SRTC Quarterly Report, July - August - September 1996

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Savannah River Technology Center Quarterly Report

July, Aug., Sept. 1996

**Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808**

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

WSRC-TR-96-0100-03

**Savannah River Technology Center
Quarterly Report**

July, Aug., Sept. 1996

EXECUTIVE SUMMARY

TRITIUM

- Cleaning, loading and function testing of W76 DEV2 units has begun with approximately 60% of the work completed to-date. Prototype fixtures have been provided by EES. Fit-up and testing are complete on these items. Acoustic monitoring during the function operations has been conducted. Lifetime testing of the isolation valves used on the cleaning fixture has been completed and indicates a need for periodic cleaning operations.
- Three Acorn 3U function tests have been completed on tritium-filled units in support of the W76 program. This work successfully demonstrated SRTC's capability to conduct Acorn function tests and demonstrated equivalency to LANL equipment/operations. The results were presented to the Navy at the W76 Program Review.
- A resistance plug weld for fabrication of tritium storage vessels was developed for Los Alamos National Laboratory as part of the program to demonstrate resistance welding technology for fabrication of reservoirs. Fixtures were designed and fabricated for welding samples provided by Los Alamos. Welding conditions and joint design were determined. Mechanical tests and temperature measurements of the final configuration confirmed weld suitability. Test results indicate that resistance welding is an excellent method for assembling these vessels and should meet Los Alamos requirements. Vessels for storage will be welded when components are received from Los Alamos.
- Research conducted on metal hydrides used in tritium processing was presented at the 1996 International Symposium on Metal Hydrogen Systems in Les Diablerets, Switzerland. Drs. J. R. Wermer and J. S. Hölder presented papers on the long-term tritium aging of LANA.75 and the short-term tritium aging of palladium-rich alloys, respectively. Over 280 papers on related subjects were presented at the week long conference.
- An ultrasonic inspection method has been developed for inspection of the fill bore area of LF7 reservoirs fabricated of Type 21-6-9 stainless steel. The method has been applied to the inspection of 103 retired War Reserve LF7 reservoirs. Results of the inspections are being validated by metallography of reservoirs exhibiting ultrasonic indications of interest. Methods for inspection of 1K and 2M reservoirs are under development.
- Provided expertise and equipment to perform proof-of-principle demonstrations of viability of digital radiography/computed tomography to image and evaluate geometry and integrity of pinch welds.
- A literature survey and report, "Literature Survey of Tritiated Waste Characterization and Disposal (U)," WSRC-TR-96-0209, September 6, 1996, has been completed.
- Five secondary container designs for tritium reservoirs have been evaluated for the impact of a temperature excursion to -85°C. So long as service

conditions other than temperature remain normal, the secondary container pressure boundary should remain intact, with no rupture or leakage. However, if the reservoir inside were to leak, in addition to a temperature excursion to -85°C , the pre-load on the closure cap screws for two secondary container designs may be lost, resulting in leakage from the secondary container as well. Further evaluation of these two secondary containers has been recommended - increasing the cap screw pre-load (torque) could be sufficient to avoid this possibility.

- Design input for the Commercial Light Water Reactor Tritium Extraction Facility (CLWR-TEF) is being generated by SRTC/CHTS personnel for the Tritium/Product Processing and Process Heating and Cooling (for hydride beds) Systems. These System Design Descriptions were approved September 30, 1996, and met the project milestone.
- SRTC/ADS is providing assistance in the design of analytical chemistry and related functions for the CLWR-TEF program.
- A project is underway to permit spent melts to be removed from the Tritium Extraction Facility (TEF), to the E-Area Interim Level Tritium Vaults (ILTV) in a manner that is in compliance with DOE orders and site procedures. The TEF storage capacity for processed spent melts is limited to approximately 12 crucibles. When this limit is reached, it becomes necessary either to move the spent melts to the Burial Grounds or cease extraction operations. SRTC's Packaging & Transportation Group is providing Tritium with the necessary radioactive material (RAM) packaging developmental activities in support of these movements.

SEPARATIONS

- SRTC/ADS supported Laboratories Department spectrometer systems.
- SRTC/ADS calibrated a detector for Pu measurements of 292-F waste boxes
- SRTC/ADS provided neutron activation analysis support of CHTS Pu mixing studies
- The old solvent in tank 16.3 was found to be of generally poorer quality than the first cycle solvent in inventory.
- It was shown that the dissolution process temperature could be reduced to minimize corrosion.
- Rush analyses were performed to verify FB-Line valve composition.
- Software modifications are being made to allow new Analytical Laboratories spectrometers to make uranium measurements.
- New canyon cooling water gamma monitor installation design was reviewed with F-Canyon engineers.
- The blended first cycle showed poorer than expected properties. Alumina cleaning is a possible remedy if the solvent performs unacceptably.

- Tests are in progress to show a flow sheet to recover plutonium from wash solutions and feed to FB-Line for stabilization.
- Tests have shown that sulphate conversion can be made at double the concentration and have the volume with near complete conversion.
- SRTC/ADS made Pu-239 holdup measurements in the FB-Line mechanical line.
- Studies were begun on a improved method for tributyl and dibutyl phosphate analysis.
- A portable instrument was provided to FB-Line for gamma ray assays.
- The acid concentration for the proposed canyon dissolver flowsheet was lowered to six molar and the dissolving of both sand fines and slag chunks conducted at 71-72°C to avoid ruthenium volatility.
- Sweepings and turnings are two types of scraps and residues from FB-Line that are candidate materials for dissolution in HB-Line and will be evaluated by SRTC.
- A 10% release of activity from a liquid spill in F-Canyon during a seismic event was verified based on a conservative analysis of the exchange rate through the porous expansion joints. The analysis was completed in less than a week and provided a technical basis to convince the DNFSB of the validity of this previously assumed release fraction. Measurements of the porosity of the expansion joints are planned to support this evaluation.

ENVIRONMENTAL

- The annual multispectral scanner overflight of the Savannah River Site was conducted.
- The consequences of potentially lowering L Lake and fluctuating water levels in Par Pond were evaluated with respect to Bald Eagles on the SRS.
- The wetland damage clean-up at the sanitary landfill was surveyed with representatives from ER and EPD.
- The first series of injection tests have been completed at the H-Area Injection Test site. The first series of injections were used to test and calibrate the instruments installed at the site and to develop standard protocols for conducting tests using tritium as part of the injectate.
- A sampling and analysis plan was written to document WSRC's strategy for coordinating the sampling and analysis of sediments from the L Lake and soils from adjacent land areas.
- Assistance was provided to ERE in conducting extended testing of two vadose zone vapor treatment units to determine maximum solvent recovery

rates and initiate investigations into the effective zone of capture for the current recovery well systems.

- Blackhawk Geosciences completed field work for a shear wave seismic survey of A/M Area. The purpose of the survey is to delineate and assess the competence of the Crouch Branch Confining Unit and other shallower confining units.
- The Biotechnology Group provided technical assistance to ER for final drum removal and installation of two horizontal wells and vadose zone monitoring wells by the subcontractor.
- Water samples from Par Pond and L Lake have been collected and shipped to an offsite vendor for mercury and radionuclides analysis. The samples were part of the Par Pond Water and Fish (PPWF) project.
- The Sanitary Landfill Optimization Test is an extensive ongoing study to determine the best possible solution for remediating the groundwater beneath SRS's Sanitary Landfill. Campaigns have been completed for in-situ air stripping and in-situ bioremediation.
- A report on the analysis of sediments from the P-Reactor Canal system, including the two reactor pre-cooling ponds, Pond 2 and Pond 5, is under final review. Sediment near and below the existing water level were analyzed for gross alpha, gross beta, and gamma activity in support of the Environmental Impact Statement to determine the consequences of shutting down the river water distribution system.
- SRS personnel are planning a two phase program in order to reduce the amount of dissolved chlorinated solvents that are being transported to the McQueen Branch via the wellbore and gravel pack zones of the A/M Area production well system. Six production wells in the A/M Area are involved in this investigation.
- A comprehensive video describing environmental remediation actions in the A/M Area is being developed to assist researchers, the public, regulators, and other concerned individuals in understanding the source history, previous and current remediation activities, and ongoing innovative remediation plans.
- A geostatistical study was conducted to identify monitoring wells associated with the F&H Area Seepage Basins that can be removed from the quarterly sampling schedule without reduction in the quality of quarterly monitoring information. This information was used in a geostatistical model to identify wells that yield redundant samples because of their proximity to other wells.
- ESS personnel are providing information for the development of remediation technologies within the southern sector of the A/M Area that incorporate Vertical Recirculation Wells. These activities are being developed and implemented to capture and remediate those portions of the dissolved solvent plume delineated by the 500 part per billion trichloroethene isoconcentration contour.
- A bioventing system using passive injection, has been installed and is now operational at the 108-3C Diesel Storage Site.

- A final report, WSRC-TR-95-0365, Final Report: Aquifer testing with 2-inch diameter wells in the Southern Sector, A/M Area has recently been prepared and distributed.
- A confined groundwater flow model is being developed to simulate conditions in the Crouch Branch Aquifer.
- ESS personnel are working with HydroGeologic, Inc. to develop and calibrate a numerical groundwater flow model for the A/M Area. The model is being developed using data fusion techniques, a technology developed by EM-50's Characterization and Monitoring Sensor Technology Program, to incorporate mud fraction data and pump test data in the determination of local hydraulic conductivity.
- The Western Sector of the A/M Area addresses subsurface contamination from Dense NonAqueous Phase Liquids (DNAPLs) that were discharged to an unlined basin. Investigators from SRTC and Clemson University are currently examining the extent of DNAPL contamination in the saturated zone. Preliminary results from the heuristic model indicate that the DNAPL is sitting in a depression in the confining green clay layer just east of the sewage basin. However, these investigations indicate that the current model of the surface of the green clay must be refined before the DNAPL model can be used effectively.
- A particle tracking routine has been developed that incorporates the necessary numerical integration algorithms with the output of the SRTC FACT code to generate particle tracks.
- Six additional piezometers were installed in the wetlands of Fourmile Branch near the groundwater extraction/injection remediation system in F- and H-Area during May 1996.
- Air pressurized slug tests were performed on several water table wells in D-Area near the coal pile runoff basin.
- Instrumentation of three piezometers in the wetlands of Fourmile Branch off Road C-4 was completed in July 1996. These piezometers will also be used to investigate diurnal fluctuations in water levels in the wetland, and to examine the hydrologic response of the wetland to meteorological events.
- SRTC has completed preliminary vadose zone characterization work at the 321-M solvent storage tank area. The characterization is focused on determining the concentrations and extent of chlorinated solvents spilled or released in the vicinity of the tanks and rail car transfer facility.
- A laboratory treatability study has been performed by Envirometal Technologies, Inc. and the University of Waterloo to determine the feasibility of treating the TNX contaminated groundwater using zero valance iron enhanced abiotic degradation. This process will be considered for treatment of TNX contaminated groundwater beyond the 500 ppb trichloroethylene plume.

- The report on the aquatic emergency response model, WSRC-RP-96-80, was approved by DOE and was issued.
- The ETS database of permissible workplace and environmental nonradiological exposure limits has been augmented. The 1996 American Industrial Hygiene Association (AIHA) Emergency Response Planning Guidelines (ERPGs) have been added.
- Dose modeling of the 1995 environmental radioactive releases has been completed. The dose to the maximally exposed individual from atmospheric releases was 0.06 mrem and the population dose was 3.5 person-rem. These doses are about 40% lower than 1994 doses due to a significant reduction in tritium releases. The dose to the maximally exposed individual from liquid releases was 0.14 mrem and the population dose was 1.6 person-rem. These doses are about the same as the 1994 doses.
- The final draft of Chapter 7, "Potential Radiation Doses" was completed on May 17, 1996, and submitted to the Environmental Monitoring Section for inclusion in the 1995 SRS Annual Environmental Report (AER).
- The computer model ETMOD (Environmental Tritium Model) was evaluated and tested as part of the Atmospheric Phenomenology and Consequence Committee (APAC) review of codes used across the DOE complex.
- The RADMAPS portable multichannel analyzer (SCOUT-MCA plus 3-inch x 3-inch NaI[Tl]) was used to demonstrate the technology and to train potential site inspection personnel who will verify the integrity of loaded spent nuclear fuel shipping casks from foreign research reactors prior to their shipment to SRS.
- A project was evaluated for measuring the deuterium to tritium (D to T) ratios for Reactor Area water samples to help determine the T source. High D-to-T ratios would be indicative of moderator contamination.
- A critical-contaminant/critical-pathway analysis for routine environmental releases was performed as required by the SRS Environmental Monitoring Plan Corrective Action Plan (ESH-EMS-94-0129). The results of this analysis will serve as the rationale bases and design criteria for the SRS Environmental Monitoring Program.
- 7Q10 flows have been calculated for each of the six Integrator Operable Units (primary stream watersheds) at SRS.
- The Radiological Impact of 1995 Operations at the Savannah River Site report was issued on June 20, 1996.
- The Field Deployable Tritium Analysis System (FDTAS) was transported to SRS and was installed in an outbuilding located in the stripper area.
- F Canyon is processing existing inventories of plutonium solutions and dissolution of targets. Analysis of the gaseous effluents from the canyon stack should provide important information regarding proliferation activities by other nations.

