feed system and the test results for the scoping study performed in the Thermal-Fluids Laboratory (TFL). The machine shop should complete fabrication of the feed nozzle before the end of August.

Progress and Accomplishments

TRITIUM

Function Test Facility (FTF) Startup Status (Project 4173) Y.K. Lutz, G. M. Thomas, B. Wilson, P. L. Morgan

The Function Test Facility (FTF) will be used to function test 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.

All WSRC ORR 'A' punchlist items were completed and the ORR Report issued on 6/30/95. Formal declaration of readiness was transmitted to DOE-SR the same day which completes the controlled milestone WPC25. Pending approval of the DOE-SR validation of the WSRC ORR and formal direction to begin the DOE ORR, DOE review activities will start the third week of July and take approximately one week to complete the initial review. Documentation is being gathered and demonstrations planned for the DOE-SR reviewers.

Currently, there are 21 open 'B' punchlist items from the WSRC RSA and 4 open 'B' punchlist items from the WSRC ORR. Closure of all these items is on schedule.

Process Realization Team (PRT)
D. L. Fish

A Program Review was held at DOE-AL on June 20th for the Navy and management. The primary purpose of the review was to provide a status report on the progress which the Process Realization Team (PRT) is making toward fielding an Acorn reservoir. SRS personnel provided a status of the Production Loading Line, the special procurements, the

Environmental Conditioning Equipment and the Function Test Facility. Since the completion of the Production Loading Line is the critical path item in the schedule for fielding the Acorn, the Navy is very supportive of any items which SRS can do to expedite its completion. Roger Stanton, Navy liaison expressed his satisfaction with the progress which had been made to-date on the program.

Fast Gas Analyzer Development
R.A. Malstrom

A Design Agency approved unit was function tested meeting a milestone to function test a DA approved unit before June 30. Temperature, pressure data were collected in real-time using the MassComp computer. In addition, Raman was used to measure concentrations of hydrogen isotopes in real-time. Raman and fast mass spectrometry are being compared for possible installation in the Tritium Facilities for function test analyses. A function test manifold was built and installed in SRTC to compare the two techniques. Raman, using this manifold, was proven capable of analysis at speeds greater than 20 times/second. The mass spectrometer will be installed by September 30.

Tritium Aging of Palladium Nickel Alloy Investigated - J. S. Hölder, D. E. Moseley, C. C. Wilkins

As was reported in the June edition, palladium alloys are under investigation in the SRTC Materials Test Facility as candidate metal hydride materials for tritium storage and processing applications. Samples, which were placed into the Tritium Exposure Program last year, are now being characterized after about 11 months of tritium aging. The primary means of characterization is the collection of a set of tritium desorption isotherms at several temperatures. The results from the 5 atom percent nickel palladium alloy [Pd(5 at.% Ni)]

sample were reported previously. Here, results from the higher atom percent nickel alloy, Pd(9 at.% Ni), sample are presented and compared to those from Pd(5 at.% Ni).

The Pd(9 at.% Ni) alloy was removed from storage after 338 days in the tritium saturated state (b-phase), and evaluated again via isothermal measurements. The results are shown in the accompanying figure, where the pressure of tritium in equilibrium with the metal tritide has been plotted against the metal tritide composition as a function of sample temperature. Four (4) aged isotherms were collected at the following temperatures and order: 35, 20, 50, and 35°C. Five (5) virgin isotherms were measured on this sample before it was put into storage. A virgin isotherm acquired at 50°C was plotted for reference.

A comparison of the virgin and aged 50°C isotherms shows the development of a tritium heel and a lowering of the plateau pressure as a result of tritium aging. Otherwise, the aged isotherms are highly regular, with little increase in plateau slope or shape. An apparent reversal of the tritium aging induced plateau pressure depression was observed to result from cycling (desorption followed by absorption). The 35°C isotherm collected after 3 cycles has a higher plateau pressure vis-à-vis the initial aged isotherm at 35°C. The ingrowth of lattice strain, from tritium decay to helium (^3He), is thought to be responsible for the reduction in plateau pressure and this appears to be partially relieved by cycling. However, this process is not completely reversible, as the plateau pressures

of the cycled isotherms remain below those of the virgin sample.

As in the analysis of the Pd(5 at.% Ni) sample, the partial pressure of ^3He was subtracted from the observed pressure to give the partial pressure of tritium in equilibrium with the sample for the initial aged isotherm. This value was calculated from the daily amount of tritium in the gas phase and the tritium decay constant. The total pressure inside the sample vessel was found to decrease slowly with time, as the rate at which tritium leaves the gas phase was slightly higher than the rate of ^3He production in the gas phase. Tritium which decays in the solid phase is replaced by tritium absorbed out of the gas phase, while the decay in the gas phase produces two ^3He atoms for each tritium molecule.

A concern with the palladium alloys is the degree of tritium heel formation. It was found that the Pd(5 at.% Ni) alloy developed a heel of about 0.05 T/M in 321 days of aging; the Pd(9 at.% Ni) formed a heel of about 0.09 T/M in 338 days of tritium aging. The 9 at.% sample also had a lower tritium capacity than the 5 at.% sample. This indicates that the rate of heel formation is a function of alloy composition and increases with atom percent. (*n.b.*, The trapped or heel tritium may be removed by exchange with lighter isotopes of hydrogen.) This investigation is continuing with the characterization of aged samples of the other palladium alloys in the series.

Tritium Desorption Isotherms for Aged Pd(9 at.% Ni) Alloy

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 developments include the formation of the Reservoir Surveillance Operations Task Team (RSOTT). This multi-disciplined, cross-divisional team has been chartered with the mission to plan and implement RSO at the Tritium Facilities. At the kickoff meeting, the RSOTT defined the organizational responsibilities for RSO activities during the "interim phase" at SRS. The "interim phase" is defined as how SRS will perform RSO to support the enduring stockpile with function testing limited to 232-H and additional test capability under design/construction. Also at the kickoff meeting, team members were introduced to the Test Program Validation (TPV). The TPV is the validation of the reservoir evaluation program and will be performed by SRS and the Design Labs for all weapon system evaluations to determine all applicable processes, equipment and related procedures and specifications are acceptable for use in Stockpile Laboratory Test (SLT) programs. The TPV must be approved by the Design Lab prior to reservoir testing. In

support of the TPV approval, the RSOTT must identify WSRC procedures applicable to the RSO activities and develop any that do not exist.

The RSO activities and the TPV were reviewed at another RSOTT meeting and it was decided that smaller teams should convene to discuss groups of activities that are currently being performed at the Tritium Facilities. A smaller task team spun off the RSOTT has met to resolve the receiving, storage and inventory of parent weapon components, WR parts and laboratory test parts. Another smaller task team has met to resolve issues concerning special inspections, disassembly and assembly required for RSO units. All teams have met with the understanding that duplication of effort is to be minimized and existing capabilities are to be applied whenever possible.

Long Term Tritium Storage

J. E. Klein, A. S. Poore, J. R. Wermer, K. Shanahan

The hydride storage vessel (HSV) is intended to provide long term tritium and deuterium storage for the SRS Tritium Facilities. To safely and efficiently store the tritium, titanium hydride was selected as the storage material in the HSV. Titanium hydrides yield very low hydrogen

over-pressures and provide large storage capacities, making it an excellent tritium storage medium. Titanium is currently being used by the Canadians at their Darlington facility for long term tritium storage.

As part of the SRS program, several forms of titanium were evaluated at SRTC to determine the best material to be used in the HSV. Two forms of titanium that have been tested are titanium rod (grade 2, 1/4" diameter by 1/4" height) and HY-STOR 106 made by Ergenics. HY-STOR 106 is a processed form of titanium which is hydrided, then crushed and sintered back together to form larger particles. Side-by-side comparison of the Ergenics material and the titanium rod were performed using the same test conditions. Superior absorption properties were shown by the Ergenics material while test results with the rod material were inconsistent. These test results are presented in SRT-HTS-95-0155.

Based on these initial test results, it is recommended that HY-STOR 106 material be used for the HSV program in order to meet project deadlines. Further small scale and large scale prototype testing with the HY-STOR 106 material will continue to develop specific plant activation, loading, and unloading conditions.

SRTC/CHTS will continue to provide information to Tritium and Tritium projects as it develops. Information for the procurement specification for the Ergenics HY-STOR 106 material will be given to Tritium Projects by mid-July. Task Technical plans are currently being finalized for the tritium exposure program and the prototype testing program. The Technical Data Summary for the HSV will be completed by December 1995.

Pinch Welding NDE - B.D. Howard, R.W. Poland, B.Z. Meers III

Conventional radiographic methods are routinely used to evaluate the integrity of pinch welds; however, twenty (20) pinch weld specimens were evaluated with digital radiography as well as with conventional "film" radiography. Digital radiography offers a number of advantages over conventional methods. One of those advantages is being able

to acquire dimensional data automatically. Optimas software has recently been purchased and is in-house. Optimas is specifically designed to precisely measure imaged objects. Specific training in the use of Optimas is required. The next training class will be held the second week of August.

Other advantages of digital radiography are that geometrical images are displayed **immediately**, since no film processing is required, and multiple "views" of pinch welds may be acquired in a very few minutes. ASET has been discussing the incorporation of digital radiography and computed tomography in a Tritium facility. Meetings will be scheduled in the very near future to discuss total costs for development and deployment of a prototype DR/CT scanner.

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, will be analyzed for chemical impurities and physical properties at SRTC and LANL. SRTC sampled each lot of material using a spinning riffler (sample divider) to ensure each sample is statistically equivalent. Analytical results are expected in mid-July. These analytical results will be used as part of a technical evaluation to help choose the supplier for the RTF material.

Tritium - Joe Cordaro

EES is continuing to supply support to the new Function Test Facility. Repair of the Marrotta fast acting automatic valve is in progress. The valve is key to performing Argon simulation runs before a function test. Design change forms are being prepared that will modify the simulation line piping such that leak points and flow restrictions are minimized. Fireset cables and spare fireset electroincs are being fabricated to support a planned Tritium function test following the completion of the DOE ORR.