- The FTIR open path spectrometer can be used to examine the plume from a smoke stack. The newly designed mirror assembly allows the study of gaseous plumes at 90 degrees with respect to the telescope plane.
- Plant Vogtle/SRS river samples continue to be analyzed, where only Shell Bluff and Hwy 301 samples are now taken due to limited funding. The 1995 annual report for these studies was revised based on earlier comments.
- The TOF-SIMS is currently being used to analyze glass and canister samples obtained from the "cold runs" at the DWPF vitrification facility.
- The gamma data acquisition system (GDAS) was used to survey the C/S Area in an attempt to find a low background area for conducting future experiments on the detection of depleted and natural uranium. The surveys revealed elevated backgrounds in the area due to the storage of some radioactive materials.
- A program review and field tour of activities was conducted for the Department of Interior, including the National Biological Survey.
- During this quarter three cone penetrometer-based soil moisture probes were tested. Measurements of the dielectric and electrical conductivity of the sediments were processed. Several vadose zone piezometers were installed. Soil samples were also taken.
- The D-Area Interceptor Well (DIW-1) has an innovative design which includes a 30-foot deep by 240-foot long, subsurface vertical high density polyethylene (HDPE) barrier immediately downgradient from and in direct contact with a continuous gravel pack with both vertical and horizontal (lateral) screens. All actual testing on the Interceptor Well itself was completed on April 25, 1996. Well DCB-25 installation was completed on June 21, 1996. This well will be used to determine the hydraulic conductivity profile of the watertable aquifer. A pump test of DCB-25 was initiated on July 15, 1996 and a borehole flowmeter test is planned to begin on July 30, 1996.
- In cooperation with Environmental Restoration, an "oleofilter" was installed and operated on A/M Area groundwater. A Cooperative Research and Development Agreement with GeoCleanse International has been placed for a full scale field demonstration of in situ oxidation of a known DNAPL target in an aquifer at SRS. Detailed pretest site characterization, well installation and permitting are scheduled for FY96 and initiation of the demonstration of a controlled Fenton's Reagent addition is scheduled for mid FY 1997. Alcohol injection extraction tests are complete at three wells.
- A new groundwater technology "In-Well Vapor Stripping" (IVS) is being evaluated by SRTC at TNX. The IVS system is used to treat groundwater contaminated with chlorinated volatile organic compounds (CVOCs). A well for testing the IVS has been installed and developed at TNX.
- The Visitor's Day was planned by the Institute and the Czechowice Oil Refinery to showcase the collaborative effort between the U.S. Department of Energy and the Polish Institute emphasizing their partnership in international technology transfer. Nearly 300 government officials, scientists, engineers

and private company executives from Poland and neighboring countries arrived. The Czech Republic, Hungary, Belarus, Ukraine and Russia were in attendance. Media coverage including more than 40 journalists from newspapers, magazines and radio and 6 local and national TV stations were actively seeking interviews and potential articles for publication. The Visitor's Day activities were televised on Polish National TV.

- The ETS database of permissible workplace and environmental nonradiological exposure limits has been augmented. The 1996 American Industrial Hygiene Association (AIHA) Emergency Response Planning Guidelines (ERPGs) have been added.
- A fully executed licensing agreement was completed between WSRC and Savannah River SRT, Inc. for the global positioning system recorder (GPSR) technology.
- Using PHOSter, a SRTC Group Patented Technology, STC subcontracted Vaughn and Associates to demonstrate the technology at Jimbo's, a local abandoned gas station.
- ESS initiated a review of the Columbia County Landfill at the county's request. This evaluation provided a number of bioremediation enhancements that would: increase the biodegradation rate, increase subsidence, eliminate the need for leachate treatment, stabilize refuse mass sooner, decrease long-term liability and monitoring costs, decrease leaching of metals and organic contaminants, and decrease methane generation.

WASTE MANAGEMENT

- Continuous emissions monitoring (CEM) of mixed waste thermal processes is desired for verification of emissions compliance and process control. SRTC is involved in tests of mercury, particulate matter, and dioxin CEMs through agreements with DOE, EPA, and commercial industry.
- The TNX Off-gas Components Test Facility (OCTF) is a 1/10 scale pilot facility used to evaluate the operating performance of the Consolidated Incineration Facility (CIF) off-gas system. Excessive water accumulation at the off-gas HEPA filters was attributed to condensation from lower temperature at the HEPA housings caused by air in-leakage. Regasketing of flanged joints and repair of a small duct hole reduced the measured OCTF air in-leakage from 7.9 cfm to 0.22 cfm.
- In September, testing was successfully completed on the Tank 49 V1 slurry pump. This pump was the first pump rebuilt and tested after removal from radioactive service at SRS. All operating parameters, pressures, flows, and vibration readings were within acceptable ranges.
- Recent solubility studies for cesium and potassium tetraphenylborate reported within expand the understanding of the amount of sodium tetraphenylborate needed in the In-Tank Precipitation process. The collected data improves upon literature data previously used for the process. When completed, the studies will allow more precise control of the amount of organic precipitant used thereby limiting the material available to form benzene.

- Researchers developed prototypical samples to collect organics floating in Tank 43H. Personnel intend to use these devices to obtain a better characterization of the organics found in the tank. These organics cause numerous problems with operations. Identification of the species will guide efforts to minimize future accumulations.
- Researchers report initial analyses of supernate samples from Tank 41H following start of the waste removal demonstration. The data demonstrates the speed of mixing in the supernate and the concerns raised by regions of the tank initially outside the specifications for corrosion protection. Continued sampling and analysis will provide information on salt dissolution rate.
- Sample analyses for solids removed from Tank 20F were completed. The solids contain minor amounts of metal hydroxide sludge -- with low radionuclide content-- and large amounts of cryolite (i.e., a sodium-aluminum-fluoride compound). The data provides information for performance assessments associated with closure activities for the tank.
- J. R. Cook is working on the SRS program to complete the Composite Analysis required to address DNFSB Recommendation 94-2.
- S. M. Serkiz and J. Myers issued a report documenting the results of geochemical modeling to estimate the impact of the disposal of wood products (e.g., railroad cross ties) in the E-Area slit trenches on the mobility of radionuclides also in the trenches. Geochemical modeling was used in conjunction with transport codes to attempt to account for the processes of enhanced transport (organic complexation), degradation, and dilution.
- C. G. May has been informed by MELE Associates that the Corpex 921S chemistry planned for use in the 235-F glovebox decon will be ineffective on high fired (sintered or ceramic form) plutonium. This Pu form is insoluble and is the primary source of the plutonium contamination in the Old Met Lab glovebox. The demonstration is on hold while WSRC evaluates the revised decontamination plan and will carry over to FY97.
- A preliminary model of glass canister handling operations in DWPF from the melter to the Glass Waste Storage Building was developed using the EXTEND manufacturing simulation software package. The model includes nominal process times for individual operations, estimated equipment availability and failure rates, typical repair operations and completion times, and storage locations within the facility to accommodate interruptions to the normal canister flow paths. DOE intends to use this model to better understand normal material flows and to identify potential bottlenecks in the operation.
- The Production Planning Model (ProdMod) played an essential role in the HLW Division's recent re-baselining of the System Plan to provide input to the new DOE EM-1 Ten Year Plan. ProdMod generated an accelerated waste processing schedule out to "clean tanks" within a week of the customer's request.
- A study has been completed of wall thickness measurements made on canisters, which were fabricated for the Defense Waste Processing Facility

(DWPF). These data were a sample of the available data which were obtained by measuring the thickness of the cylinder wall for each canister using a 3-inch grid. Based upon the analysis of these data, a 12-inch grid size is recommended for wall thickness measurements in the future. This will reduce the number of measurements required to determine canister acceptability.

- Power distribution and current density distribution in the Am / Cm bushing melter have been computed through the coupled thermal-electrical analysis of the glass melter. This project is a part of the effort in improving the design of the Am/Cm Remelt Bushing.
- An experimental design and sampling plan are given for DWPF to use in evaluating a potential change in analytical method for SME samples.

GENERAL

- SRTC has prepared a total of 67 Site Level Baseline Change Control Packages during FY-96 and 52 of the packages have been approved by DOE.
- A statistical analysis has been completed on tritium measurements derived from samples of tar, gravel, and concrete taken from the roof of 232-F. An upper limit, at the 90% confidence level, on the average tritium contamination of these materials comprising the roof was developed assuming that the collection of all three types of measurements provides the best (most representative) sample of the waste to be generated by the disposal of the 232-F roof. The upper 90% confidence limit is given by 384.3 pico-Curies/gram, which is below the allowable threshold limit of 414 pico-Curies/gram for the unrestricted use of this waste.
- INEL currently has the lead responsibility for transportation and packaging activities within the CLWR Program. SRS, through WSRC/SRTC/PTG is fulfilling a backup and supporting role. The support efforts to date include meeting agenda development, attendance, and topical presentations; exchanges of draft documents and review comments thereof, and performance of specific tasks as requested by INEL.
- The LR-56S OSA has been revised in response to comments by the review team. A revised schedule for resolution of the Criticality questions and completion of the OSA has been developed. The LR-56S is being procured for the transfer of H-Canyon contents to F-Canyon for completion of processing and stabilization.
- The Packaging & Transportation Group enlarged the 9965/9968/9972-75 packaging primary containment vessel openings to enhance the utility of these packagings for future DOE missions. This design change resulted in a revision to the combined Safety Analysis Report-Packages (SARP) for these packagings. The revised SARP has been submitted via DOE SR to EM-76 for certification review.
- The chemical composition data from samples taken during the TVS Shakedown at Clemson University have been analyzed; the components of variation for the data have been estimated; and differences among the slurry, blend, and glass sample results have been investigated.

PROGRESS AND ACCOMPLISHMENTS

TRITIUM

W76 Acorn Testing Support for W76 PRT - D. L. Fish, W. J. Rogier, J. W. Johnson, M. J. King, W. D. Thompson, D. J. Trapp, B. S. Bushart, M. J. Pechersky, J. W. Dye

Testing of W76 DEV2 (barstock development units) has begun. The primary goals of this testing are: (1) to develop the methodology and technical basis for cleaning, loading, and functioning procedures which will be used in the SRS Tritium facilities for the W76 reservoir handling operations (2) demonstrate the ability to successfully clean and load multiple units simultaneously, and (3) enable qualification of the cleaning system for cleaning of the W76 Prototype units. A technical task plan (WSRC-RP-96-406) and associated QA plan (WSRC-RP-96-407) were completed in support of this work. Procedures were also written for each of the cleaning, loading and function testing operations. A loading manifold was constructed to duplicate the Tritium mini-manifold loading system. This mini-manifold duplicate utilizes a CAM bed for moderate pressure loading applications (in contrast to the Tritium system). System preparations are underway to enable cold function tests to be completed.

Pinch-weld fixtures were designed by Dean Thompson (EES). Fit up testing of the fixtures revealed some minor difficulties with tolerances/design and the fixtures were modified accordingly. Fit up testing also indicated that the units being manufactured by AS/KCP have significantly stiffer (but still within specifications) Belleville washers which make it more difficult to connect the fixture to the unit. Kansas City and the W76 PRT have been made aware of the differences and are addressing whether changes to the manufacturing process will be required.

Dean Thompson has also completed design and procurement of a prototype heater for use in

cleaning operations. Additional heaters are on order for completion of the multiple cleaning test and for use in the cleaning of the Prototype units. Fit up and initial testing of the heater with an actual DEV2 unit indicated very good performance with two minor issues (unit discoloration and uneven temperature profiles) which required further examination. The extent of discoloration on subsequently cleaned units revealed reduced amounts of discoloration. The unit discoloration may have originated from oils, etc., used in the manufacturing of the heater shells and all new heaters will undergo heating run-in tests without units in an attempt to remove any of these oils prior to use on actual units. Temperature profiles have been measured across the units in several locations. These measurements revealed somewhat larger than expected differentials and the design for the additional heaters was then modified to reduce the number of heater element windings in the "hot spot" areas in an attempt to achieve more uniform temperature profiles across the unit. Our intent is to use the revised design heaters for the multiple unit cleaning test. This test is currently awaiting delivery of these units which are slightly behind the original schedule promised by the vendor.

Cleaning, loading and function tests of the DEV2 units are well underway on a very aggressive schedule with a goal of completion by 9/30/96. This will enable approximately 1 month for completion of the report necessary for support of SRS W76 Qualification activities. It also supports completion of applicable procedures to support initial loading of W76 Prototype units with Tritium later this year. As of September 13, 1996, a total of 8 units have been assembled with fixtures, leak checked by EES, and cleaned by SRTC. Seven of these units have been loaded and 6 functioned to-date. The initial two units were cleaned individually, two were cleaned simultaneously but with some individual and some joint operations and two tests have been completed cleaning two units simultaneously (initial demonstrations of the ability to clean units simultaneously). The

majority of the cleaning operations have been completed using the W76 prototype heater. One of the units was cleaned using a heat tape and two others with a former 3U heater modified (addition of insulation to fill air gaps) to enable fitting to the W76 units. Additional details associated with the cleaning process, such as the length of the pumpout between flushes and the length of the final pumpout, have been tentatively agreed to with the Design Agency (LANL).