EES, at Tritium's request, is performing stability testing on the RTF Seismic Trigger Confinement System (STCS) triggers. EES has set up chart recorders, temperature sensors, slow speed video recorders, and laser positioning sensors to monitor drift of the triggers. Initial results clearly show a correlation between temperature and sensor drift. Some units exhibit more drift versus temperatures than others. The manufacturer has said that if the flexures (small steel springs which provide spring action for the sensor mass) have become over-stressed, that the flexure will become thermally sensitive. Over-stressing can be caused by the over tightening of the screws which hold the flexures or overextending of the flexures when adjusting them to center. The vendor has been requested to visit EES in early August to review the test setup and data.

EES completed the design and fabrication of 35 portable tritium samplers. The samplers are battery powered and contain a small motorized pump, rotameter, timer, water and/or ethylene glycol bubblers. The samplers are designed to run for up to 24 hours, but the normal sampling time is 10 minutes. The samplers were required to meet DOE tritium monitoring requirements since existing real time monitors did not have the required sensitivity.

EES delivered an inspection system for the pre-pinch weld inspection of tritium reservoir fill stems. The inspection system includes new borescopes, a high resolution video camera, and video monitor integrated with equipment obtained from Rocky Flats. A number of upgrades and enhancements were made to the Rocky Flats equipment to simplify camera/borescope mounting, improve reservoir/fill stem fixturing, and automate the positioning control.

EES, working with Tritium maintenance, completed the installation of a new ion chamber and electrometer for the stripper system. Work included the calibration of the chamber traceable to NIST and modification of the system software. Software upgrades were also made to the Stack Monitor Integrators to accommodate a new model printer.

Non-Nuclear Reconfiguration - Joe Cordaro

EES completed all as-built drawings for the Hydroburst system. Thirteen record drawings and approximately 50 development drawings were issued. EES and Tritium completed volume ductility burst testing of the nine "Round Robin" units. The Round Robin testing was requested by Los Alamos National Labs such that data could be compared between SRS, Mound, and Kansas City. The test data was turned over to HTS for issue to Los Alamos National Labs. Prior to project completion, EES is required to complete one strain gage burst test. This test is expected to occur by August 1, 1995.

EES and SPS completed all proof, leak, and flow testing of the Mini Manifold. EES was requested to expedite the schedule by over 4 weeks. The manifold was delivered to Tritium Construction on schedule and within budget. EES will continue to support Construction and Tritium operations with the installation and start up of the manifold.

EES met with Sandia National Lab personnel to review the design of a new Flow Testing manifold associated with Reservoir Surveillance Operations. The design review was required prior to completing detailed design or procurement. EES is required to complete the design, fabrication, and installation of the manifold by June 96.

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 for shipment to Oak Ridge National Laboratory. Separations Planning has requested CHTS assistance to define the pretreatment flowsheet for the proposed vitrification process. Optimal conditions must be defined for the acid adjustment, in-tank precipitation, settling/decanting, precipitate washing, and dissolution steps in the proposed flowsheet. Vitrification would take place in the Multi-Purpose Processing Facility (MPPF) in F-Canyon.

The Task Technical and Quality Assurance Plan for the Am/Cm pretreatment development program was completed. This program will be performed as a baseline R&D activity. Currently, equipment is being fabricated and assembled to perform solubility experiments for metallic impurities which have an impact on the glass formulation. The initial experiments will focus on the solubility of uranium (VI) oxalate which will be followed by non-radioactive experiments to measure the oxalate solubility of the alkali, alkaline earth, and transition metal impurities.

Phase II Restart Support

J. H. Gray, K. J. Kalbaugh, D. F. Chostner

Part of F-Canyon Phase II restart activities may include dissolution of remaining MK-31A irradiated targets. One of the issues associated with the MK-31A targets involves the need to process resultant solutions through second uranium cycle before conversion of uranium solutions to oxide in A-Line. Past operating experience indicates if a ruthenium decontamination factor (DF) greater than 10^4

can be realized in first cycle, then fission product levels will be low enough in concentrated 1EU solutions to eliminate a need for the additional decontamination provided by the second uranium cycle.

Solution samples from first cycle tanks have been used to measure Ru-106 decontamination during 1AF extraction, 1AX scrubbing, and 1BF stripping operations. The objective of these aqueous/organic contacts was to demonstrate a DF approaching 10^4 would be achieved between 1AF and 1BU streams using fewer than actual plant stages.

The overall DF for extraction, six scrub, and six strip stages was 9.5×10^3 . With three additional scrub and three additional strips stages, an overall ruthenium DF greater than 10^4 appears attainable using the additional stages provided by plant cycles. The laboratory determined DF has provided support to existing operating experience that the second uranium cycle should not be required to process MK-31A targets in the future.

Plutonium Ceramic

D. G. Karraker, W. G. Ramsey

A process for dissolving powdered materials in the F-Canyon could lead to canyon processing of powdered Pu-bearing residues, such as Rocky Flats incinerator ash or JB-Line glove box sweepings. Nuclear safety considerations restrict a charge of powdered materials for a canyon dissolver to a sub-critical mass. However, if the materials can be fixed in a homogenous matrix, the dissolver charge can be safely limited by the final Pu concentration of the dissolver solution, a factor ten or more greater than a sub-critical mass.

This study aims to find an oxide that will dissolve PuO_2 and incorporate Pu into a matrix that will dissolve at the same rate as the Pu. To do this, PuO_2 must react with an acidic oxide to form a new compound, similar to the ceramic or glass matrix. Previous work found that PuO_2 would not

react with B_2O_3 (1100°C, 4 hr). PuO_2 reacted nicely with Fe_2O_3 - P_2O_5 frit to form a compound amorphous to x-ray, probably a Pu phosphate. This glass proved very difficult to dissolve in HNO_3 , because of the low solubility of Pu phosphate. The solubility was improved somewhat by adding 10wt.% Na_2O to the glass, but was still slow in hot, concentrated HNO_3 .

A Preliminary test of the solubility of PuO_2 in iron-phosphate glasses has been successful, but the processing of Pu from phosphate solutions would be hampered by the low solubility of $Pu_3(PO_4)_4$. Converting the glass to a hydroxide by metathesis with 10M $NaOH$ is tedious, since it requires contacting the glass with $NaOH$, dissolving off the Pu hydroxide layer with HNO_3 , and repeating the alternate $NaOH$ and HNO_3 treatments until the material dissolves. Three $NaOH$ - HNO_3 cycles on Pu - Fe_2O_3 - P_2O_5 glass recovered only 50% of the Pu.

A more attractive prospect from the standpoint of chemical processing is a borate glass. Although PuO_2 does not react with B_2O_3 , 10 wt.% PuO_2 dissolved in $CaO \cdot 2B_2O_3$: X-ray diffraction showed only amorphous material and no PuO_2 lines, demonstrating that PuO_2 had reacted with the frit to form a new compound. A sample of this glass partially dissolved in HNO_3 -HF; the residue was identified by X-ray as H_3BO_3 with a trace of PuO_2 . Further studies are in progress.

Dissolution of Sand, Slag, and Crucible Material in Canyon Dissolvers

J. H. Gray, K. J. Kalbaugh, K. N. Forrest

Additional studies are being conducted to identify a flowsheet that could be used in canyon dissolvers for dissolution of sand, slag, and crucible (S,S,&C) material stored in FB-Line. Based on results from initial series of experiments, modifications to the standard FB-Line flowsheet used to dissolve S,S,&C material in the dissolver will be necessary. These adjustments were necessary because

incomplete dissolution of both S,S,&C chunks and fine particles had occurred. This would result in solids accumulating in canyon dissolvers which would raise criticality issues, increase dissolution time, and reduce throughput.

Results from recent tests indicate both particle size (surface area) and concentration limits determine when solids dissolution will stop. At the canyon dissolver mass to volume ratio of one gram S,S,&C solids per liter of solution, dissolution of all fine particles remains rapid. However, dissolution of the large chunks initially is fast, then begins to slow down when 40-50% of the chunks has dissolved. From then on, dissolution of the remaining chunks proceeds slowly, even when fresh solution has been introduced. Previous analyses of undissolved fines and remaining chunks established that these materials are essentially pure calcium fluoride (CaF_2).

The major modification to the dissolver flowsheet is introduction of all the aluminum nitrate to the nitric acid solution at the beginning of dissolution and charging the dissolver with the one gram per liter ratio. The addition of piggy-back batches may be possible when dissolution of all plutonium and solids is verified.

Dissolution of Plastic Bags for SS&C Processing

J. H. Gray, R. A. Pierce, K. J. Kalbaugh, J. D. Clark

The alternate flowsheet requires a soluble bag-out bag for the canyon dissolver. Studies are being conducted with acid-soluble plastic bag materials which might replace insoluble PVC and polyethylene. Previous experiments selected nylon as the material of choice, and conducted an initial bag dissolution to create a "stock" solution for subsequent testing. Current tests are aimed at demonstrating that dissolution of the bag will not cause problems in F-Canyon solvent extraction and solvent washing processes.

Initial stock solution containing the equivalent of 10-15 SS&C bags dissolved into 4.5M nitric acid was contacted with technical grade TBP/dodecane. The purpose of the test was to submit sample to ADS and track dissolved plastic components through the process. These tests proved to be inconclusive because of the relatively low plastic-to-acid ratio. Therefore a second stock solution was created which simulated approximately 300 SS&C bags dissolved.

Analysis of the contacted aqueous versus the non-contacted aqueous showed little or no change in various bag "fragments" which could be tracked and identified. This meant that analysis showed little or no extraction of organic from the aqueous into the organic phase. Subsequent tests with the contacted organic confirmed the results of the aqueous phase. Analysis showed less than 10 ppm (more likely less than 2 or 5 ppm) of extracted organics in the TBP/dodecane. These tests suggest that dissolved nylon bags from SS&C processing will not affect F-Canyon solvent extraction and solvent washing processes.

Pick-up tests will be conducted using the second "stock" solution to determine directly the effect, if any, of high concentrations of dissolved bag material on extraction processing.

Mixing in Canyon Tanks - Solids-Suspension -

N. M. Hassan, Y. J. Simpkins

Criticality Engineering Group (NMPD) has been performing nuclear criticality safety analyses for F and H Canyon tanks. Typical analyses quantify the maximum safe solids mass in the tanks by assuming that the installed paddle agitators are providing sufficient power input to uniformly disperse the fissile solids in bulk solutions and the sampling system presently used is capable of providing representative samples in tanks known to contain fissile solids. However, no documentation is available to justify that the installed agitation/sampling system in the canyon vessels are capable of providing complete and/or homogeneous suspension.

The solids suspension report WSRC-TR-95-0258 has been completed. In the report, several questions posed by Separations Engineering have been answered or discussed.

The minimum impeller speeds achieved for the complete but non-uniform dispersion/suspension of liquid-liquid and solid-liquid systems were 173 and 120 rpm, respectively (vs. 68 rpm standard). 173 rpm should ensure that both solid-liquid and liquid-liquid systems are in the desirable stage 3 range. However, a 30% increase to 225 rpm would give axially more uniform concentration distribution.

Determination of Freon® Constituents in Hazardous Waste Water

John Young

In 1993, an HVAC maintenance activity in 772-F inadvertently contaminated several hundred gallons of water with traces of Freon-11 and compressor oils. The material was determined to be non-radioactive, although it had been generated within a contamination area. Processing of the resulting waste water in the 300-M area waste water treatment facility required detailed characterization of each of the 10 waste drums.

Analytical methodology was applied using the ADS GC-MS volatile organics method. Since the Freon compounds are not routinely analyzed, special data interpretation and analysis were performing using archived calibration standard data.

Through pre-communication of the customer's needs, followed by preparation of the calibration tables prior to receipt of samples, a one-day turnaround of analytical results was achieved to exceed the customer requirements. Trichlorofluoromethane (Freon-11) was the primary volatile organic contaminant, with traces of Dichlorofluoromethane (Freon-21) present as a decomposition and/or manufacturing impurity.

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 code has been translated into QuickBasic and now exists as a module inside the standard ADS SPECTRO software package. The old code contained options for about ten different lab procedures; to reduce memory requirements for the software, the new version incorporates only the options of current interest. Testing and optimization of the code are now in progress.

FB Line Eductor

N. M. Askew and D. C. Poprik

Product from recovery operations in FB-Line collects in the product run tank. This material then is transferred back to F-Canyon for reprocessing. This transfer is achieved with the use of an eductor. A motive fluid is pumped through the eductor that jets this motive fluid above the tank. The jet pulls a vacuum on the tank, sucking the fluid from the tank. The solutions then exit the eductor together and flow to the canyon. A key function of the motive fluid is to dilute the product solution to a concentration of Pu that is acceptable for the canyon to handle. Maintaining the proper dilution is a nuclear safety concern.

A concern has been raised that partial pluggage of the eductor nozzle could decrease the dilution of the product. A single particle, lodged in the nozzle, would reduce the flow cross-sectional area. Such a particle would disrupt the motive fluid jet exiting from the nozzle. Some of the jet fluid momentum will be deflected in the transverse direction, leading to eddies and large, irreversible energy losses by viscous dissipation. Under such conditions, momentum transfer from the motive fluid jet to the suction fluid would be degraded, reducing the suction fluid flow rate. In addition, some of the motive fluid will be directed against the suction inlet, effectively

increasing the pressure at the inlet, also reducing the suction flow rate. Therefore, an increase in the concentration of product being sent to the canyon from the recovery operations in FB-Line due to a foreign substance lodging in the nozzle of the eductor is considered very unlikely. A report has been issued.

Fissile Material Storage in Tanks 10.2, 12.1, and 18.3

J. H. Gray, K. J. Kalbaugh, K. N. Forrest

The tanks in H-Area being monitored for solids include 10.2, 12.1, and 18.3. Tank 10.2 contains an enriched uranium (EU) solution, while both 12.1 and 18.3 tanks contain off-spec plutonium with a 50/50 Pu-238/Pu-239 isotopic split. All three solutions use boron as a soluble poison. Recent solution samples collected from each tank contained solids and demonstrated the wide variations seen in fissile content and solids volume and composition.

The EU solution, briefly stored in Tank 10.3 until solids from 10.2 were characterized, was recently returned to 10.2. Sufficient time was allowed for solids in the bottom of 10.2 to redissolve before the solution was resampled. Prior to transfer of the EU solution from 10.2, the solids were predominantly boric acid, containing small quantities of EU, and trace amounts of silicon, aluminum, and nickel. Since the transfer back to 10.2, most of the boric acid solids has dissolved, EU content is lower, and the small volume of solids remaining are the typical corrosion products, sand, muscovite, and a few fission product metals. No criticality issues remain in Tank 10.2.

Solids in 12.1 and 18.3 samples are exhibiting wide variations from month to month. The last three samples from 12.1 have fluctuated from no solids in the previous two, to 66 micrograms of plutonium in the July sample. The plutonium content in 18.3 solids has ranged from 106 micrograms, to 15 micrograms, and back up to 49 micrograms. With the increase in plutonium content, the usual volume increase in solids volume is

being observed. At the higher plutonium content levels and with boron in solution, any criticality issues are addressed on a sample to sample basis.

Cooling Water Effluent Flow Measurement

Stanley Nave and John Elliott

Previous audits and assessments of canyon cooling water effluent monitoring pointed out the need to verify and document the basis for the ability of the on-line alpha and beta/gamma monitoring systems as well as the grab sampling procedures in use to detect the levels of contamination claimed. ADS and Separations Engineering personnel planned a test that will accurately measure the flow and mixing characteristics of the effluent system to evaluate the adequacy of the monitoring and sampling presently used.

The procedure was previously written and is now being routed through Separations management for approval. The on-line spectrometer system that will be used to measure dye concentration at selected points in the effluent system continuously during the test is assembled in SRTC and is ready for deployment. Separations is in the process of providing access points at the appropriate locations for insertion of fiber optic probes.

Separations Support - Jim Wong

EES is continuing work on the test calorimeter for the Special Nuclear Materials (SNM) Vault. All parts that require machine work for construction of the test calorimeter have been delivered to the machine shop, and the machining process is nearly complete on the heat transfer well.

The vendor search of Automated Guided Vehicle (AGV) equipment for the SNM Vault is near completion. Detailed technical requirements for the AGV system are still under discussion between EES and Separations.

EES has added an engineer to the program from SPS to assist with development of leak testing equipment that will serve a dual use to check

both the Primary Containment Vessel (PCV) and the Bagless Transfer Container.

A copy of TriTool's proposal to integrate the welder and cutter on the Bagless Transfer was received. The goal is to commit funding for design this fiscal year and purchase a system next fiscal year.

Two highly sensitive accelerometers to perform the resonant frequency tests on the Acoustic Gas Analysis project have been received. Hammer tests have been conducted on the vessel to experimentally determine the natural frequencies of the bell jar. SRTC/ATS completed some finite element analysis calculations on a model of the same bell jar to do a thorough comparison of the experimental and analytical results.

Materials for the Vault mock-up have been received, and construction will begin by the end of July and will last one week. Retaining racks will be fabricated and installed later. EES has begun a redesign of the retaining rack to make improvements discussed in the last project review meeting which will reduce fabrication cost. A seismic review of the retaining rack will be initiated between EES and Separations.

PCV mock-ups are in fabrication now and will include the minor modifications discussed in the last project meeting (weld backing plate). NDE requirements are being investigated.

EES made a presentation on Artificial Intelligence (AI) to Separations and discussed several applications for AI in the Vault equipment.

EES has completed cable and piping designs for the Americium/Curium Pilot System being installed in TNX. Design of piping, cable tray, and frit feed supports are currently underway. A comprehensive list of all components needed for the TNX pilot system is being created.

EES is continuing the design of the FB-Line Bagless Transfer System. Component designs have been modified to incorporate recent changes in the bagless transfer can size per the customer's request. Test parts for the snap-in tungsten tip and the helium backfill device have been placed in the machine shop for fabrication.

Commercial rail tables, motors, and drives are still being selected.

EES/NMP and Los Alamos have initiated a collaborative effort to install a bagless transfer system at Los Alamos for hot testing. The cooperative effort between the two labs will help speed definition of a complex-wide solution to repackaging efforts.

EES was requested by Separations Engineering to support a modification to the H-Canyon personnel tunnel. A recent contamination incident led to this modification, and EES supported this job by providing a duct transition piece. The transition piece will be used to connect the obtained blower to the required duct connection. The transition piece is complete and has been delivered to Separations Engineering.

EES is preparing to perform a vacuum test on a filter housing used in HB-Line to filter vacuum transfers. A leak developed recently in one of the current filter housings. A spare housing was located, and EES is performing a vacuum test to insure that the housing meets leakage requirements.

ENVIRONMENTAL

Ecology Data Atlas Moved To Site Server - H.E. Mackey

The Ecology Electronic Data Atlas has been transferred to the WSRC-EPD Unix computer server (FALCON). This transfer was done in an effort to further increase the availability of this spatial data tool and centralize WSRC Geographical Information System data. Access authorization can be obtained through EPD/EMS. Additional Data Atlas modules for bibliographic data and site selection are completed and will be installed.

Radiological Impact Report - G.T. Jannik

The "Radiological Impact of 1994 Operations at the Savannah River Site" report was issued on June 12, 1995. Highlights for 1994 taken from the report include the following:

- maximally exposed individual air pathway dose was 0.09 mrem
- maximally exposed individual liquid pathway dose was 0.14 mrem
- maximum potential drinking water pathway dose was 0.06 mrem
- total collective dose was 8 person-rem.

Site radioactive releases continued their downward trend and the 1994 air pathway dose was 18% less than the 1993 dose. However, even though there was a decrease in radioactive liquid releases, the 1994 liquid pathway dose remained essentially the same as the 1993 dose because of a decrease in Savannah River flow, causing less dilution to occur.