Weight changes due to air exposure have been made but results have not been as consistent as anticipated. Weight losses upon cleaning have been measured and some inconsistencies are being examined. Unit volume measurements have been completed on some units to verify the volumes provided by AS/KCP. Accurate volumes are necessary to validate the load and function test data. Loading operations appear to be very consistent and function tests have also gone without any unexpected difficulties or surprises.

Brian Bushart (EES) & Marty Pechersky (MTS) have designed, installed and operated acoustic monitoring equipment in 774-A in support of the function test operations. This equipment has successfully collected information relative to different events occurring during the function tests.

Don Trapp (SPS) has successfully completed lifetime testing of the isolation valves which are being used for the cleaning/loading fixture. These tests have indicated that the valves can be operated with up to 25-50 closures without problems but that they should be cleaned on a regular basis. Cleaning is used to remove small amounts of particulate which appear to extrude out of the glass-filled Teflon packing with time. Routine cleaning of the valves should enable them to be used for much longer time periods.

3U Acorn Function Testing - **D. L. Fish, Y. K. Lutz**

Three tritium-filled 3U units have been function tested in support of the W76 program. These units were originally shipped from Mound. Additional bottles were supplied by Mound in support of the function tests. The units and associated bottles were assembled in the SRS

Tritium facilities. Some modification of former procedures were required prior to the assembly operations. Some additional changes were necessary during the actual assembly operations due to problems with the assembly fixture and due to scratches observed on one of the sealing surfaces. The three tests were completed on-schedule and supported analysis of the results prior to the W76 Program Review with the Navy in August. LANL personnel were invited to attend all three function tests. B. A. Meyer (LANL) attended the initial test and was provided with the function test raw data on an expedited basis to enable evaluation prior to the program review. LANL conducted four, 3U tritium function tests during this same approximate time period in their recently established function tester. The objectives for conducting these tests at the two labs were to: (1) provide information on the function testing of aged Acorn units, (2) demonstrate equivalency in systems and consistency in results between the function testing systems at the two laboratories and (3) to demonstrate to the Navy that the two labs can effectively serve as each other's backup for function testing of Acorn units.

The initial function test revealed a slightly slower delivery than expected. This was discovered to be due to a very small line restriction which was removed for subsequent tests. Excellent agreement was observed between the results from the two laboratories indicating that the second objective above was met. Effective demonstration of the third objective was provided by successful shipping of the two environmentally conditioned units and the good agreement between the two labs in the test results. A joint presentation of the test results was presented to the Navy at the W76 Program Review in August by B. A. Meyer of LANL and D. L. Fish of SRTC. The presentation was favorably received.

Burst Diaphragm Storage Vessels - **W. R. Kanne**

A resistance plug weld for fabrication of tritium storage vessels was developed for Los Alamos National Laboratory as part of the program to develop resistance welding technology for fabrication of reservoirs. The two inch diameter plug contains two burst diaphragms. The burst

diaphragm plug weld is similar to SRS side bonded reclamation welds (which, at 0.275 inch diameter, are much smaller) and the defense waste canister closure welds (which, at 5 inch diameter, are much larger). Vessels will be loaded and placed in storage at Los Alamos National Laboratory after fabrication.

Los Alamos provided twelve weld samples representative of the vessel body and the plug. Fixturing for the Los Alamos samples was designed and fabricated. It consists of a copper ring in which the samples (and later the vessel bodies) are hung on a flange surface. This fixturing method prevents the electrical current from going through the vessel body and promotes symmetrical distribution of current during welding. A copper electrode to carry current to the top of the plug was designed and fabricated. The top electrode is contoured to match the sample surface and is centered to contact only the plug without short circuiting to the vessel body.

Development of welding conditions and joint design was completed. Welds were made on test pieces provided by Los Alamos using three different interferences between the plug and flange into which it is sealed. An interference of 0.020 inches was chosen to minimize distortion of the diaphragms installed in the plug while providing full weld strength. A welding current of 65,000 amperes and a force of 12,000 pounds was used for the final development test pieces.

A compression test was used to measure weld strength. A force of 85,000 psi was required to push out the plug of the Los Alamos test pieces. Tests showed that there is little effect on weld strength of the interference between the plug and flange.

Temperature measurements were made by T. R. Smail of EES on the Los Alamos samples. Results showed a peak temperature due to the heat from welding of 105°C in the chamber below the plug and a 200°C peak temperature in the plug approximately 0.5 inch from the weld. These temperatures are well below those which could cause a problem for vessel operation and are below the temperatures expected if the plug were welded with a fusion welding process.

Vessel components for storage are currently being machined at Los Alamos. After welding, the components will be returned to Los Alamos for further assembly, loading with tritium, and for storage.

Tritium Aging of Metal Hydrides Presented at ISMHS 96 - J. S. Hölder, J. R. Wermer

The 1996 International Symposium on Metal Hydrogen Systems, Fundamentals and Applications, (ISMHS 96) was held in Les Diablerets, Switzerland, from 25 to 30 August, 1996. This year's biannual gathering of the international metal hydride community drew over 330 participants with more than 280 scientific papers from university, governmental, and industrial research groups. The European community was well represented, along with Japan, China, Israel, nations of the former Soviet Union, Russia, Canada, and the United States.

The Savannah River Site was represented by Drs. J. R. Wermer and J. S. Hölder, who presented papers on the tritium aging of metal hydrides used in tritium processing applications. Dr. Wermer's paper was titled, "Effects of Long-Term Aging of $\text{LaNi}_{4.25}\text{Al}_{0.75}$ -Tritide Process Beds," and Dr. Hölder's paper was titled, "Short-Term Tritium Aging of Palladium-Rich Alloys." Both papers attracted interest and requests for pre-prints, particularly from scientists in France conducting similar research. University research on metal hydrides, directed and supported by CHTS, was also presented by Prof. Chandra from the University of Nevada-Reno, and Prof. Flanagan from the University of Vermont.

In general, applications are the focus of Japanese researchers, while European researchers tend to emphasize more fundamental investigations. Metal hydride batteries and high density hydrogen storage dominated the papers presented on applications; in this arena, the Chinese are conducting an incredible volume of research on AB₅-type hydrides. A Japanese team is developing technology to use hydrogen as an energy source on an industrial scale. A most interesting development was the use of

yttrium hydride thin films as an optical switch. A book of abstracts was distributed at the conference, and is available in the authors' office for those interested in details.

Bids were considered for ISMHS 98 by the International Steering Committee, and it was decided to award the next conference site to China, although Russia put forward a strong proposal. The U. S. delegation did not feel there was sufficient financial support within industry or government to host the event and did not submit a proposal. It was also thought that since the counterpart to this conference, the Gordon Research Conference on Metal Hydrogen Systems, is always held in the U. S., it is not fair to the rest of the international community for the U. S. to bid on the ISMHS. The site of the ISMHS 2000 will be decided at next year's Gordon Conference in July 1997.

Enhanced Inspection of 21-6-9 Reservoirs - E. Majzlik, A. Placr, W. Hinz, R. Moore

The objective of this task is to develop and apply advanced ultrasonic inspection methods for inspection of the fill bore area, reclamation weld area and girth weld of LF, K and M type reservoirs manufactured from Type 21-6-9 stainless steel.

To date the fill bore area of 103 retired LF7 War Reserve reservoirs has been inspected. This concludes the initial inspection phase for LF7 reservoirs. The inspection data has been reviewed using the "echo dynamic" criterion and several reservoirs having indications of interest have been identified. Metallography is underway on those reservoirs. The preliminary results of the metallographic examinations and conclusions drawn to-date were presented in detail at the Enhanced Surveillance Program Review held September 17 - 19, 1996, at the Los Alamos National Laboratory.

Field application procedures for inspection of the reclamation weld area of LF7 reservoirs are complete and circulating for approval. A total of 35 retired War Reserve reservoirs, 23 of which have been previously inspected in the fill bore area, have been transferred to the inspection facility. Inspection of the reclamation weld area

of these 35 LF7 reservoirs will be completed in October 1996.

Work on fixturing and mock-ups for the fill bore inspection of the 1K and 2M reservoirs is continuing on schedule. Five retired War Reserve reservoirs of both types have been identified for initial field application of the inspection methods. Development of reclamation weld inspection methods for these two reservoir types is continuing.

Requirements and concepts for ultrasonic inspection methods for the cap weld and girth weld of the LF, M and K type reservoirs are being considered. Funding for development of the girth weld inspection method has been requested for FY97 through the Enhanced Surveillance Program.

Digital Radiography/ Computed Tomography of Pinch Welds - B. D. Howard, R. W. Poland, D. M. Immel, B. Z. Meers III

All lens-coupled imaging system hardware and software needed to conduct proof-of-principle digital radiography and computed tomography imaging experiments were received and installed. Proof-of-principle digital radiography imaging experiments using a cooled, slow-scanned CCD camera with a 2K x 2K, scientific-grade imaging chip have demonstrated that pinch welds can be satisfactorily imaged and that computer software can be used to evaluate a pinch weld for conformity to Tritium Operation's dimensional acceptance standards; however, lens-coupled imaging components are not particularly suitable for a glovebox application. The principle investigators evaluated flat-panel imaging devices. Two of those devices were assessed and the investigators recommend that these devices be evaluated more thoroughly in FY97. The investigators have also visited Omega International Technology, Incorporated to see a demonstration of its ultra-precise, computed tomography system based on a unique tangential data acquisition method. Further evaluation of this technology should be included in our PCAP activities for FY97. The principle investigators have requested permission to delay issuing the final report with a definitive recommendation until flat panel imaging devices and the

tangential computed tomography system have been fully assessed.

Characterization and Disposal of Tritiated Waste - E. A. Clark

Characterizing, handling, and storing tritiated waste is challenging because of the physical and chemical properties of tritium. Tritium is soluble in and permeates into most materials, and so parts exposed to tritium are normally contaminated throughout the bulk, not just on the surface. The relatively low kinetic energy of the β^- decay prevents directly detecting tritium anywhere but very near the surface of materials. Tritium readily exchanges with hydrogen in water vapor, and the resulting tritiated water can permeate into many materials. Most of the tritium contamination in structural metals resides in the surface oxide film and in organic films at the surface, when exposed to tritium at ambient temperature and pressure, whether the exposure is to gas or tritiated water.

The most reliable method of assaying tritium is to dissolve samples in a proper liquid scintillant and use β^- scintillation counting. Other methods that require less time or are non-destructive (such as smear/counting) are significantly less reliable, but they can be used for routine waste characterization if sample dissolution/liquid scintillation counting is regularly employed to benchmark them.

Tritiated materials are decontaminated in numerous ways. Most common are flowing moist air, heating, and aqueous detergent and other solvent cleaning. They differ in ability to decontaminate the surface versus the bulk of materials, as well as cost and facilities required. Modern methods, such as plasma cleaning and ultraviolet light/ozone cleaning, show promise to more effectively decontaminate materials.

Tritiated waste storage usually involves segregation by one or more properties including tritium content, tritium offgas rate, material, and source of the waste. Liquid and gaseous tritiated waste is normally converted or fixed to a solid form. Radiolysis can generate significant gas pressure during storage if storage containers are sealed, so either sufficient free

volume must exist in containers or the container must vent whatever radiolytic gases are produced.

The report "Literature Survey of Tritiated Waste Characterization and Disposal (U)," WSRC-TR-96-0209, 6 September 1996, documents this literature survey.

Low Temperature Materials Evaluation of Tritium Reservoir Secondary Container - W. L. Daugherty

Several secondary containers for tritium have been designed for storage at temperatures as low as -60°C . A recent review identified the need for a disciplined review of a temperature excursion to as low as -85°C (the capacity of the refrigeration unit) due to failure of the controls. Accordingly, a materials evaluation of the pressure boundary components for five secondary container designs was conducted to ensure the pressure boundary integrity would be maintained. The secondary containers typically consist of a shell, head, and various components such as valves and a pressure gage.

Vendor information identified many of the components as acceptable for the lower temperatures being evaluated. For other components, low temperature material property data (strength, ductility, toughness) was reviewed to evaluate the pressure boundary integrity. Based on this review, the pressure boundary materials (304L and 316 stainless steels, 2024 Al, and copper) are acceptable for service to temperatures of -150°C or less. At such temperatures, the properties relevant to maintaining the pressure boundary are not significantly reduced below room temperature properties. In addition, the specified valves contain a stem tip made of hardened 17-4PH steel. This material is subject to low temperature embrittlement; however a fracture mechanics evaluation of the stem tip concluded that failure was not likely at -85°C .