Par Pond/L Lake Coring Completed - J. W. Koch

A program of underwater coring was initiated to provide data on sediment contamination in the sediments of Par Pond/Pond C and L Lake. Over twenty cores were collected in the two reservoirs and samples were shipped to laboratories capable of providing certifiable analyses. Core samples were divided into five

depth intervals for analysis, with analyses emphasizing metals and radionuclides. Preliminary results of analyses are expected in September with validated results received in October. The results of this work will be used to generate a list of preliminary contaminants of concern for these two reservoirs.

L Lake Study - W. G. Winn

ETS has been asked by John Gladden of ESS to conduct measurements on L Lake with the underwater HPGe detector. These measurements will provide data for scoping the location distribution of Cs-137 and other gamma-emitting radionuclides in the lake sediment. Such information will help guide options regarding the future status of the lake including draining it.

The underwater HPGe detector was tested in the small northwest room of the new D-Wing extension. Measurements at depths down to 70 ft are anticipated and the detector/winch system can reach depths of about 110 ft. The actual measurements are scheduled to begin in July.

River Water Shut-down Environmental Impact Statement - J. B. Gladden, K. L. Dixon, R. A. Hiergesell, K. M. Jerome, F. A. Washburn, J. Cardoso-Neto

Five piezometers will be installed in support of the Environmental Impact Statement for the River Water Shutdown of Par Pond. These piezometers will be used to determine water level measurements and groundwater flow patterns. It has been decided that the piezometers will be permanent and installed by conventional mud rotary drilling techniques. A scoping meeting has been held and the Site Use/Site Clearance permits are in the resolution process. Drilling is scheduled to start in September.

Par Pond Vegetation Surveys Initiated - H.E. Mackey, R.S. Riley

The refilling of Par Pond during 1995 has established conditions for the shorezone plant community to redevelop in the reservoir. Surveys of this plant community were initiated

in June and repeated in July to evaluate the pattern and rate of aquatic and wetland plant reestablishment. Forty-eight transects that were utilized in previous surveys before the drawdown are being resampled to allow comparisons to pre-drawdown conditions. Initial results indicate that extensive beds of maidencane are persisting and waterlily, lotus, watershield and spikerush are becoming reestablished. Cattails, a dominant species prior to the drawdown, is not showing a rapid regrowth.

Data Logging Systems for Meteorological Monitoring - M. J. Parker

A review of available data logging systems for meteorological monitoring applications was conducted in preparing for WIND System configuration changes. Data collection is presently conducted through phone lines between each data building and the two VAX 8550 WIND System computers in SRTC. Ideally, in the future, all data collection will be performed at each tower site with automated downloading to a central distribution/archival computer.

June 16 Tritium Release - R. J. Kurzeja

On June 16, 1995, 10,700 Curies of elemental tritium were released from H Area at 9:30 am. At 10:15, SRTC personnel began tracking the plume and SRTC sampling teams were dispatched to collect samples. The TRAC van was also dispatched to monitor for tritium oxide. Over 30 samples were collected near the Georgia cities of Louisville and Waynesboro. Analysis of these samples has shown general agreement with estimates from the Puff/Plume model. A report on the results is being prepared.

Support for Emergency Services Department - C. H. Hunter

Work began on scenario development for the 1995 DWPF series of emergency response drills and exercises. ETS participation in these exercises will include activation of the Weather Center and TRAC vehicle as well as providing staff in the Emergency Operations Center. The

formal, graded exercise will be conducted in November 1995. Preparations for the graded exercise consist of a series of drills in August and September and a practice exercise in October. Three general sets of scenario meteorological conditions were developed (drill series, practice exercise, and exercise) and used to perform calculations of environmental consequences from an accidental release. The results of the calculations will be used to develop scenario field monitoring data. Complete sets of refined data, including local and regional observations and forecasts, to be used by the participants will be developed.

Effects of Rainfall on Bivanes M. J. Parker and L. R. Hipp

A study is being conducted on the effects of rainfall on bi-directional wind vanes. Rainfall rate, measurement height, turbulence, wind speed, and event length are the variables of primary interest and the inter-relationships between variables are also being studied. Preliminary results indicate that the elevation (vertical) angle measurement is significantly affected during rainfall at low, near-threshold wind speeds. However, little "memory" by the vane was shown after the event ended.

Environmental Restoration Surface Water Transport Modeling for F/H Seepage Basins Risk Assessment - K. Chen

The SRS Citizens Advisory Board, DOE, EPA, and SCDHEC have asked for an analysis of risk from drinking water contaminated with F- and H-Area Seepage Basins (FHSBs) tritium in Fourmile Branch and Savannah River. SRTC performed surface water transport of tritium released from FHSBs groundwater into Fourmile Branch and the Savannah River. WASP5 was used to simulate surface water transport for tritium releases from the F- and H-Area Seepage Basins. The WASP5 model was qualified with the 1993-1994 tritium measurements at U.S. Highway 301. The tritium concentrations in Fourmile Branch and Savannah River were calculated for tritium releases from FHSBs. A draft report was completed to document the study.

Seedling Survival at F/H Area Seepage
- E.A. Nelson

Seedlings of the native tree species (*Nyssa sylvatica*) were planted in the impacted areas along the F and H area Seepage Basin seepage line in winter 1994. Survival of these seedlings was exceptionally high at the end of the first growing season and overwinter survival was also high, although signs of vegetation stress were higher than during the previous fall sampling. These seedlings were resurveyed during July to evaluate survival mid-way through the growing season. Tupelo seedlings showed a substantial increase in stress indicators. Additionally, seedling mortality had increased substantially at the two sites that were resampled during the July survey. The changes are considered to be a result of the increased root growth into, and reliance upon, groundwater and soil resources in the area during the second year of growth.

Detailed Three-Dimensional Flow and Contaminant Transport Modeling of the Old Burial Ground - M. Harris, G. Flach, L. Hamm

Preliminary results from a detailed, three-dimensional tritium transport model of the Old Burial Ground (OBG) have been generated. The total amount of tritium buried in the OBG is estimated to be 288g or 2.8 million Ci (decay uncorrected). As of 1995, 49% of this amount has decayed within wasteforms, 45% has been released to the vadose zone, and 6% remains in wasteforms. The peak release rate to the vadose zone occurred in 1961 and has declined to 4% of the maximum in 1995. Spent melts release tritium to the vadose zone at a much higher rate than other wasteforms, on average. In the context of a first-order leaching and decay model, the leaching constant for spent-melts is about 0.341/yr compared to 0.029/yr for non-spent melts on average. Overall, 61% of the decay-uncorrected tritium inventory is buried in the western end of the OBG and 39% in the east end. However, 97% of the spent melts lie in the east end. The peak amount of tritium in the groundwater occurred in 1972 (600,000 Ci) and has declined to 41% of this maximum in 1995. The tritium flux to Fourmile Branch is estimated to have peaked at about 4500 Ci per year in 1990. A significant decline is expected in the

near future. Simulated tritium plumes indicate that the source of tritium discharge to Fourmile Branch to-date is entirely from sources buried in the west end of the burial ground. The predicted plumes are reasonably consistent with monitoring data. The transport model will be used to predict future tritium discharge to Fourmile Branch and assess remediation alternatives at the Old Burial Ground, such as capping. A final report is being prepared.

Octanol Dialysis Sampling for Chlorinated VOCs - R.L. Nichols, T.R. Jarosch, B.B. Looney, S.L. Baxley, R.D. Raymond

The Groundwater Group of the Environmental Sciences Section was requested by ER to conduct a scoping study to evaluate the applicability of dialysis sampling for groundwater monitoring. The potential benefit of dialysis sampling is the elimination of investigative derived waste (IDW) that results from the purging of a groundwater monitoring well prior to sampling. The technical assistance request was centered on the feasibility of using dialysis with octanol as the receiving solvent for quantitative analysis of chlorinated volatile organic compounds (CVOCs) in groundwater. Preliminary work involved investigations into the appropriate dialysis materials, fabrication of a sampling device to hold the dialysis bags, and testing of an analytical technique for determination of chlorinated organics in octanol. The final design employed 2-ml bags constructed of regenerated cellulose membrane tubing. The octanol is analyzed via direct injection into a gas chromatograph. Filled bags were tested in the laboratory with distilled water to ensure that losses of octanol were minimal. The first phase of testing was set up to evaluate the rate of diffusion into the dialysis bags. The monitoring well selected is located at TNX and contains elevated levels of trichloroethylene (TCE). Both bag and water samples were taken periodically over a one week period. Results revealed that the TCE concentrations in the octanol were still rising after one week. Data analysis of the linear uptake region of the concentration-time plots ($t < 4$ days) using estimated mass transfer parameters gave an average calculated TCE concentration in the water of 638 ug/l. The average TCE

concentration from water samples was 575 ug/l. The slope of the linear region is directly proportional to the water concentration. Therefore, once slopes are calculated from field data with parallel water analysis, water concentrations can be measured at other wells. This slope should be constant for a given compound, membrane, and solvent barring any significant change in the water characteristics but will be dependent on the depth of sampling. These results suggest that the dialysis technique is behaving as expected and that a sampling method can be employed at water table wells in which the bags are kept in the well for a period of from one to three days. The second phase of testing will repeat the first phase to ensure reproducibility. A third phase of testing is being planned to investigate two additional wells with a significantly higher and lower TCE concentration to ensure the field calibration of the uptake rate is applicable over a range of concentrations typically observed at the SRS.

Detritiation Technologies Review - **B. Looney, K. Jerome**

A program to evaluate the status of current and emerging aqueous detritiation methods and develop a practical assessment of potential viability will be conducted to support the Environmental Restoration efforts in the remediation of the F & H Area Groundwater Plume. The statement of scope for the SCUREF contract was submitted to procurement and the request for proposal has been forwarded to the universities. Vincent Van Brunt, USC, has responded to the request for proposal. A review of Van Brunt's proposal was completed on March 10 and transmitted to the buyer. Funding has been provided for this project from the Plumes Focus Area. Routing of the purchase requisition for signature has been initiated.