One potential scenario of breaching the pressure boundary was identified. Two of the secondary container designs specify a torque for the closure capscrews lower than that for the other designs. These two containers will lose most of their closure preload due to differential thermal

expansion of the flanges and bolting as the temperature decreases. The remaining preload is not sufficient to maintain a seal if the tritium reservoir should also leak. In other words, the combined effect of a temperature excursion to -85°C and a reservoir leak would also lead to leakage from the secondary container. Further investigation of this scenario has been recommended -- it can likely be remedied by increasing the specified closure torque for these two designs.

Commercial Light Water Reactor Tritium Extraction Facility Support -

A. S. Poore, J. E. Klein

The Commercial Light Water Reactor (CLWR) Project will establish, by 2003, the production capability and operations systems necessary to produce tritium in a commercial reactor so that tritium can be delivered to the nuclear weapon stockpile by 2005. The Tritium Extraction Facility (CLWR-TEF) project will establish processes, equipment, and facilities for production-scale extraction of tritium which minimize personnel exposure, environmental releases and waste generation, and provide reasonable capital and operating expenses. The CLWR-TEF will have the capability to extract and purify tritium from CLWR targets and all other tritium sources, except the Accelerator Production of Tritium (APT) helium-3 target, at a rate that meets current and projected national defense requirements. The facility will also have the capability to process and deliver "readily recoverable" helium-3 (but not to separate helium-3 and helium-4).

The conceptual design phase of the CLWR-TEF project began on July 1, 1996, and the conceptual design phase report is scheduled for completion in mid-February, 1997. The project is an FY98 line item. SRTC/CHTS is providing technical support in the areas of process development and lead engineering support for the tritium processing systems.

The Tritium/Product Processing Systems in the CLWR-TEF perform elemental and isotopic separation and purification of extracted process gases from the CLWR targets as well as other tritium and/or helium-3 sources. The Tritium/Product Processing Systems also include product and flush gas evacuation

systems, tritium recovery systems, and tritium process support areas. The Tritium/Product Processing Systems is divided into the following systems: Inert Separation, Hydrogen Isotope Separation, Tritium/Product Delivery, Product Processing Support. The Process Heating and Cooling System provides support systems for hydride bed operation.

The design input for the Tritium/Product Processing Systems and the Process Heating and Cooling System has been generated in the form of System Design Description Documents (Section 1.0). They include:

- Inert Separation System
X-SYD-H-0002
- Hydrogen Isotope Separation System
X-SYD-H-0003
- Tritium/Product Delivery System
X-SYD-H-0004
- Product and Flush Gas Evacuation
Systems
X-SYD-H-0005
- Tritium Recovery Systems
X-SYD-H-0006
- Tritium Processing Support Systems
X-SYD-H-0007
- Process Heating and Cooling
X-SYD-H-00011

These System Design Descriptions have been approved to meet the September 30, 1996, milestone date.

Process development opportunities for the CLWR-TEF Tritium/Product processing Systems have been identified. High priority areas include: hydrogen enrichment (making stackable hydrogen), zeolite bed recovery (waste-free water cracking), and passive heating and cooling for all hydride applications (including hydride material selection and bed design to minimize tritium permeation). Process models have been developed during late FY'96, which will impact the preliminary technology baseline selection due in September 1996. Other areas have also been identified as potential candidates for R & D at a lower priority. These process development areas provide some overlap with other Tritium projects.

Analytical Chemistry Design for CLWR-TEF - S. F. Peterson

An effort to provide System Design Description (SDD) documents for the analytical chemistry, accountability, and health protection functions for the Commercial Light Water Reactor Tritium Extraction Facility (CLWR-TEF) design effort was begun. The SDDs provide conceptual-level functions, requirements, and criteria that must be satisfied by the systems to ensure that the Tritium Extraction Facility is able to fulfill its mission. The SDDs are used as primary input to the Conceptual Design Report, scheduled for issuance in mid-February, 1997.

The TEF analytical chemistry functions have been partitioned into three SDDs: 1) HP and Radiometric Laboratory System, which provides radiometric counting facilities for analytical chemistry and routine HP support operations, and supports general TEF waste characterization. 2) Mass Spectrometry and Accountability System, which provides measurements of specified process gases within the TEF to meet designated measurement control and accountability requirements. 3) Material and Waste Characterization Laboratory System, consisting of a remotely-operated hot cell and glove box and/or hood and bench space, in which irradiated targets may be characterized (pre or post extraction) for disposal, testing, or verification.

Tritium Support - Kirsten Aylward

EES provided weekend support in troubleshooting the Replacement Tritium Facility forms monitors. During routine source checking, a valid reading could not be obtained. Through a series of tests, it was determined that the cause of the problem was not electrical even though the main symptom was a 3 VRMS noise signal on the output of the electrometer. Additional testing proved that the cause of the 3 VRMS noise was vibration in the room. Since startup, the vibration levels had increased and reached a level that caused the Kanne chambers to vibrate at a mechanical resonance. The spacing between the center electrode and the outer shell of the chamber was fluctuating at the resonant frequency (20 Hz) causing the 3 VRMS signal. By installing vibration isolators between the Kanne chambers and the skid, the noise was reduced by a factor of 10. Acceptable

source check values verified correct operation. The system was on line by late Sunday evening, two hours before the facility would have been placed in a Limited Condition of Operation.

EES provided support on the extraction furnace control system and completed software upgrades for the automatic leak detector. EES is in the process of upgrading the software for the automated leak system for the Container Management Facility.

EES is close to installing the new borescope inspection station. Most material has been received and some fabrication is underway. This will be the first fixturing for borescopic inspection set up at the site for contaminated work. The temporary fixturing will be used to support the examination for cracks in the bore of a reservoir on the life storage project. These cracks in the alloy have been found with ultrasonic NDE and will be verified visually with borescopic inspection before mounting and sectioning in the hot met lab.

EES completed the design and calculations for the uranium beds for the extraction process. The design drawings have been turned over to Tritium for procurement of new uranium beds. The beds are used to separate tritium from other gases during the extraction/purification process.

EES, working with MTS and Tritium, purchased a production plasma cleaning system from Allied Signal Binghamton, NY and was given a smaller research plasma cleaning system from Allied Signal Kansas City. The systems are being evaluated for use in the cleaning and/or decontamination of tritium associated components. SRS presently uses an Oakite water mixture and/or alcohol for decon and cleaning. Since this produces radioactive liquid waste, Tritium is looking for alternative methods.

Non-Nuclear Reconfiguration - Kirsten Aylward

Testing of the EES designed and fabricated NNR calorimeter has been completed. Acceptance criteria for the test was to meet a one milliwatt standard deviation for a standard unit. Calculations indicate that a 0.14 milliwatt

standard deviation was achieved for ten standard runs.

EES completed acceptance testing of the Sample Assay Vacuum Bakeout (SAVB) and Function Test System (FTS) control panels at the vendor. The acceptance testing included the use of the EES fabricated relay chassis. Both panels were powered up and every instrument tested using simulated signals. Interlock circuits that could be simulated were also tested. EES engineers brought current sources, voltage sources, TCVG simulators, and strain gage simulators from SRS to the vendor to ensure a complete test of the instruments and wiring. The panels were shipped directly to Tritium Construction for installation.

Ordering of material for the environmental conditioning stripper system and Kanne system continues. The design for the stripper beds is complete and the purchase requisition is out for quotes. Much of the instrumentation has already been ordered. Fabrication of the Kanne skids has begun.

A design review was held on the environmental conditioning Data Acquisition & Control System (DACS). The EES designed system will control the operation of the drop tester and centrifuge. In addition, it will capture accelerometer data from drop tester, centrifuge and vibration table. The hardware includes a 120 MHz industrial Pentium, high speed digitizers, Neff data acquisition hardware, a storage scope, filters and a custom designed control chassis.

Overpack for Tritium Spent Melt Crucibles - Design and Test - P. S. Blanton

The deliverable for this project is an overpack and ancillary handling and loading equipment. The overpack functions as the primary radioactive material containment boundary during transportation from TEF to SW and during subsequent disposal activities at the ILTV, an open air facility. The overpack design is nearing completion on paper. Three full scale prototype units, (20 feet long - 18 inches diameter), have been fabricated by Central Shops and are currently in different stages of functional testing. Functional testing include leakage rate tests performed by EES, and facility

remote handling tests performed by Tritium and Solid Waste. Tritium remote handling tests began in July and are approximately 70% complete. Solid waste satisfactorily completed their first set of remote handling tests on 8/6/96 (video footage of this test is available). EES has successfully leak tested two of the three overpack seals.

Following the successful completion of these tests, scheduled to end in August, and Tritium's and Solid Waste's acceptance of the design, a procurement specification will be issued for the purchase of 40 overpacks.

SEPARATIONS

Pu Calibration of New Spectrometers

L. C. Baylor

Aging spectrometer systems used in F-Area analytical laboratories were recently replaced with more up-to-date models when replacement component supplies for the older models were exhausted.

Adjustments were made to the 772-1F laboratory 122 system light source to correct a problem with unstable lamp intensity. ADS began discussions with Laboratories Department personnel to address software changes needed to allow the systems to make uranium measurements.

F-Area Gamma PHA Calibration

R. A. Dewberry, G. R. Griswold

SRTC/ADS has provided in the past a portable germanium detector for performing fissile material holdup measurements in FB-Line and HB-Line along with measurement assistance and data evaluation.

Energy and efficiency calibrations of the portable germanium detector were completed for assaying 8X8X10 ft. waste boxes from 292-F. The boxes must be assayed for Pu-239 before burial. Calibrations were performed using 5 Pu sources ranging from 10 to 100grams. A FB-Line Se-75 source was used to correct for self-absorption in the standards.

Radiometric Analytical Chemistry -

S. F. Peterson and D. P. DiPrete

SRTC/CHTS is performing a study to determine the distribution of solids in canyon tanks for sampling validation purposed. Not only is the distribution of solids in the samples important but also the distribution of any Pu solids within the total solids content. Nickel has been determined to be a good stand-in for Pu for non-radioactive studies. The nickel content can be determined very well in these study samples by neutron activation analysis.

Two reports were made of the results of neutron activation analysis (NAA) for nickel in CHTS samples as part of the canyon tanks solids sampling study. A total of 18 samples were analyzed. Each analysis entails a 60 minute irradiation, 10 minutes of decay time, and 50 minutes of counting.

Phase II Restart Support Activities

J. H. Gray, K. N. Forrest

One option for removing degraded solvent from Tank 16.3 is blending with first cycle solvent. However, before consequences of solvent blending can be reviewed, the results of dibutyl phosphate (DBP) analyses and pickup tests to measure solvent quality are required.

F-Canyon has cleaned up the solvent in Tank 16.3 and sent samples to SRTC for evaluation of solvent quality. The appearance of Tank 16.3 solvent samples was a dark brown color. This alone was an indication of degraded solvent. The residual alpha activity was 3×10^5 dpm/ml. This value is about two orders of magnitude higher than "good" solvent.

The DBP content was only 16 ppm. This result indicates that the residual alpha activity is not due to a Pu-DBP complex. The residual alpha activity is probably bound to degraded solvent ligands which will not be removed by carbonate-nitric acid washes. Alumina cleaning is usually required.

The 16.3 solvent extracted plutonium normally. However, after nine strip stages, the remaining alpha activity was still high, at 7×10^4 dpm per ml. This is about a factor of 20 higher than remaining alpha activity in good solvent. Again results indicate residual alpha activity is not bound with DBP and will not be removed by carbonate-acid washes.

F-Area Support - L. C. Baylor

Old Hewlett Packard 8451 diode array spectrophotometers used in F-Area Analytical Laboratories for uranium and plutonium measurements are being upgraded to the newer HP 8452 models.

Software modifications were made in January to allow the instruments to make plutonium measurements. Some minor changes were needed to the operating software to ready it for uranium measurements. Most of these changes have been completed - a few minor details cannot be finished until new calibration models are collected.

F-Canyon Gamma Water Monitors - **Frank S. Moore**

The old swirl cell gamma monitors used in the canyon cooling water effluent streams are to be replaced with an improved design overflow monitor. ADS had previously established the operating parameters and calibrated the new monitors.

I demonstrated the prototype gamma water monitor to the new F-Canyon engineers on the project and explained electronics changes I recommended to make it more user friendly to the mechanics maintaining it. I also suggested shielding and reviewed the drawings showing the shielded detector.

Blending Tank 16.3 Solvent - **J. H. Gray, K. N. Forrest, K. J. Kalbaugh**

The blending of Tank 16.3 solvent with the solvent inventory in first cycle was completed. Following recent laboratory measurements of the solvent quality, washing with 50% sodium hydroxide solution was conducted to determine if additional caustic scrubbing would improve solvent quality.

Extraction and strip pickup test results confirmed that additional caustic washing would not improve the quality of solvent in Tank 16.3. However, since the volume ratio of first cycle to 16.3 solvent is 10 to 1, the impact of this blending operation on solvent quality was expected to be minimal and to remain well within limits established for "good" solvent. However, after blending was complete, additional solvent samples showed unexpectedly low solvent interfacial tension (IT) values and long disengaging times.

The low residual alpha activity, 8.1×10^3 and 1.0×10^4 dpm/mL, efficient stripping of plutonium after nine strip stages down to 4.2×10^3 and 4.0×10^3 dpm/mL, and low dibutyl phosphate (DBP) content, 46 and 24 ppm, all indicate these solvent quality parameters were not adversely affected by the mixing of 16.3 degraded solvent with 14.7 first cycle solvent. However, low interfacial tension values between 2.5-3.0 dynes/cm and difficulty in phase separation of carbonate/14.7 solvent phases indicate these solvent quality parameters are less than desired for hot operations.

Alumina (Al_2O_3) scrubbing of the blended Tank 14.1 solvent is being examined as a clean-up method. Samples of blended 14.7 solvent were scrubbed with alumina and comparisons of disengaging times and emulsion cloudiness in the solvent before and after alumina treatment were made. The alumina scrubbing significantly improved solvent quality. Disengaging times were reduced from over two minutes to 22 seconds and the blended solvent was a clear, pale yellow color with no visible cloudiness. This backup allows recovery if first cycle operations are unacceptable.

Plutonium in Carbonate Wash Solutions **- J. H. Gray, K. N. Forrest, K. J. Kalbaugh**

The recovery of plutonium from spent carbonate wash solutions would provide additional feed material for B-Line operations. However, conversion from a carbonate to a nitric acid solution and destruction of remaining tributyl phosphate (TBP) and dibutyl phosphate (DBP) is necessary before the solutions would be suitable feed.

Review of carbonate wash solution processing flowsheets is complete. A flowsheet variation resulting in a reduction in initial nitric acid molarity will mean an extended boiling period could become necessary. However, by using diluted nitric acid starting solutions, the possibility of sodium nitrate salt precipitations may be eliminated. After digestion for extended periods, samples will be taken and pickup tests performed to establish suitability of digested solutions as plutonium feed.

Anion Resin Sulfate Conversion -
N. M. Hassan, E. A. Kyser, and Y. J. Simpkins

The disposal of the anion exchange resin from FB-Line waste recovery process must be in a stable form; the nitrate form anion exchange resin can be unstable and poses potential fire and explosion hazards. The flowsheet for the anion exchange sulfate conversion process in FB-Line normally uses 1 wt % sulfate to achieve near complete sulfate conversion. SRTC/CHTS has been requested to investigate the kinetics involved in the total sulfate conversion process by doubling the concentration of sulfate, while reducing the total feed volume by half.

Two sets of batch tests were conducted with Dowex 21™ anion exchange resin converted to sulfate form (i.e. 1 and 2 wt% sulfate) in an 8 mm diameter column. Prior to conversion, the anion exchange resin was conditioned with 8M HNO₃ and then rinsed with approximately 10 bed volumes of deionized water. Column effluents were sampled for residual nitrate concentrations. The nitrate form anion exchange resin was slurried in 25 mL aliquots of the 1 and 2 wt % sulfate solutions and the solutions were stirred at ambient temperature. Samples were taken after 2, 4, and 6 hours and analyzed for residual nitrate concentration by ion chromatography (IC).

Results from the tests indicate that the kinetics involved in the overall exchange reaction were fairly fast as complete conversion was achieved in less than 2 hours. Calculations show that 0.07 and 0.11 meq of nitrate ion remained in anion exchange resin of the 1 and 2 wt% sulfate solutions, respectively. At theoretical capacity of 1.15 meq/ml of the Dowex 21K resin, the overall conversion efficiencies for the 1 and 2 wt% sulfates were found 94 and 89% complete. Thus the reduction in the overall conversion efficiency is practically insignificant.

Rush Analysis for FB-Line on Valve Components - S. L. Crump

Before the valves could be engaged in designated activity at FB-Line, personnel

needed confirmation that poly(vinylidene)fluoride (PVDF) had been used in manufacturing the devices. The valve material was required by design specification to be PVDF, but recently valves without documented materials of construction had been procured.

The Analytical Development Section provided analytical support on a rush basis using Fourier Transform Infrared (FT-IR) spectrophotometry to successfully identify the polymers, which were confirmed to be PVDF.

FB-Line Holdup Measurements -
F. S. Moore

SRTC/ADS previously developed a portable gamma detector system with data acquisition and storage capabilities. The system is self contained and greatly reduces the waste associated with taking measurements in contamination areas. ADS is frequently called upon to make measurements and analyze data to determine fissile material holdup.

Assistance was requested by FB-Line personnel in performing Pu-239 holdup measurements for the Mechanical Line exhaust duct. The experimental measurements were acquired, data analysis is now underway.

TBP/DBP Method Development
S. L. Crump, R. R. Livingston

The current analytical method for tributyl/dibutyl phosphate (TBP/DBP) analysis in nitric acid involves extraction of the organic into hexane, gas chromatography for separation of the components and quantitation using a flame ionization detector. The method is relatively complicated and time consuming.

Scoping studies were begun in September on a technique utilizing Fourier Transform Infrared (FT-IR) analysis to measure the TBP/DBP directly in the nitric acid.

Canyon Dissolution of Sand, Slag, and Crucible Material - J. H. Gray, K. N. Forrest

Ruthenium volatility is another issue investigated as part of the sand, slag, and crucible (S,S,&C) flowsheet development program. The concern is possible release of ruthenium from canyon dissolvers during dissolution of the S,S,&C material.

Previous canyon dissolver campaigns established that ruthenium volatilization is a function of nitric acid concentration and dissolving solution temperature. At an acid concentration of six molar, ruthenium is not released as long as the solution temperature remains below 81°C.

The acid concentration for the proposed canyon dissolver flowsheet was lowered to six molar and the dissolving of both sand fines and slag chunks conducted at 71-72°C. The sand fines continue to completely dissolve at the lower acid and temperature conditions. Only after dissolving the third batch of slag chunks in the same solution did any solids remain. These solids appeared as a "brown mud", did not contain plutonium, and rapidly dissolved in a fresh nitric acid solution.

Processing FB-Line Scraps and Residues - J. H. Gray, R. R. Livingston, K. N. Forrest, K. J. Kalbaugh

Sweepings and turnings are two types of scraps and residues from FB-Line that are candidate materials for dissolution in HB-Line. The fissile material separated from these solids would be interim stored in H-Area prior to transfer back to F-Area for stabilization.

Initial discussions with B-Line personnel have identified candidate flowsheet dissolving conditions, operating constraints, and arrangements needed for selection and transfer of samples to SRTC for dissolution and characterization studies. However, prior to receipt of the sweeping and turning samples, remaining S,S,&C sample inventory being used to develop a flowsheet for canyon dissolvers will be returned for storage.

Development work for dissolving S,S,&C material has focused on hydrogen generation, ruthenium volatility, and corrosion issues. Some of these as well as other HB-Line facility

specific constraints will be examined during the Turnings and Sweepings Laboratory program.

Portable Assay Instrument Provided to FB-Line - F. S. Moore

FB-Line frequently has need to perform gamma assays of equipment and piping to determine plutonium accumulation. ADS has been called upon to perform these assays.

A surplus Compac portable computer was obtained and equipped with a multichannel analyzer (MCA) board and assay software. The system was transferred to FB-Line and the FB-Line engineers trained on its use for making gamma ray assays. This system gives FB-Line the capability to perform their own gamma ray surveys when appropriate. ADS will continue to support the assay needs as requested.

Separations Support - Jim Wong

Separations personnel currently use epoxy based scintillators in the effluent alpha water monitors and periodically replace the scintillators due to warpage. The previous design, of polycarbonate polymer base (Lexan) bonded to a layer of zinc sulfide with double sided tape, was ineffective because the zinc sulfide would wash away, but did not experience warpage. EES was requested to test a new scintillator design utilizing Lexan bonded to an epoxy-zinc sulfide mixture. Initial testing of Lexan showed that it does withstand static testing at 130 F/ 60 psi, and repeated 30 psi impacts (from 15 psi) without breaking, in spite of circumferential stress fractures that develop at low pressures. The stress fractures may have an impact on the scintillation capabilities. Thus, MTS has been requested to investigate alternate materials.

EES was been requested by FB-Line to design and fabricate a radiography system for inspection of approximately 1000 containers of special nuclear material. A kickoff meeting was held to discuss schedule and funding. Funding has been established, schedule reviewed, and design will begin in October. In the design effort, EES will evaluate feasibility of including a HEPA filter system on the radiography enclosure, thus considerably reducing costs. System installation is scheduled for FY98.

EES was requested by FB-Line to modify the induction furnace for processing RFETS metals. This activity will involve design of a new casting chamber, design of an insulator for elevated temperatures, modeling and cold testing, and a hot demonstration in FB-Line. An initial casting chamber design is complete, one prototype and two vessels will be fabricated. Two different insulation blanket designs are being considered and will be purchased for evaluation.

EES is designing a new filter for HB-Line. The new filter, part of the Pu239 activity, has a newly requested completion date of 1/97. Drawings of a prototype are complete and machine shop work initiated. Testing of the prototype will be complete in October.

Testing of the FB-Line bagless transfer unit in Building 717-A is complete. Software modifications are complete. Four weeks of operations and maintenance training are complete. The unit has been shipped to FB-Line for installation. EES has been requested to prepare paperwork for the purchase of 50 production canisters to be used in the system.

Actinide Packaging & Storage Facility (APSF) - Jim Wong

Installation of the digital radiography (DR) booth is complete. Minor leaks have been measured and will be repaired. The 450 Kev x-ray source is now installed and functional within the booth. The camera has been tested with the computer system and will be installed. Requirements for DR examination of the container have been documented. Traditional computed tomography (CT) techniques have been evaluated and found unacceptable for use with the BNFL designed container. This is due to the solid end-cap in line with the closure weld. Other techniques, including tangential CT have been proposed.

EES visited Lumonics for an onsite acceptance and training on a new laser for container marking. Additionally, an EP-61 container was shipped to the company. The laser was then used and successfully marked the container. A flow chart for temporary bar coding of

containers and bar code readers for the facility is complete.

EES participated in meetings concerning IAEA requirements and their October visit. A draft schedule for the October meeting has been jointly developed with MC&A, the project management team, and EES. It is anticipated that there will be a significant FY97 effort in the Building 305-A mockup in support of IAEA issues.

EES will complete an initial gripper for the accountability measurements gantry system by 9/30. The first gripper has been designed to handle the BNFL designed storage container. Testing of the Pu238 calorimeter is complete and has been determined acceptable for the mockup requirements. Fuzzy Logic control architecture was developed for a calorimeter and testing is complete. The Fuzzy Logic technique performed well with respect to temperature control; however, there was still a statistically significant power change due to the large mass of the 2R container tested. Improved thermal coupling of the container to a thermal control zone will be investigated. Two additional calorimeter mockups and a lead/lag storage mockup are complete.

Americium/Curium Vitrification - Jim Wong

EES completed an intensive effort with the project management team to develop an integrated detail resource loaded recovery schedule. This new schedule has factored in the new design input generated from the failure of melter two. Development of the scope of changes from the implementation of zoned power and control interlocks in the MPPF is complete. The initial design on an interlocked control system for melter one is complete and was issued for review. The activity is on schedule to issue design package three for team review.

F-Canyon Seismic Release - M. A. Shadday

An analysis of the potential release from a large liquid spill in F-Canyon during a seismic event in F-Area was completed in less than a week

and presented to the DNFSB. Due to time constraints, the analysis was based on the exchange with outside air assuming a constant wind speed and porous openings at the expansion joints in F Canyon. If the joints are assumed to be void, i.e. the packing material is gone completely, the release in the two day period for restoration of ventilation is 95%. The analysis then considered different porosities for the packing and found that the release would be less than 10% for a porosity of about 10 to 15%. Testing of the packing material is planned to determine how much leakage can be expected through the expansion joints under a variety of conditions. If the tests verify the 15% or less porosity, then the claim of 10% or less release will be validated since the analysis assumed that the air is saturated with vapor from the spill. This is a conservative assumption but the level of conservatism is very difficult to estimate since it would involve a 3-D CFD analysis in a very complex geometry. Discussions with the DNFSB indicated a willingness to accept this argument if the porosity measurements bear out the 15% value used in the analysis.

ENVIRONMENTAL

Basement Rock Materials Documented - R. N. Strom

Investigators from the Education, Research and Development Association of Georgia Universities (ERDA) have completed studies to examine and document the core materials from Triassic and Crystalline basement rock that have been archived at the Gunsite 51 Core Storage Facility. The first report "Investigation of Triassic Basin Sediments - Savannah River Site" was prepared by Dr. T. M. Chowns (West Georgia College) and by W.J. Fritz and T.E. LaTour (Georgia State College) and documents the lithologies and depositions history of the materials deposited in the Dunbarton Basin in the southern portion of the site.

Crystalline Basement Core -- Savannah River Site - R. N. Strom

The "Crystalline Basement Core -- Savannah River Site" Report focuses on the metamorphic basement in the northern half of the site. In addition to synthesizing the geologic history of the basement rocks at SRS, these reports create a record of the core materials available at the archive for future site needs. Copies of the report are available from the Geosciences Group of ESS.