Electrokinetic Migration at Old TNX Basin - J. P. Bibler, T. F. Meaker

The drilling and sampling schedule is being modified. The microwave digestion unit has been installed and is being tested. Polymers from the electrodes will be the first materials to be digested.

Old F-Area Seepage Basin (OFASB) Soil Remediation -V. H. Dukes, S. M. Serkiz, J. L. Siler

The OFASB (Building 904-49G) is an inactive, unlined basin located north of Building 221-F. This basin, which can be described as a wet-weather pond, was used to process various waste waters, such as evaporator overheads and contaminated cooling water. Cured binder screening samples (12 total) have been crushed and leached. Two different water contents were evaluated on most of the samples during preparation. The lack of differentiation between the binders studied is going to require us to perform ICP-MS on all samples, instead of a random subset. The leachate samples were analyzed. U levels were reduced to below detection limits by using portland cement (PC) or a mixture of PC and fly ash. Four additional mixtures are planned to determine the actual levels of these additives that are required to bind the U, so that the treatment costs can be reduced. A report was issued (SRT-WED-95-0192) on 7/31 to detail the soil characterization work and preliminary screening studies results.

Land Reuse Business Development Meeting- J.B. Gladden, V. Dedshenicks

The Institute of Environmental Solutions (IES) convened a meeting of the DOE laboratories to discuss mechanisms for accessing laboratory technical resources and the types of support that could be provided to the California Land Reuse Initiative. The meeting was held in Sacramento, CA in July and include representatives from most of the laboratories, DOE-HQ and the Oakland Operations Office. Laboratory technical resources for this program will primarily be provided by SRTC, ANL and ORNL until better definition of resource availability can be resolved for the other laboratories. The \$500K Work For Others agreement between WSRC and IES will serve as the model financial instrument for accessing resources for all of the laboratories.

CRADA: Sun River Advanced Oxidation (UV/Ozone) Treatment of Groundwater Contaminated with Chlorinated VOCs - T.R. Jarosch

A Joint Work Statement for a CRADA between Sun River Innovations, Ltd. (SRI, a small business located in Coconut Grove, FL.) and SRTC has been approved by DOE. The purpose of this work is to field test a mobile advanced oxidation system (UV/ozone) for the treatment of hazardous, toxic organic compounds in groundwater and process water. The demonstration will be conducted at a well site with known contamination of trichloroethylene (TCE) and/or perchloroethylene (PCE) as the primary targeted constituents in groundwater. This test will benefit SRS and DOE by providing data and validation on the use of this and similar technologies in meeting clean-up needs. Benefit to SRI will be derived from evaluation and validation of the system in a "live" setting at the SRS. This work focuses on a method to treat such aqueous waste streams directly using an advanced oxidation system employing ozone and ultra-violet (UV) light developed by Sun River Innovations (SRI), Ltd. The system utilizes a uniquely designed single UV lamp reaction chamber and a dual phase destruction loop to provide enhanced energy and destruction efficiency. The system's design criteria is directed at providing a highly compact and mobile treatment system with the capability for remote monitoring and operation to address the needs for a broad range of remediation sites. Present work is focused on further development of the scope of work and evaluation of potential tests sites.

Unmanned Aerial Vehicle Data Acquisition System - K. J. Hofstetter, M. M. Pendergast, D. W. Hayes, Eric Corban

Scientists and technicians from Guided Systems Technologies (GST), Atlanta, and from SRTC conducted a series of demonstration tests at SRS on June 19 and 20 using the GST unmanned aerial vehicle (UAV) to survey selected sites. The sensors on board the UAV were supplied by SRTC and integrated with the flight control system to permit real-time capture and evaluation of the data as the UAV helicopter flew a pre-programmed flight path. The oil contamination test site in the 400-D area was surveyed with the UAV recording intra-red thermal images, on-board color video, position

coordinates via differential GPS and altitude simultaneously. Flights were made at 1 meter and 2 meter elevations. In another test, a three-axis magnetometer was flown over the same area to obtain signatures of buried metallic objects. This area has been extensively surveyed and monitored by a variety of ground-based techniques. In a third demonstration, the UAV scanned the Steed Pond area while carrying the on-board color video camera, a precision barometer, the differential GPS, and a small NaI(Tl) gamma-ray sensitive radiation detector. These experiments were part of the DOE/MTI-funded project to evaluate the ability of a hovering UAV to perform low-level surveys in remote areas while carrying a suite of sensors developed by SRTC. Data evaluation are presently underway.

Remotely Operated and Field Deployable Tritium Analysis System K. J. Hofstetter, J. E. Noakes

The sample holder configuration was modified slightly from the previous design by coating the interior of the copper housing with a white reflector paint to enhance the photon transmission. A 10-mL quartz sample vial (with 40-mm diameter) having a flow-stop capability was designed for use in the sample holder configuration. The flow/stop cell was incorporated into a test rack to evaluate the sequencing of the sample injection, sample outflow, and cell cleaning cycle. These parameters have now been defined for operation on a manual basis. Work has been initiated on a test rack set up for computer automated operation of the flow/stop cell. Phase I testing of the prototype is scheduled for August. An agreement has been reached between C.A.I.S. and Packard Instrument Co. for the incorporation of an external standard into the flow cell design for the final system scheduled for delivery in February 1996.

UCF Gamma Analyses of Non-Routine Samples - W. G. Winn

This month a total of 50 non-routine samples were analyzed on different detectors of the Underground Counting Facility. The large 90% and 166% HPGe detectors analyzed 39 water filter samples (37 for IAEA and two for

USGS), one biota sample (Mississippi River), and three special samples (IAEA). The 20% and 25% detector analyzed five water samples (IAEA) and two Shell Bluff resin samples (SRS).

Technology Development MAG*SEP Demonstration - K. Jerome, R. Nichols, M. Phifer, F. Sappington, Miles Denham, Chuck Betivas, J. Bibler

The MAG*SEP Demonstration will provide for the development, design and first field tests of two new technologies; the Magnetic Separation System, referred to as the MAG*SEP system, and the EnviroWall Barrier. This demonstration brings DOE, National Laboratories, operating facilities, and private vendors together to develop and test new technologies which are targeted for Environmental Restoration needs. Savannah River is hosting the demonstration and providing process chemistry support, and all site support and site characterization.

A team meeting was held on July 13 in Atlanta, GA. Representatives from WSRC, ANL, Selentec, RUST E&I, BWNT, and DOE-SR were present. Updates were provided on all activities and a walk-thru of the MAG*SEP trailer was conducted.

A letter was received from ANL on July 18, requesting WSRC analyze all samples from the MAG*SEP demonstration. Cost estimates were prepared by WSRC based on two different sets of numbers received from ANL. The FY95 carryover money and the FY96 request will allow the completion of samples collected from all demonstration activities up through the demonstration at well DCB4A, plus or minus \$7K (the number of samples has not been finalized by ANL as of this date). Funds do not exist at present to fund testing the MAG*SEP system at the barrier wall.

The Industrial Wastewater Treatment Approval Package was submitted to SCDHEC on July 21, 1995.

The Process Hazards Review for the MAG*SEP system was conducted on July 26, 1995.

The construction of the EnviroWall Barrier was completed on July 27, 1995.

Ongoing activities of significance are provided below. Procurement of materials and preparation of the site for the MAG*SEP demonstration has begun. Monitoring of select wells at the D-Area site continues on a routine basis. Support of the process chemistry continues at a high level of effort. WSRC personnel have received both the draft MAG*SEP test plan and the MAG*SEP sampling and analysis plan for review. Comments were provided to ANL on the test plan. Comments on the sampling and analysis plan are due on August 18.

A tour of the barrier wall/MAG*SEP demonstration area was conducted for Liz Goodson, DOE-SR on July 28.

MAG*SEP Demonstration Process Chemistry - J. P. Bibler

SRTC studies have enabled recommendations to Selentec, Inc. that may considerably streamline the process chemistry of the MAG*SEP demo in D-Area. Water from a different well than had previously been considered will be used in the demo. The new well, DCB-4A has much less iron and aluminum than the previous well, DCB-1A. Water samples are being characterized and tested with MAG*SEP particles. New particles, containing highly pure magnetite from Sweden, have been tested and initial analytical results indicate that the particles are effective at decontaminating the new D-Area well. Testing has also been done to determine whether the hydrogen form of the resin on the particles can be used. Results were favorable and a recommendation was made that the H-form be used in the demo. Changing to the H-form of the resin will significantly reduce the secondary waste volume from the process. Additionally, it will eliminate three chemical processing steps, along with NaOH and sodium acetate and required tankage. Researchers were in Atlanta June 7-9 at the Selentec facilities to test the groundwater decontamination and elution of spent particle processes using Selentec's prototype equipment. Samples of two magnetite materials, one from the US and one

from Sweden, were analyzed at SRTC by X-ray diffraction and scanning electron microscopy. SRTC was able to advise Selentec that the US material contained about 30% hematite as an impurity whereas the Swedish material was very pure.

MAG*SEP Particles Incorporating TEVA SPEC Resin for Tc-99 Removal from Arctic-Ocean Water - J. P. Bibler, D. A. Brooks, D. J. Beals

Bradtec Mag*Sep magnetic particles, coated with EIChrome's TEVA SPEC resin have been used to remove Tc-99 from Arctic-Ocean water. The adsorption capacity was shown to be linear with Tc-99 concentration. It was apparent from the tests that the resin was not saturated in any of the tests. This implies that very small particle loadings of this resin can be used to extract Tc from seawater for analysis. Experiments are now in progress to determine the minimum contact time needed to effect statistically reliable extractions. The maximum number of cycles that the particles can sustain without efficiency loss has not yet been determined.

Landfill Stabilization Focus Area (LSFA) - M. A. Phifer

Coordination of DOE and WSRC Environmental Restoration (ER) concerns and involvement with the Landfill Stabilization Focus Area (LSFA) Technical Task Plans (TTPs) has been provided. Both DOE and WSRC ER will become more involved in the LSFA TTP work conducted at SRS and that work conducted at other DOE sites which may have applicability to SRS ER problems. Both DOE and WSRC ER personnel have been assigned to follow the selected TTP subtasks and work with the individual Principal Investigators (PIs). This close coordination with ER personnel will help facilitate the transfer of OTD work to actual field implementations.

Stabilization/Containment Systems Technical Task Plan (TTP) -

M. A. Phifer, D. M. Tuck, C. B. Fliermans, H. E. Mackey, C. E. Murphy, A. L. Kielpinski, C. R. Ward, M. G. Serrato

A draft Stabilization/Containment Systems Technical Task Plan (TTP) has been prepared to support FY96 funding requests in the FY96 PEG. The projected funding level for this TTP is \$2,266K. The TTP subtasks include: Demonstrate Surface Containment Systems Repair, Demonstrate In Situ Intrinsic Remediation of Landfills, Demonstrate In Situ Plasma Vitrification, Demonstrate Remote Sensing of Cover Systems Performance, Detect Subsidence via Instrumented Routine Maintenance Vehicles, and Demonstrate Instrumentation for Closure System Failure. Based upon the funding level and the Draft TTP, detailed subtask plan are currently under preparation.

Closure Repair Techniques -

D. M. Tuck, M. A. Phifer, M. G. Serrato

FY95 OTD funds have been made available for Landfill Focus Area Technology Demonstrations. Included in the scope are funds for Closure Repair Techniques for the Kaolinite compacted clay caps at SRS. A Scope of Work (SOW) for laboratory studies of closure cap repair techniques has been prepared. The SOW has been sent by Procurement to the Lawrence Berkeley Laboratory (LBL) for quotation.

RADMAPS Radiation/Position Detection Unit - K. J. Hofstetter and D. W. Hayes, R. F. Eakle

The results of the gamma-ray and neutron spectra taken of waste drums containing TRU contaminated waste were analyzed. These experiments were reported in last month's report. The 2" x 2" NaI gamma-ray detector and the enriched Li-6 doped-glass scintillator neutron detector recorded spectra emanating from typical waste drums containing Pu-239 and Pu-238 under pre-programmed protocols. The differential Global Positioning System (GPS) has been received and is presently under study. This unit will be installed in the prototype RADMAPS DAS unit. Position data were recorded with the Aerial Monitoring System during the run near Steed Pond and was georegistered onto site maps as further

demonstration of the Nuclear Information System (NIS) portion of RADMAPS.

Sanitary Landfill Groundwater Bioremediation Optimization Test - T. C. Hazen, K. H. Lombard, M. M. Franck, D. Altman, J. D. Young, C. J. Berry, F. A. Washburn, J. Santo Domingo, C. B. Fliermans, J. Shappell, N. O'Halloren

During this reporting period only compressed air was injected into all the injection wells at both sites at the Sanitary Landfill. Site 2 has stabilized and injection pressures and flows are being logged on a continuous basis using pressure transducers and auto-dataloggers. GC analysis of the water and soil gas during the air injection campaign have shown a marked reduction in concentrations of the contaminants, many below detection. In order to continue testing, the system has been turned off to allow the contaminant concentrations time to recover as the groundwater moves through the test sites. Water and gas samples will continue to be taken to monitor the change in concentration. Microbiological activity and water parameters will also continue to be monitored.

WASTE MANAGEMENT

Tank 51 Slurry Pump Modification & Testing - M. J. Dalmaso, D. B. Stefanko, J. P. Wood, and C. L. Sharpe

IWT is coordinating the modification of new slurry pumps (originally slated for installation in Tank 40) to prepare them for installation into Tank 51. The pumps currently installed in the tank leak excessive bearing water which causes operability and process control concerns. Four new pumps are being disassembled, inspected, reassembled and tested at TNX prior to installation into Tank 51. Activities completed this reporting period include:

- A Nonconformance Report (95-NCR-11-0012) was written on the replacement slurry pumps after excessive wear was found on the lower pump shaft and impeller during post run-in test inspections.
- Hydraulic components for all four pumps and one complete column assembly were shipped to Sulzer Bingham in Portland, OR, for examination, repair and testing.
- A scope of work for Sulzer Bingham testing was prepared. The scope was issued by the HLW procurement organization.
- A list of parts needed to complete slurry pump testing was assembled and forwarded to HLW for procurement.
- A scope of work was prepared for an Interworks Requisition (IWR) to the Westinghouse Electro-Mechanical Division (WEMD). WEMD will provide an independent assessment of the pump hydraulics.

Update

SRTC (J. P. Wood) witnessed testing of a slurry pump shaft modification proposed by Sulzer-Bingham to eliminate the shaft/impeller/casing wear problems discovered during pre-installation testing activities performed at TNX. Testing was conducted

during the period July 13-17 at Sulzer-Bingham's manufacturing facility in Portland, OR. The initial test performed at Bingham lasted only 30 minutes and resulted in significant shaft, impeller and casing wear. A subsequent "dry run" test was performed which provided the first conclusive evidence that hydraulic forces were a significant contributor to the overall problem. Additional modifications were made to the shaft, impeller, and lower carbon bushing which resulted in reduced component wear rates; however, performance was still deemed to be unacceptable. Sulzer-Bingham plans to implement an additional shaft modification to further stiffen the shaft and to test this modification in conjunction with another impeller fabricated from a new casting. This test will take place on or about July 30.

TNX Off-gas Components Test Facility - D. B. Burns, B. W. Walker, and A. Wong

The TNX Off-gas Components Test Facility (OCTF) is a 1/10 scale pilot facility used to evaluate the operating performance of the Consolidated Incinerator Facility (CIF) off-gas system. Activities completed this reporting period include:

- Completed the system modifications which eliminated the accumulation of scrubber water in the horizontal duct before the scrubber.
- Installed new steam and scrubber water nozzles capable of delivering twice the original flow rate, and completed a 48-hour post modification shake-down.
- Collected total particulate samples from the stack exhaust in accordance with EPA Method 5 under the new test conditions (5% salt in the quench, steam to off-gas ratio of 0.25 and scrubber water to off-gas ratio of 0.5). The readings ranged from 0.002 - 0.008 grain/dscf. This is nearly a 10 fold reduction from HEPA run #1 (10% salt in the quench, same steam and scrubber water ratios).
- Completed modifications to the cascade impactor (adding insulation, heating strips, and changing the sampling piping) to obtain representative particle size distribution data.

The path forward includes completing the HEPA life confirmation testing (10% salt in the quench, scrubber water to off-gas ratio of one and steam to off-gas ratio of 0.5) with the new 304 SS cleanable HEPA prefilters.

Radiolytic Generation of Hydrogen and Benzene - D. D. Walker

The first large-scale irradiation experiment was completed at Georgia Tech. The G-values for hydrogen and benzene were smaller than the expected values based on small scale experiments and were much less than the values currently used in the ITP safety analysis.

A barrel containing 40 gallons of partially-washed 10 wt % slurry (KTPB, NaTPB, MST, and sludge) was irradiated to a dose of 100 Mrad (96 hours). The slurry was agitated for the first 72 hours. Hydrogen and benzene concentrations were measured in the helium ventilation stream. Benzene was produced at a fairly constant rate at a yield of 0.008 molecules/100 eV. This is significantly lower than the expected yield of 0.1 molecules/100 eV for this slurry composition. It is also much lower than the value of 0.7 molecules/100 eV used in the current safety analysis. During the first thirty hours of the irradiation, hydrogen was below the detection limit of the analytical procedure. The helium flowrate was decreased to produce higher hydrogen concentrations. For the subsequent 45 hours, the hydrogen yield averaged 0.035 molecules/100 eV. The expected hydrogen yield based on the solution composition (1.14 M NO₃⁻ and 0.42 M NO₂⁻) is 0.07 molecules/100 eV. The ITP safety analysis assumes a hydrogen yield of 0.46 molecules/100 eV.

Vigorous stirring was maintained through the first 72 hours of irradiation. At that time, the stirring was stopped for 12 hours, then resumed for 12 hours. When ventilation was stopped, there was a rapid decrease in the hydrogen and benzene concentrations in the vent stream. When stirring was resumed, the benzene and hydrogen concentrations increased above their previous levels (during continuous agitation), then began to decrease.

The irradiated slurry was removed from the Co-60 source and divided into two parts. Water was added to one half of the slurry to dissolve the excess NaTPB solids. No trapped benzene was observed for thirty hours following the water addition. Based on previous small scale tests, approximately 1 gram of benzene should have been released and would have been easily detectable. The lack of benzene is surprising and is under investigation. The composition of the slurry before irradiation, after irradiation, and after water addition is under investigation to determine how much NaTPB actually dissolved during the test.

Correlation of Late Wash Simulants Filtrate Flow Rate - R. A. Peterson, C. A. Nash, D. J. McCabe and T. B. Edwards

Late Wash Engineering requested Interim Waste Technology (IWT) to investigate the relationship between irradiation and filtrate flux. Filtration experiments were performed using the Experimental Lab Filter (ELF) and process simulants exposed to 0, 90 and 230 Mrad of Cobalt 60 irradiation. From these results, a model was developed with the assistance of the Applied Technology Section to predict filtrate flux as a function of irradiation dose. Other parameters found to have a significant impact on filter performance were the concentration of sludge solids present, the axial velocity and the pressure drop across the filter. These parameters were also employed in the development of the model. The presence of 6000 ppm of sludge solids was found to decrease the filtrate flux by between 35 and 50%. Filtrate flux was found to improve by 10% for every additional 1 ft/s of axial velocity employed above 6ft/s. Finally, filtrate flux improved by 3% for every additional 1 psi of operating pressure employed above 10 psi. Additional work will be performed to determine if the scale of the experimental equipment plays a significant role in determining the filtrate flux. These experiments will involve the Parallel Rheological Experimental Filter (PREF) unit. The PREF employs more than 4 times the filter area of the ELF.