Remote Sensing Overflights Completed in April - H. E. Mackey

The annual multispectral scanner overflight of the Savannah River Site was conducted in the last half of April, 1996, by ESS and Bechtel Nevada (formerly EG&G). Specific target areas included Pen Branch corridor and delta reclamation areas, the F and H Area Seepage Basin clay caps, as well as clay caps in the Burial Ground, the Sanitary Landfill, and M Area. In addition, target areas such as Lost Lake, L Lake, and the Par Pond system were flown. False color infrared film was flown in support of the scanner surveys and pre-dawn thermal imagery was acquired of the clay cap areas. A poster describing recent scanner overflights of the SRS was prepared and displayed in the 773-A lobby.

Pen Branch Reforestation- E. A. Nelson

A work crew from Americorp based in Charleston was utilized to install a series of non-permanent stocking plots in the Pen Branch corridor. This information will be used to get an estimate of tree density in the reforestation areas and to direct future replanting needs. After a safety orientation, nearly 200 plots were located and tallied in a 3.5 day period. Assistance from SREL and USC-Aiken in providing additional crew leaders and supervisors helped the crew work rapidly and safely in the swamp conditions.

Bald Eagle Assessment - J. B. Gladden, E. B. Hart

The consequences of potentially lowering L Lake and fluctuating water levels in Par Pond were evaluated with respect to Bald Eagles on the SRS. Both changes in the physical habitat and exposure to contaminants were evaluated. It was concluded that the elimination of L Lake would likely result in the relocation of the Pen Branch eagle nest, while the nest near Par Pond would not be affected by the fluctuating water levels in that reservoir. The evaluation of potential exposure to contaminants in the reservoirs was less conclusive because of insufficient data. Generally, it was concluded that the probability of overt toxic effects on eagles was extremely remote, while it might be possible that sublethal effects could occur. Additional studies are required to provide basic information on foraging behavior of the eagles before the assessment can be refined.

Evaluation of Planted Seedlings in the F- and H-Area Tree Kill Zones - E. A. Nelson

Four areas of tree kill in the F-Area and H-Area seeplines were planted with swamp tupelo seedling to speed up the reforestation of the impacted areas. These areas were remeasured to determine the current survival within the four areas. The seedlings are beginning their third year in the field. Two areas are apparently recovering and two areas still seem to be

expressing prior impacts on vegetation. A memo is being prepared to present the results to ER with suggestions for future measurements of the areas.

**Cleanup of Impacted Wetland at Sanitary Landfill - E. A. Nelson,
D. V. Osteen**

The wetland damage clean-up at the sanitary landfill was surveyed with representatives from ER and EPD. A large "vacuum truck" successfully removed the sediment deposition in the wetland. Minimal additional damage occurred to the wetland, and the sub-contractor is getting to within one to three inches of the original wetland surface. The project was deemed successful and the natural seed-bank is expected to revegetate the area. No further action, other than normal sediment control associated with the capping, is anticipated to protect this wetland.

**Geochemical and Physical Properties of Wetland Soils Report - K. L. Dixon,
J. B. Gladden, B. B. Looney,
J. Weber, S. Conner**

In 1992, a field project was initiated to establish the naturally occurring geochemical and physical properties of wetland soils at the Savannah River Site. Soil samples were collected from wetlands across the site as well as from wetlands in offsite areas. Samples were analyzed for a variety of constituents including RCRA Appendix IX parameters, metals, and other inorganic parameters. A report detailing the results of this project is currently in progress. SAIC delivered the first draft of the report in June 1996 and WSRC comments have been returned. The second draft of the report is expected in August 1996.

**Injection Studies Begun at H-Area -
R. N. Strom**

The first series of injection tests have been completed at the H-Area Injection Test site. This site has been developed and instrumented by SRTC and the Savannah River Ecology Laboratory to obtain detailed information of the mobility of colloids in the subsurface that results from injection of treated water from the

F/H-Area ground water remediation activities. The first series of injections were used to test and calibrate the instruments installed at the site and to develop standard protocols for conducting tests using tritium as part of the injectate. Future injection series will test the retardation of commonly used solute tracers relative to tritium, and evaluate the impacts of remediated water on the chemistry of the water table aquifer and on the mobilization of colloidal particles in the aquifer.

Photographic Support - H. E. Mackey

Waste site remediation efforts were supported by providing recent 1995 and/or 1996 vertical aerial photographic materials to ER for habitat evaluation of the C-Area Burning Rubble Pit and the D-Area Oil Seepage Basin. Historical aerial photography from 1943 and 1951 was provided to EPD to assist in discussions with SCDHEC concerning the determination of wetlands below the A-3 outfall. Low altitude 1996 false color aerial photography was provided to ESS personnel to assist with mapping for remediation of wetland communities in the Pen Branch Corridor and Delta. Historical photography of L Lake during its construction in 1984 and 1985 was provided to ESS personnel to assist in mapping of potential disposal units in the bed of the lake.

L Lake Commitment - D. L. Dunn

A sampling and analysis plan was written to document WSRC's strategy for coordinating the sampling and analysis of sediments from the L Lake and soils from adjacent land areas. This sampling plan describes a four part strategy for characterizing contaminants in the L Lake basin. The data provided by these studies will be utilized in the preparation of an Environmental Impact Statement (EIS) that will evaluate the consequences of discontinuation of river water pumping at the SRS. The work will also provide data for the preparation of a Site Evaluation Report for the L Lake basin. The status of each phase is described below.

Phase 1: The first phase (sampling completed June 1996) involved the sampling of surface sediments (0-1 ft depth) in submerged portions of the L Lake basin and sampling surface soils

in reference (background) locations at two depths (0-1 ft and 1-4 ft depth intervals). Sampling locations in the L Lake basin were chosen based on soil type, history of contamination and types of disturbance. Dominant soil groupings within the basin and several sites that were suspected to have been used for disposal of contaminated vegetation and sediment were sampled by field operations personnel in the Environmental Technology Section (ETS).

Phase 2: Deep core sediment sampling in the second phase will emphasize the investigation of ash disposal areas in the submerged portions of the L Lake basin. The ash disposal areas are believed to be the result of the burning of clean vegetation that was subsequently buried under clean soil immediately adjacent to the burning site. Samples will be collected using a vibracore sampler.

Phase 3: Underwater High Purity Germanium (HPGe) measurements were made during May and June at 195 grid spaced locations on the L Lake surface sediments. The results of these measurements were consistent with similar measurements made during L Lake transect surveys conducted during August 1995. The measurements show that the bulk of the radionuclides (primarily cesium-137) is concentrated in the old stream channel of Steel Creek.

Phase 4: The 'Waterways Explorer', a fully equipped research vessel operated by the Waterways Experiment Station (WES), was deployed at the L Lake by WES personnel during June 1996. A subbottom hydro-acoustic survey of L Lake was conducted by WES in an effort to locate submerged burial pits within the L Lake basin. Acoustic impedance measurements resolved from the seismic reflection data are directly related to identification of sediment interfaces and characterization of the subbottom sediments. WES personnel will post-process all geophysical field data and prepare a summary report and graphics of the test results.

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. SRTC worked with the University of South Carolina (USC) at Columbia on this program. The evaluation consists of a classical engineering analyses of the technologies available. The report titled "Status and Practicality of Detritiation and Tritium Reduction Strategies for Environmental Remediation" has been completed. At present the report is proceeding through the document approval process for unlimited distribution. The WSRC/ER department with the support of SRTC developed a pathforward using the results of the above mentioned report. This pathforward was transmitted to DOE/SR by correspondence titled "Recommendation to Pursue Development of Detritiation Technologies for Environmental Remediation", dated May 22, 1996, SWE-ERD-96-0412.

Dialysis Sampling as a Method to Reduce Generation of IDW - K. Jerome

The Environmental Restoration Department is evaluating methods to minimize the generation of investigation derived waste (IDW). One method being explored is dialysis sampling. This process involves placing dialysis sample "bags", which contain a concentrating chemical, in monitoring wells and then analyzing the material inside the bags for the contaminant of interest. With this method no purging of the wells prior to sample collection will be required. The final report for the evaluation of the dialysis sampling method was transmitted to WSRC/ER on April 26, 1996. A presentation of the report was conducted for WSRC-ERD management on June 17, 1996. The results of the study indicate this method is not appropriate for analysis of groundwater containing volatile organic compounds such as TCE and PCE.

ER Support for A/M-Area Vadose Zone Remediation Project - R. D. Raymond,
M. B. Riha, J. Rossabi, T. R. Jarosch

Assistance was provided to ERE in conducting extended testing of two vadose zone vapor treatment units to determine maximum solvent recovery rates and initiate investigations into the effective zone of capture for the current recovery well systems. This work is being used to meet corrective action plan requirements agreed to with SCDHEC on the Vadose Zone Project. The assistance with the tests included continuous on-line monitoring of the influent to the vapor treatment systems using a photo-acoustic IR sensor and periodic analysis of grab samples taken at the wells, influent, and stack using an off-line GC. The tests conducted by ER and M-Area Operations involved operating the units at three different total flow rates with the flow manifold set wide open to each well and using no dilution air. The maximum recovery rates are being used to augment data for amendments to the current air permits in an effort to use the recovery wells and vapor treatment units more effectively. In addition, drawdown vacuum data was taken at adjacent vadose zone monitoring wells equipped with transducers and data loggers at the surface. This information will be used to augment future tests to determine the zone of capture for each well independently.

**Shear Wave Seismic Survey at A/M Area - M. E. Denham, C. Eddy-Dilek
R. S. VanPelt**

Blackhawk Geosciences completed field work for a shear wave seismic survey of A/M Area. The purpose of the survey is to delineate and assess the competence of the Crouch Branch Confining Unit and other shallower confining units. Shear wave seismic is ideal for detecting thin shallow reflectors. Approximately 4 line miles were shot in the vicinity of the M-Area Settling Basin. The data compliments the previously obtained Time Domain Electromagnetic (TDEM) survey and the two will be integrated with bore hole geophysical data to produce a comprehensive picture of the shallow subsurface of A/M Area.

**D Area Oil Seepage Basin - J. Radway,
E. Becker, C. Berry, K. Lombard,
T. Hazen**

As part of a rapid response for ERD, the Biotechnology Group provided technical assistance to ER for final drum removal and installation of two horizontal wells and vadose zone monitoring wells by the subcontractor. This represented a significant savings in money and time since the subcontractor was already mobilized with heavy equipment at the site and could easily install these systems. The major contaminants of concern at the D area oil seepage basin are petroleum derived compounds and chlorinated solvents used as degreasers. The dominant component of identified so far is the petroleum compounds. Demonstrations and active remediation programs at several SRS sites, e.g., D area SOILS facility, M area basin, Sanitary Landfill, and LUST sites at C and K, have shown that the most efficient and cost effective way to remediate soil and groundwater contaminated with these compounds is bioremediation. Thus installing wells that can be used to monitor and/or stimulate biodegradation is extremely cost effective for the current investigation activities. Monitoring and future tests with these monitoring piezometers will provide data to evaluate remedial alternatives for this site.

Southern Sector Bioremediation ERD Support - R. Brigmon

A subsurface plume of trichloroethylene (TCE), and perchloroethylene (PCE) is predicted to impact the Southern Sector of the A/M-Area. A survey of the area to quantify the microbial and plant population known to be capable of remediating TCE and PCE is proposed. This survey will determine the amount of time before the microbes begin allowing contaminant break through. The study will allow design of a phytoremediation system for complete degradation of groundwater contaminants.

**Par Pond and L Lake Water Sampling -
N. V. Halverson**

Water samples from Par Pond and L Lake have been collected and shipped to an offsite vendor for mercury and radionuclides analysis. The samples were part of the Par Pond Water and Fish (PPWF) project. This effort will be repeated in the third and fourth quarters of calendar year 1996. The data from these and

other samples from Par Pond and L Lake will be used to determine whether the water quality in the reservoirs, and subsequently the ecological functioning of their ecosystems, is altered by the reduction of river water input to the reservoirs.

108-4R Basin Groundwater ERD Support - F. Washburn, D. Altman, C. Berry

In support of ERD the Biotechnology Group is looking at the feasibility of bioremediation at the 108-4R Overflow Basin. The 108-4R Overflow Basin is an unlined basin that was used to contain overflow from the diesel storage sumps in R-Area. Past operating practices allowed diesel storage tanks to be filled daily. Temperature changes over the course of a day would cause the tanks to overflow and spill into a sump. The sump was then subsequently pump to the overflow basin. Wells were drilled and developed in this area for further characterization of the soil and groundwater. The Biotechnology Group responded to an immediate ERD need for handling of investigation derived waste. A 2,500 gal tank was moved to 108-4R to collect water from the new well development. This water was found to be clean and discharged at the site. A study to determine the effectiveness of bioremediation on the sediment has also been initiated. Sediment concentrations of total petroleum hydrocarbons in the basin are high. ESS's Biotechnology group has sampled the sediment and water in the basin. Bioremediation treatability studies are in progress. The current remedial philosophy is to test biosparging in a soil pile contained in the basin proper.

Sanitary Landfill Optimization Test - T. Hazen

The Sanitary Landfill Optimization Test is an extensive ongoing study to determine the best possible solution for remediating the groundwater beneath SRS's Sanitary Landfill. Campaigns have been completed for in-situ air stripping and in-situ bioremediation. A final report has been issued. A helium tracer test, a respirometry test and final groundwater and air sampling have been completed at one of two

sites. Demobilization of this test site is complete. Comprehensive sampling at Site 1 is complete. A baseline respiration test was conducted over a 4-day period. The test was successfully completed and the data along with the gas, water, etc. data is being processed. A Mark helium gas analyzer will be used to obtain helium tracer data during the next phase of the injection test. The design and construction of the full size remediation system is continuing.

Pond 2 and Pond 5 Report - N. V. Halverson, J. V. Noonkester

A report on the analysis of sediments from the P-Reactor Canal system, including the two reactor pre-cooling ponds, Pond 2 and Pond 5, is under final review. Sediment near and below the existing water level were analyzed for gross alpha, gross beta, and gamma activity in support of the Environmental Impact Statement to determine the consequences of shutting down the river water distribution system. Activity levels found in this study were comparable to activities measured during other studies of the Par Pond Cooling system. Consequently, contamination in the P-Reactor Canal system would not be expected to alter the risk assessment conclusions which were based on pre-existing Par Pond contamination data.

Par Pond Phytoplankton Taxonomy Questions, e.g. How Much Blue-Green Algae? - E. W. Wilde

Bill Cody, an algal taxonomist with Aquatic Taxonomy Specialists (ATS), visited SRS to consult with ESS regarding an ongoing analysis of the phytoplankton of Par Pond. The work is being done in conjunction with a limnological study of the Par Pond. The limnological study is being conducted in response to NEPA requirements associated with the drawdown and subsequent refilling activities necessitated by a leak in the Par Pond dam.

Examinations of live material by the use of fluorescence microscopy facilitates clear determination of the following two key properties not possible when analyzing preserved algae by conventional techniques: (1) unquestionable differentiation of photosynthetic

algae from materials such as bacteria and fungi that can be of identical size and shape as algal cells, and (2) unquestionable differentiation of blue-green algae from similarly appearing green algae.

Another visit is planned at the end of the collection period to develop the best and most accurate reporting strategy for final reporting of the data in the published literature.

In-situ Bioremediation of 108-3C Diesel Storage Site - J. R. Kastner

In support of Reactor Engineering, a bioventing system using passive injection, has been installed and is now operational at the 108-3C Diesel Storage Site. Past operating practices at 108-3C resulted in diesel contamination which was partially excavated (500 yd³). Bioventing was considered a more economical choice when further characterization revealed deeper contamination. Baseline data was obtained from the site. Initial startup data from the site has shown that the bioventing system has increased oxygen concentration in the soil and a vacuum at the injection wells and vadose zone piezometers has been measured. Currently, air (or O₂) is the only nutrient being passively transported into the contaminated zone. A campaign of air injection only will continue until in situ respiration rates have been measured and tracer analysis has been performed. Nutrient addition (triethylphosphate) via the "PHOSter" process will follow. Cleanup is expected to take 12 to 18 months.

Waste Site Data Collection - N. V. Halverson

A task order has been issued to SAIC for consolidation of waste site data in support of the Integrated Operable Unit Program. SAIC will compile RCRA and CERCLA waste site characteristics, groundwater, soil, and ecological data. The data will be used to define the source terms of contaminants for the risk evaluation. Data analysis will include an estimate of the inventory of all identified contaminants in each of the waste sites.

Fluidized Bed Bioreactor - D. J. Altman, F. A. Washburn

The fluidized bed bioreactor is an innovative pump and treat system designed to degrade groundwater contaminated with chlorinated organics. This project is supported by ERD and the Strategic Environmental Research and Development Program (DOD-DOE-EPA). The system principle is based on a continuous up flow process that enables longer contact times between the contaminated groundwater and the microorganisms attached to activated carbon. The Department of Energy has approved the contract and it has been officially placed with Radian. Well selection is complete and regulatory permits have been approved. A kickoff meeting with Radian was held on February 27-28, 1996. A 50% design review meeting and HAZOP review was held on April 8-9, 1996. Final design is complete and construction began on July 9, 1996.

Modifications to the A/M Area Production Wells - D. Jackson, B. Beavers, M. Jones, T. F. Kmetz, R. S. Van Pelt, J. J. Kubar, D. G. Wells, H. Campbell

SRS personnel are planning a two phase program in order to reduce the amount of dissolved chlorinated solvents that are being transported to the McQueen Branch via the wellbore and gravel pack zones of the A/M Area production well system. Six production wells in the A/M Area are involved in this investigation. During Phase I of the program a commercially available inflatable packer and check valve assembly will be installed inside the casing at the altitude of the McQueen Branch Confining Unit in wells 905-20A and 905-53A. This immediate, short term solution will eliminate the majority of the contaminant mass that is moving downward through the wellbore of the A/M Area production wells. During the packer installation process several pre- and post-installation testing activities are planned to aid SRS investigators in understanding the dynamics of the flow conditions and effectiveness of the installed assembly.

Pre-installation activities include a down-hole video survey of each wellbore, packer testing of the upper casing, measurement of the vertical flowrate inside each wellbore, and the collection

and analysis of groundwater samples from specific horizons in each wellbore. To date, video surveys have been performed on LA-4 and 905-15A. Water samples have also been collected and analyzed from specific horizons in these two wells. Packer testing of the upper casing in LA-4 has been completed and the data is being analyzed. Water samples, velocity logs, and packer testing is planned for well 905-53A in early August.

The second phase of the program will address the small amount of contaminant mass that is moving downward through the continuous gravel pack of the production wells. The current plan is to permanently abandon 905-15A and 905-31A. An attempt was made to collect water samples from discrete horizons in 905-31A, however vertical deviations in the upper section of the well prevented access to the lower section of the well.

Video Presentation of the A/M Area Environmental Remediation Activities -
D. G. Jackson, B. B. Looney, R. S. Van Pelt, C. L. Bergren, E. L. Funderburk

Operations at the facilities within the A/M Area have resulted in the release of chlorinated solvents to the subsurface which have resulted in the contamination of the soil and groundwater within the area. Since the discovery of dissolved solvents within the groundwater in the early 1980's, SRS has pursued an aggressive path towards environmental remediation of the groundwater and subsurface contamination. To achieve this goal, SRS has installed an extensive groundwater recovery well network to treat contaminated groundwater, supported the characterization of subsurface features to determine influences on groundwater flow, developed a demonstration program for soil and groundwater remediation technologies, and created numerical models to simulate groundwater flow mechanisms.

A comprehensive video describing environmental remediation actions in the A/M Area is being developed to assist researchers, the public, regulators, and other concerned individuals in understanding the source history,

previous and current remediation activities, and ongoing innovative remediation plans. The video will highlight the important aspects of the A/M Area remediation program using computer visualization and historical footage. A preliminary storyboard has been developed that highlights the following subjects: Background and Information on A/M Area, Purpose of the A/M Area, Subsurface Contaminants, Hydrostratigraphy, Application of Sectors as a Management Tool, and Cost Effective/Innovative Characterization Techniques. Video Services has provided historical footage that is currently being reviewed for applicability.

F&H Area Sampling Reduction Study -
M. E. Denham, E. Shine, R. Anderson, C. Tuckfield, C. Knapp

A geostatistical study was conducted to identify monitoring wells associated with the F&H Area Seepage Basins that can be removed from the quarterly sampling schedule without reduction in the quality of quarterly monitoring information. Wells that yield unreliable samples because of grout contamination or poor water production were identified. This information was used in a geostatistical model to identify wells that yield redundant samples because of their proximity to other wells. Draft reports for wells associated with the F-Area Seepage Basin and the H-Area Seepage Basin have been submitted to the Environmental Restoration Department. A substantial cost savings could be realized by removal of the identified candidate wells from the sampling schedule.

Vertical Recirculation Well System for the Southern Sector of the A/M-Area -
D. G. Jackson, B. B. Looney, R. S. Van Pelt

ESS personnel are providing information for the development of remediation technologies within the southern sector of the A/M Area that incorporate Vertical Recirculation Wells. These activities are being developed and implemented to capture and remediate those portions of the dissolved solvent plume delineated by the 500 part per billion trichloroethene isoconcentration contour. In order to design and develop an

effective remediation system, it is necessary to develop an understanding of the highly three-dimensional distribution of the dissolved plume within Southern Sector of the A/M Area. Personnel have examined the horizontal and vertical extent of the dissolved plume within the Southern Sector of the A/M Area by incorporating quarterly monitoring well data, depth discrete soil headspace data, physical laws governing groundwater flow and contaminant transport with source history information to develop a three-dimensional representation of the plume. This representation is being used with a numerical flow model representative of the hydraulic conditions of the southern sector to develop an optimal remediation system for the southern sector. Due to the relatively low concentrations of dissolved solvent in the southern sector and the large plume size, optimum southern sector cleanup should incorporate carefully located wells screened vertically within the flow path trajectory to optimize the volume of contaminant removed. The numerical model developed is based upon the previously developed fully three-dimensional model of the A/M Area and incorporates the results of recent aquifer tests and field studies within the southern sector. Incorporation of depth discrete sampling during the installation of additional recovery wells should be considered a necessity to optimize the performance of the future recovery systems.

Final Report: Aquifer Testing in the Southern Sector, A/M Area - R. Hiergesell, B. Pemberton, R. Van Pelt

A final report, WSRC-TR-95-0365, Final Report: Aquifer testing with 2-inch diameter wells in the Southern Sector, A/M Area has recently been prepared and distributed.

Five aquifer tests were conducted in the Upper and Lower Lost Lake Aquifer Zones in the Southern Sector of the A/M Area using fully penetrating, 2-inch diameter wells which had maximum pumping rates in the range of 3 to 8 gallons per minute. The tests conducted were multiple-well tests in which the hydraulic response to pumping was monitored in a separate well at some distance from the pumping well. The five tests were unusual in that standard aquifer tests usually employ a

larger diameter well, 6 to 12 inches, and pump at much higher rates. A tanker truck was utilized to transport the water from two of the tests to an air stripper for disposal.

The conducting of aquifer tests is often not possible in areas where the groundwater is contaminated because the wells produce an excessive quantity of water that must be disposed of according to SRS and SCDHEC regulations and at an additional cost. Due to this constraint, past efforts to conduct aquifer tests at SRS have either focused on localities where the groundwater was clean, were conducted at a time when there were no restrictions for disposing of slightly contaminated water to the ground, or were performed in wells that were already installed as part of a pump-and-treat remediation system. Existing pump-and-treat wells can be used for traditional high-pumping rate aquifer tests in areas of contaminated groundwater because they are connected to a treatment system for the pumped water. Locations of these wells are usually selected based solely on contaminant concentration information from monitor wells with little prior knowledge of aquifer hydraulic characteristics. It appears that 2-inch wells pumping at a low rate of flow offer a way to obtain credible in-situ estimates of hydraulic parameters in contaminated formations prior to construction of pump-and-treat wells and at minimal additional costs to dispose of the contaminated water.

Development of a Cretaceous Model for the A/M Area - D. G. Jackson, R. S. Van Pelt

Discharges of chlorinated solvents in the form of degreasers within the SRTC complex has resulted in the contamination of the Cretaceous sediments. The purpose of this activity is to develop a numerical flow model of the Crouch Branch (Cretaceous) Aquifer so that an assessment of the extent and amount of contamination from chlorinated solvents present in this aquifer zone can be made. The conceptual model being applied in this development is that those confining zones in the tertiary sediments, the Green Clay and the "Upper" and "Lower" Clays of the Crouch Branch Confining Unit, become thin and discontinuous within the vicinity of the SRTC

complex. These effects result in this area serving as a recharge source zone for the Cretaceous sediments which results in a locally strong downward gradient from the Tertiary to the Cretaceous sediments.

A confined groundwater flow model is being developed to simulate conditions in the Crouch Branch Aquifer. The domain is being discretized for numerical simulation with the top representing the Crouch Branch Confining Unit and the bottom representing the McQueen Branch Confining Unit. These surfaces have been generated using hydrostratigraphic data from Aadland's Hydrogeologic Framework and incorporated into ten horizontal layers that will represent the Crouch Branch Aquifer Unit.

Boundary conditions and leakance from the over- and under-lying units are currently being examined and implemented into the model. This information will be developed from potentiometric maps of the Lost Lake Aquifer Zone and the McQueen Branch Aquifer Zone. The model calibration will be to 1995 water levels and a "revised" potentiometric map for the Crouch Branch Aquifer. A "revised" potentiometric map of the Crouch Branch Aquifer is being developed that incorporates control that exists along the drainage of Hollow Creek, north of A/M Area. The hydrostratigraphic representation being employed indicates that this tributary and the Savannah River serve as a discharge point for the Crouch Branch Aquifer slightly north and west of the A/M Area.

Once the flow model is developed and calibrated the groundwater velocity information will be used with two-dimensional analytical transport solutions to estimate the length and width of the plume.