Technology Development Award Fee Milestone Met - D. Burge

A Technology Development Award Fee Milestone was met by completing the CIF Health Based Risk Assessment(HRA) before June 30. As part of the OTD Economic Development Program, a CIF HRA was begun in 1994 through an ERDA contract with Ga. Tech. This model evaluated human health risk to the public and on site workers from hazardous and radioactive constituents from future CIF emissions. When this work was begun, HRAs were not required for incinerators, but were being proposed. SRS took a proactive role in beginning this work. The EPA now requires an HRA to be performed for new incinerators. On June 28, the final CIF HRA documents were issued, which included metal, radionuclide, and organics emissions estimates, and radionuclide and toxic chemical risk assessments. The model calculated risk for an expected baseline emissions rate and a high emissions rate, which is ten times higher than the expected rate. Cases considered included an onsite worker, and a farmer, fisher, individual, and child at the boundary of SRS. The health risk impact due to emission of radionuclides and toxic chemicals from the CIF is negligible. Once the CIF trial burn is complete, actual emissions data will be input into the HRA model. Don Burge was the principal investigator for this work. He did an outstanding job in managing this work and meeting the Award Fee Milestone, in spite of a number of unplanned issues from the EPA that required attention to keep the CIF regulatory program on schedule.

English China Clay (ECC) Work for Others - L. N. Oji, C. B. Flierman, S. T. Wach, D. C. Beam

ECC International, a major kaolin producer from Sandersville, GA, has requested SRTC perform irradiation testing on kaolin slurry. ECC is searching for a way to control bacteria with reduced levels of chemical biocides. SRTC previously performed similar tests under the DOE funded Industrial Assistance program with encouraging results. The upcoming tests will be paid for by ECC as a Work for Others through SERA and the International Forest Center. Cost is estimated at \$10K and follow-on work is anticipated. This is a joint effort between IWT, ESS and DWPT.

OCTF Status - J. P. Wood, D. B. Burns, B. W. Walker, A. Wong

The Off-gas Components Test Facility(OCTF) is a 1/10 scale pilot facility at TNX, which is being used to evaluate the operating performance of the CIF off-gas system. Previous testing showed that the HEPA prefilter life may be only several days at expected CIF conditions, which is unacceptable. The OCTF is on a critical schedule to test several options that may resolve this problem; increased steam and water flow to the scrubber, and cleanable HEPA prefilters. During a ten day run (6/30-7/9) with these options, considerable improvement was found in the HEPA prefilter life(estimates are that lifetime has been extended by at least an order of magnitude). Future OCTF tests will have reduced steam flow to the scrubber to optimize steam required for the CIF trial burn.

Over the last several weeks, the quench nozzles have plugged with debris on numerous occasions. Alterations have been made to the quench nozzle inlet piping to help with this problem, but occasional plugging continues. A strainer that is cleanable on line is being pursued and will be installed at the next available opportunity. A similar strainer is also being recommended for consideration for the CIF.

High Level Waste - Malcolm Kyle

EES is continuing fabrication of the Waste Tank Interior Video Inspection System control boxes and is approximately 50% complete. The purchase order for the deployment cable reel has been placed, and the delivery date is expected to be late August. Bids have been received on the purchase requisition for the camera housing, and the order is expected to be placed the week of August 1.

EES is approximately 20% complete with the fabrication of the Annulus Camera System control boxes. The purchase requisitions for the deployment cable reel and the camera housing have been sent to procurement and will go out for bids to offsite machine shops.

EES is working to complete fabrication of four ITP Reel Tape RS-485 to BCD converters. The converters are approximately 90% complete at

this point. Progress was slowed down due to the resignation of the task leader, but work on this job has resumed.

EES was requested by HLWE to repair a mechanical problem with the periscope used to perform annual inspections of Type 4 tanks. A threaded section of the eyepiece was damaged making assembly impossible. The section was repaired, and the periscope is back in service.

EES completed repairs on a remote cell camera cable that was damaged during remotability testing in the New Waste Transfer Facility. This is the third cable to be repaired. The customer was previously notified that these cables would continue to have problems due to improper strain reliefs and assembly. Temporary strain relief was added to this cable in an effort to prolong its useful life. The cable was reinstalled and is working properly.

Defense Waste Processing Facility - Malcolm Kyle

EES is continuing work on the DWPF Analytical Cell Upgrades. Wiring of the internal junction boxes is nearly complete. Due to a fabrication error by the vendor, the Fischer coax connectors will not be received as scheduled which will delay the completion of the internal junction boxes, severely impacting the schedule.

Modifications to the sample prep microwave controller are complete, and the unit has been racked in the equipment tower. Two Mettler balances, one mixer mill, one capper/decapper, one balance controller, and the sample prep microwave controller have all been modified. The moisture solids analyzer and controller have been received from DWPF for modifications. The final piece of equipment to be delivered to EES for modifications is the muffle furnace microwave.

All of the cables internal to the Analytical Cell cabinets have been completed and installed. Fabrication of the internal equipment cables is approximately 30% complete, and CSWE E&I is 80% complete on fabrication of the penetration cables. The single-phase 240VAC power distribution for the AC cabinets is complete.

The penetration seal boxes have been received from an off-site machine shop on schedule. Construction has agreed to fabricate the cell services adapters for 274 hours. No completion date has been set at this time.

Upgrades were designed for the in-cell light fixtures for electrical connector upgrade, easier assembly, and stability.

The electrical installation DCP #E-DCP-S-95047 and eductor modification DCP # M-DCP-S-95050 were completed and are being reviewed by DWPF technical. Comments have been resolved on the penetration seal installation/electrical demolition DCP #M-DCP-S-95044, and routing is continuing for approval.

EES is continuing work on the DWPF Melter Pour Spout Modifications. A revision to the Tele-manipulator procurement specification has been made to allow installation of the manipulator arm from the canyon side. New bids based on the revision are due by July 31. Fabrication of modified Adapter components is being done by Southern Machine & Tool, and all Inconel 690 work is being done by the 717-A machine shop. Designs for the Melter Pour Stream Viewing Camera are complete and ready for fabrication.

EES is currently fabricating drive housings and hanging racks for the DWPF Analytical Cell Remote Titrator. All fabrication, except wiring, is expected to be completed by August 4.

Late Wash - Malcolm Kyle

EES has completed fabrication of Field Termination Cabinets FTC15-01 and FTC15-02. The DWPF Control and Production Systems Group has performed the factory acceptance test procedure for the two cabinets, and the cabinets will be transported to the Late Wash Facility for field cable terminations by Bechtel Construction the first week of August.

EES is continuing work on the Benzene and Nitrite Analyzer Systems for Late Wash. The Lab Operator Interface Control Station assembly and connection diagrams have been delivered to the customer for review. Design modifications have been made to the Benzene and Nitrite

Progress and Accomplishments

Analyzer System connection diagrams to reflect changes made by Bechtel.

Due to a design error, glovebox fabrication has been delayed to make the necessary changes. The draft mechanical enclosure isometric drawings have been received from BSRI, and installation of the internal components will begin after the glovebox modifications are completed.

GENERAL

Change Control Status - L. R. Chandler

The current status of the Site level Baseline Change Proposal (BCP) packages developed by SRTC for the FY95 Annual Operating Plan is: Thirty-four have been prepared; one is routing in SRTC for approval; three are awaiting DOE approval; thirty have been approved by DOE; and twenty-five have been entered into the FY95 AOP electronic data base.

Reactor Support - Malcolm Kyle

EES completed final assembly of the electric pump power cart and the pump hanger bracket for the Disassembly Basin Vacuum System. All of the electric pump system components were delivered to 105-K for final assembly and installation.

EES demonstrated the Telescopic Fuel Handling Tool for the Rhode Island fuel. A modified tool design has been submitted to the shop based on customer feedback from the demo.

EES fabricated a tool for the C-Area Decon Facility to improve plastic hut cleaning and decontamination methods using the Kelly Vac system. EES is currently evaluating ultrasonic decontamination methods to be used on hand tools or similar items and filtration methods to extend the life of the solvent.

EES presented a talk on application of the Sampled Data Spectroscopy (SDS) System for monitoring Cesium activity levels in the Disassembly basin. The possibility of combining SDS with pH and conductivity monitoring systems was discussed among the attendees. If successful, this would greatly reduce the need for routine basin water sampling. EES will demonstrate a proof-of-concept system later this month, and data from the demonstration will be compared to data from a parallel analog multichannel analyzer system and to laboratory analysis of the routine basin water samples.

Site Robotics Support - Ivan Lewis

EES was successful in capturing a video inspection of lead counterweights on the evaporator pot. This video provided invaluable information that has been used in determining the best course of action for remotely removing the counterweights. A small video camera with a zoom lens was lowered into the evaporator cell, a contamination and high radiation area. The camera was mounted to a flexible fiberglass pole which provided more stability and control than the conventional method of lowering the camera on a cable. A manual tilt device was used to position the camera.

EES assisted with modifying the specification for the DWPF Melt Cell Manipulator based on the technical evaluation of three bids received from industry. The modified specification on the tele-manipulator was delivered back to the vendors with a new bid date of July 31. The new manipulator will replace an existing melt cell manual manipulator and will perform several routine operations that are pushing the limits of the manual manipulators and provide a method for recovering from a melter pour spout pluggage.

Robotics for Mixed Waste Operations - Ivan Lewis

EES met with representatives from INEL, LLNL and FEMP at SRS for discussions of the completion and delivery of SWAMI II (Stored Waste Autonomous Mobile Inspector) to Fernald later this fiscal year. Assembly of the system at SRS is progressing. The mast, folding arms, and inspection pods have been assembled and mounted to the vehicle. The rear bumper, which houses the University of Michigan's backing sensors and a pirouette sensor, has been mounted. Final wiring of the drum locating sonar sensors is complete. A third sensor has been implemented in the algorithm to eliminate false center findings resulting from sensor noise and crosstalk. Vehicle path planning has also been completed. The system will perform autonomous inspections of drums stored in warehouses including reading drum bar codes and inspecting for dents, bulges, rust spots, and streaks.

**Office of Technology Development -
Tanks Focus Area - Ivan Lewis**

EES delivered to the test facility at Hanford the Overview Video Systems developed for use within underground storage tanks (UST). The test facility at Hanford allows full size, fully prototypic deployment of UST systems for qualification. The EES-designed systems will be used in conjunction with the Light Duty Utility Arm (LDUA) or as standalone devices. EES performed checkout of these systems at Hanford in July. Fabrication of three End Effectors for the LDUA and their controls has begun.

Robotics for D&D - Ivan Lewis

The Mobile Automated Characterization System (MACS) was transported to Washington, DC, for a demonstration in the U.S. Government Inter-Agency Environmental Technology Expo, held in the Hart Senate Office Building. While speaking at the press conference, Mr. Tom Grumbly used MACS as an example of technologies being applied to environmental problems. The tour began with a brief demonstration of MACS. EES developed and delivered MACS to ORNL as part of an Office of Technology Development Program earlier this year.

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

EES and Separations personnel completed the draft of a Technical Task Plan (TTP) to request funding for the deployment of a robotic system to remotely dismantle a glovebox and remove highly radioactive source material in Old HB-Line. The TTP is routing for comments prior to submission.

**Work For Other Customers - Ivan
Lewis**

DOE-SR approved a work for others agreement for EES to assist a small robotics company. The agreement allows the company to place task order in the robotics and remote systems area for a period of two years and up to a total of \$208,000 with EES. The majority of the work

is expected to involve pipe inspection equipment for potential customers in the oil industry.

EES hosted Dr. Pratt Mounfield, President of M&M Technologies. Dr. Mounfield has successfully won a Small Business Innovative Research (SBIR) grant from NASA to investigate Natural Tracking Algorithms. He has applied for two future SBIRs regarding applications of Natural Tracking Algorithms. He is interested in using the TNX Telerobot facility to demonstrate this technology because of the redundant degrees of freedom in the robotic system.

EES met with the International Thermonuclear Experimental Reactor (ITER) group in San Diego, to determine the potential for a participation role in the design of the international proof-of-principle fusion reactor now under development. The specific subject of the meeting was the remote handling of very large components in high radiation and toxic environments.

ASET has entered into a SCUREF agreement with the Medical University of South Carolina to determine the feasibility of applying lens-coupled digital radiography to standard medical x-ray imaging applications. The research is sponsored by the Economic Development Division.

The Mobile Chest X-ray Trailer acquired from the SRS Medical Department was used to perform the initial testing. In preparation for digital radiographic imaging, many trailer modifications were required. The interior was totally refurbished, and the exterior was painted. The chest x-ray unit was partially dismantled to allow for installation of the digital camera and scintillator. All modifications were complete, and the system is operational for the MUSC visit.

Dr. Don Frey of MUSC assisted in the digital imaging of three medical phantoms he supplied: a contrast phantom, a contrast/detail phantom, and a chest phantom. All images were acceptable (i.e. comparable to images that are acquired on the Fuji photostimulable plate system at MUSC). Dr. Frey will conduct the very same parametric tests at MUSC in the

following weeks for direct analysis of the two systems, with limited film imaging for comparison. Further tests were also conducted at SRS to improve the images of the chest phantom. Dr. Frey is expected to deliver image comparison results in early August. At that time additional testing will be conducted at SRS.

Glass Waste Storage Building - R. A. Dimenna and S. Y. Lee

Development of a one-dimensional model to calculate roof temperature profiles in the GWSB was begun this month. The objective is to calculate the transient temperature response in the concrete roof following a loss of all forced convection in the building for a range of loading patterns in the building.

The model is being developed in two separate parts. The first part is a one-dimensional flow model that represents the inlet section of the building, a lower plenum region through which air enters the annulus region of the individual glass cylinders, the glass cylinders, an upper plenum which collects the air discharged from the cylinders and directs it toward the building outlet, a riser section which includes the HEPA filters, and a fan to discharge air from the building. Flow areas, pressure loss factors, and a fan head curve representative of the actual building components will be used in the various components. The model is designed to characterize the building behavior by a single slice of glass cylinders through the middle of the building.

The second part of the model is a computational fluid dynamics (CFD) model of a single glass cylinder. This will be used to determine a friction factor correlation and a heat transfer coefficient correlation for flow in the annulus region as a function of the average fluid velocity in the cylinder. The velocity range used to correlate these parameters was estimated from the one-dimensional model and imposed on the CFD model as pressure boundary conditions.

Currently, the one-dimensional model has successfully run a five-parallel channel case with one-dimensional heat conduction in the concrete roof under normal fan operation. Heat transfer correlations and pressure loss factors have been estimated as typical textbook values

while the CFD analysis of the glass cylinders continues. The initial CFD analysis has been completed for four separate cases spanning the expected pressure differences across a single cylinder. The results are currently being analyzed to estimate a heat transfer coefficient and a friction factor.

Am/Cm Melter Liquid Feed System - T. L. Spatz

Testing at TNX with a feed nozzle supplied by the ETF group is planned for the end of October, 1995. Fabrication of the feed nozzle for the TNX tests will begin shortly. The ETF group will now be responsible for delivering the entire liquid feed system for the TNX tests. This will include hardware from a feed tank to the feed nozzle.

ITEMS OF INTEREST

EES hosted the Vice Provost of Research at USC, Congresswoman Cynthia McKinney, and representatives from the Augusta Chronicle and Thermo Savannah River in tours of the Robotics Laboratory

EES presented a paper on Tank Wall Crawler developments at the recent ASME Pipe and Pressure Vessel Conference.

EES presented a paper on the Bagless Transfer System at both the ANS Annual Meeting and the American Glovebox Society Conference.

EES demonstrated the Bagless Transfer System to representatives from DOE-Oakland and LANL.

EES hosted Eric Koglin, the Technology Transfer Officer for EPA's Environmental Monitoring System Laboratory, in a tour of the Robotics Laboratory. He was accompanied by Kliss McNeel (Mixed Waste Focus Area) and Steven Clapp, (Manager, Environmental Assessment Technologies) both from INEL. SIMON, SWAMI, pipe crawlers, wall crawlers, and mobile teleoperators were shown and described as systems for performing environmental tasks.

T. L. Spatz gave a joint presentation, "Edible Optics and Other Traveling Science Demonstrations," with representatives of the University of South Carolina at Aiken (USC-Aiken), Ruth Patrick Science Education Center (RPSEC) at the Third International Conference of the National Science Teachers Association (NSTA). The topic of the presentation was the education outreach program ongoing between USC-Aiken RPSEC and the WSRC known as the Traveling Science Demonstration Program.

An International Containment Technology Workshop sponsored by DOE, EPA, and DuPont will be held in Baltimore Maryland on August 29 through 31, 1995. M. A. Phifer has been invited to speak and participate in the workshop's Permeable Reactive Walls Session.

A paper on the ETEX forecasts was accepted for oral presentation at the Ninth Joint Conference on the Applications of Air Pollution Meteorology with the Air and Waste Management Association. This conference is part of the AMS annual meeting to be held in Atlanta, Georgia, from January 28, 1996, through February 2, 1996. An abstract for "Prognostic Modeling of Long-Range Atmospheric Pollutant Transport for ETEX" by D. P. Griggs was submitted June 1.

The July issue of "Environmental Protection" magazine is using laser confocal micrographs taken by R. L. Brigmon of the Biotechnology Group for the cover. The color photograph used is of the diverse community that develops in the biofilm of a methanotrophic trickle filter bioreactor for treatment of contaminated groundwater. This mobile bioreactor test was directed by C. J. Berry of the Biotechnology Group at TNX for the Environmental Restoration Department.

July 20, 1995, Dr. Hazen of the Biotechnology Group gave an invited presentation on "Landfill In Situ Bioremediation". The newly founded Landfill Committee at NAS is currently examining the DOE-OTD Landfill Focus Area and asked Dr. Hazen and 3 other experts in containment and remediation to provide general presentations on the state-of-the-art for their first meeting. The distinguished panel was extremely complementary of the bioremediation work that has been done at SRS. They noted that at how little of OTD's work in field demonstrations is known in academic circles, and hope to come up with recommendations to correct this.

The five EPA Hazardous Substances Research Centers invited Dr. Hazen to give the opening keynote to their meeting. The theme for the meeting was "flask to the field". Dr. Hazen's seminar was on "The need for interdisciplinary interaction on large scale field projects". His banquet talk was attended by more than 300 scientists/engineers and students. The EPA centers feel that full scale field demonstrations are essential for the development and implementation of environmental remediation technologies and are very interested in teaming with SRS to do demonstrations.

The Minnesota PCA asked Dr. Hazen to give a presentation of the bioremediation demonstrations that had been done at SRS and a overview of bioremediation technologies. The seminar was attended by more than 50 people from the agency and the University of Minnesota.

The Georgia EPD asked Dr. Hazen to give a presentation of the bioremediation demonstrations that had been done at SRS, an overview of bioremediation technologies, and options for the Columbia County Landfill. The seminar was attended by more than 25 people from the agency, Columbia County administrators and representatives of Bearehaven Remediation Inc. EPD gave verbal approval to injection demonstrations for biostimulation in the new subtitle D Landfill in Columbia County. They were also receptive to changing the requirements for closure and monitoring of older unlined parts of the Columbia County landfill.

As a result of press releases done on the R&D100 Awards recently won by SRTC, the Augusta Chronicle ran an article "Microbes Cleanup Soil and Groundwater". This very pro-SRS article ran on July 20, 1995, p 6C&8C.

"Portable Radiation Detector and Mapping System", (K. J. Hofstetter, D. W. Hayes, and R. F. Eakle), was submitted for presentation at 1995 ANS Winter Meeting, San Francisco, CA, November 1995. (WSRC-MS-95-0203)

"Microbes clean chemical contaminates from soil" by Karin Schill was included in the July 20, 1995, Augusta Chronicle