Aquatic Emergency Response Model - K. Chen

The report on the aquatic emergency response model, WSRC-RP-96-80, was approved by DOE and was issued. This report documents the benchmarking of the revised STREAM code with data from an accidental release of tritiated water from K Reactor in 1991. The revised

STREAM code is the aqueous emergency response model for the WIND System.

Development of a Fully Three Dimensional Groundwater Flow Model for the A/M Area using Data Fusion - D. G. Jackson, R. S. Van Pelt

ESS personnel are working with HydroGeologic, Inc. to develop and calibrate a numerical groundwater flow model for the A/M Area. The model is being developed using data fusion techniques, a technology developed by EM-50's Characterization and Monitoring Sensor Technology Program, to incorporate mud fraction data and pump test data in the determination of local hydraulic conductivity. Application of this state-of-the-art technology aids in the refinement and calibration of groundwater flow models. A model developed and calibrated using the data fusion technique provides investigators with a superior distribution of the parameters that effect groundwater flow over conventional modeling techniques. This project will incorporate the Data Fusion Module into the development of a numerical groundwater model for the tertiary sediments (principally the M-Area and Lost Lake Aquifer Zones) of the A/M Area.

The model is to be calibrated to the steady-state groundwater levels for 4Q95 based upon the available monitoring wells within the domain. The hydraulic conductivity field that the model incorporates will be determined using the data fusion algorithms to minimize the residuals of the estimated hydraulic conditions. Inputs to the data fusion algorithm include hydraulic conductivities derived from mud fraction data, aquifer pump tests, and laboratory permeability tests, along with quarterly monitoring well data. The calibrated hydraulic conductivity field that results from this model will be used in the development of additional models in the A/M area. Hydrogeologic has submitted a status report dated July 3, 1996.

Western Sector: A Heuristic DNAPL Model for Estimating the Extent and Thickness of DNAPL on the Green Clay Confining Zone - D. G. Jackson, B. B. Looney, Tamra Payne, R. S. Van Pelt

The Western Sector of the A/M Area addresses subsurface contamination from Dense NonAqueous Phase Liquids (DNAPLs) that were discharged to an unlined basin. These contaminants serve as a long-term source zone for groundwater contamination in the A/M Area. Investigators from SRTC and Clemson University are currently examining the extent of DNAPL contamination in the saturated zone. The migration and distribution of DNAPL beneath the water table will be controlled by the finer grained sediments, the Green Clay Confining Zone. Thus an understanding of the topology of the Green Clay is important in the characterization and prediction of DNAPL migration. Currently investigators are incorporating regional hydrostratigraphic data with local cone penetrometer and seismic data to develop a representation of the Green Clay in the suspected NAPL zones. This surface will then be used with a combined technique of particle tracking, hydrostatic force balance, and known NAPL release volumes to develop estimates on distribution of DNAPL along the Green Clay. The numerical tools to perform this analysis have been developed and are being tested and verified for simple geometries. Once the method is validated for the simple geometries, it will be applied to the geometry of the Green Clay. Preliminary results from the heuristic model indicate that the DNAPL is sitting in a depression in the confining green clay layer just east of the sewage basin. However, these investigations indicate that the current model of the surface of the green clay must be refined before the DNAPL model can be used effectively.

Development of Numerical Algorithms for the Analysis of Groundwater Flow using Advective Three-Dimensional Particle Tracking - D. Jackson, G. Flach, Kelle Langham, S. Aleman, L. Hamm

In recent years government and industry have become increasingly concerned with the fate of groundwater contaminants. In particular, efforts have been focused on containing and remediating existing groundwater contamination plumes. The application of numerical modeling techniques for identifying the location of

subsurface contaminant plumes and evaluating the influence of remediation programs is vital to this effort. Particle tracking is a powerful numerical analysis tool for visualizing the flow patterns of groundwater in order to access the effectiveness of remediation programs. Particle tracking techniques utilize groundwater velocity information from numerical models to generate paths of particles through a domain over a given length of time. A particle tracking routine has been developed that incorporates the necessary numerical integration algorithms with the output of the SRTC FACT code to generate particle tracks.

Installation of Piezometers in the Wetlands of Fourmile Branch near F-Area - K. L. Dixon

Six additional piezometers were installed in the wetlands of Fourmile Branch near the groundwater extraction/injection remediation system in F- and H-Area during May 1996. The network now consists of twelve piezometers in F-Area and eight piezometers in H-Area. The additional piezometers were installed to depths ranging from five to ten feet using hand augering techniques. The purpose of the piezometers is to provide hydraulic head data for the water table aquifer in the wetlands prior to and following startup of the extraction/injection groundwater remediation system. Development of the additional piezometers was completed, and initial water level measurements were made. Water level measurements for all piezometers in the network are made monthly.

Instrumentation of Piezometers in the Wetlands of Fourmile Branch near F-Area - K.L. Dixon

Instrumentation of three piezometers in the wetlands of Fourmile Branch off Road C-4 was completed in July 1996. The piezometers were equipped with pressure transducers to allow for continuous monitoring of water levels prior to the start of the extraction/injection remediation system in F-Area. These piezometers will also be used to investigate diurnal fluctuations in water levels in the wetland, and to examine the hydrologic response of the wetland to meteorological events. Instrumentation of three

piezometers in the wetlands of Fourmile Branch near H-Area is scheduled to be completed in August 1996.

Vadose Zone Characterization at 321-M Solvent Storage Tanks - T. R. Jarosch, B. Riha, C. L. Bergren, T. F. Kmetz

SRTC has completed preliminary vadose zone characterization work at the 321-M solvent storage tank area. The characterization is focused on determining the concentrations and extent of chlorinated solvents spilled or released in the vicinity of the tanks and rail car transfer facility. This work is being conducted for ER to both aid in the investigation of the effectiveness of the current soil vapor extraction unit and provide additional data to determine the feasibility of employing a thermal enhanced remediation method at the site. The preliminary characterization was conducted with the DOE (SCAPS) cone penetrometer truck. A total of fourteen pushes were performed with the electric CPT to measure tip pressure, sleeve stress, pore pressure, resistivity and moisture content to a depth of approximately 50 feet. The tip was also equipped with a cone sipper for soil gas monitoring. In addition, six boreholes were pushed to obtain two foot cores at preselected depths. One of the core boreholes was pushed with the FUGRO Geo-Probe. Plug samples from the cores were taken to determine VOC content using headspace analysis with a gas chromatograph. Three boreholes were completed with vadose zone piezometer clusters each screened at two depths (approximately 45 to 50 feet and 20 to 25 feet).

Previous characterization conducted in 1989 and 1990 revealed the presence of a substantial shallow plume (< 40 foot depth, with the bulk of the plume at a 20 to 30 foot depth) near the storage tanks. Initial examination of the present soil samples has confirmed this result. However, the previous borehole locations did not include the earthen bermed region immediately adjacent to the tanks. Soil analysis results of plug samples taken between a depth of 8 to 20 feet in this bermed area suggest that the bulk of the plume near the tanks is much shallower than originally predicted. Concentrations in this region are greater than

1000 ppm (ug/g) for PCE and 50 ppm for TCE. Due to the PCE content of these soils, the current headspace analysis method used is restricted by the solubility limit of the targeted chlorinated solvents in water (the extraction phase for the soil plugs), and calculations of the solvent content require significant extrapolation of standard data. Therefore, the PCE content in the soils determined with this method is likely to underpredict the actual content of the highly contaminated soils. The bulk of the plume lies immediately adjacent to the southeast corner of the tanks and most likely extends beneath and along the railroad tracks east of the tanks. Friction ratio data (sleeve stress to tip pressure) taken with the electric CPT shows that the plume is retained in a high clay content region extending from a depth of from 5 to 30 feet (the heaviest clay zones are from 8 to 20 feet). The top of the screen zones for the current vapor extraction wells in the area are located just below this clay region. Preliminary data on the vacuum influence in this shallow region taken at the installed piezometer clusters suggests that the clays are not affected by the extraction wells. Future drawdown data will also be available from zone of capture tests conducted as part of the corrective action plan for the vadose zone extraction units. In addition, further characterization is being considered that may include angular drilling techniques to determine the plume content under the tanks.

TNX Permeable Wall Laboratory Study M. A. Phifer, J. E. Cardoso-Neto

Zero valance iron enhanced abiotic degradation of chlorinated volatile organic compounds (CVOCs) is essentially a reductive dechlorination process, which uses the iron as the reducing agent and produces degradation products such as ethane and methane. A laboratory treatability study has been performed by Envirometal Technologies, Inc. and the University of Waterloo to determine the feasibility of treating the TNX contaminated groundwater using zero valance iron enhanced abiotic degradation. This process will be considered for treatment of TNX contaminated groundwater beyond the 500 ppb trichloroethylene plume (i.e., that contaminated

groundwater not treated in the planned pump and treat system).

Testing of four high flow rate (220-240 cm/day) laboratory columns was conducted from January 15 through February 2, 1996. Testing of two of the columns was continued at a lower flow rate (46 cm/day) from February 2, through April 15, 1996. The following four columns have been tested:

- 50% sand, 40% iron, and 10% pyrite column treating groundwater containing ~30 ppb chlorinated volatile organic compounds (CVOCs).
- 100% iron column treating groundwater containing ~200 ppb CVOCs.
- 50% sand, 40% iron, and 10% pyrite column treating groundwater containing ~200 ppb CVOCs.
- 90% iron and 10% pyrite column treating groundwater containing ~200 ppb CVOCs.

The last two columns were tested at both the high and low flow rates.

A final report was received from EnviroMetal Technologies, Inc. on July 15, 1996. The following are some of the highlights from the laboratory studies:

- Both the trichloroethylene (TCE) and tetrachloroethylene (PCE) in the TNX groundwater can be successfully dechlorinated using zero valence iron degradation.
- Half lives for TCE and PCE ranged from 0.37 to 1.8 and from 0.4 to 1.1, respectively.
- The high nitrate levels do not appear to interfere with the dechlorination of the CVOCs, however nitrate levels appear to decrease due to the treatment process.
- The pyrite addition appears to offer no advantage.
- Porosity losses due to inorganic precipitation appear to be minimal.

A cost study of the following three application methods of zero valence iron enhanced abiotic degradation as applied to the TNX flood plain

contamination has been performed with the following summary results:

- Continuous Permeable Wall ~\$915K
- Funnel and Gate System ~\$1,483K
- Passively Induced Flow Treatment System ~\$523K

The Passively Induced Flow Treatment System was developed by the Environmental Sciences Section and a patent disclosure has been issued for this method. Additionally ER has included approximately \$216K in their FY97 AOP to initiate a field demonstration of the zero valence iron enhanced abiotic degradation as applied using the Passively Induced Flow Treatment System.

Consolidated Incineration Facility Tritium Oxide Monitoring - D. L. Dunn

The CIF tritium oxide Sampling System Controller (SSC) continues to operate at the Tank Farm (TF), Process (PR) and building ventilation (HV) effluent sampling locations. The large GAST pumps originally specified for the SSC are being systematically replaced by much smaller Brailsford pumps. Despite vibration controls built into the SSC, there are problems with the resonate vibration caused by the GAST pumps. Tests with the smaller Brailsford pumps indicate the smaller pumps are able to move sufficient air with no apparent vibration problems. The stack data signal parameters do not seem to be constant at the PR and HV effluent sampling locations. The SSC constantly monitors the stack flow data signal to make certain that stack flow is within specified limits. An error condition is recorded when the stack flow is found to be outside the specified limits. The control room interface (not currently in use) would be used to sound an alarm in the CIF control room if the error condition occurs for two consecutive six minute intervals. The control room interface will not be connected until the stack data signal line issue is resolved. We do not want a stack flow error signal sent to the control room and we want time to evaluate other error conditions before involving control room operations. Sampling was continuous at the TF, and HV CIF locations during the second quarter, but no tritium oxide analyses were scheduled. The sampling enables trouble

shooting and evaluation of the tritium oxide sampling system at CIF. Software upgrades to facilitate the CCM - computer interface were delivered by EES. The SSC seems at this time to be a reliable piece of equipment. Sampling and evaluation will continue while funding is available. Baseline tests will be conducted prior to startup of CIF radiological operations.

NESHAP-Radionuclide Emission Monitoring at Saltstone - D. L. Dunn

Post startup National Emission Standards for Hazardous Air Pollutants (NESHAP) monitoring was completed for the Saltstone 704-Z stack and the 210-Z stack emission points as required by 40 CFR 61, subparts A and H. The NESHAP test was completed on March 25, 1996 in accordance with the Environmental Protection Agency (EPA) approved sampling and analysis protocol. The Saltstone Facility NESHAP-Emissions Monitoring report, [WSRC-TR-96-0082], was issued April 19, 1996 and was presented to the customer at the SRTC-Saltstone Program review on April 25, 1996. This report satisfies the EPA requirement to summarize emission rates of all radionuclides detected during Saltstone radiological operations startup monitoring.

Analysis of Data from Air Pressurized Slug Tests Performed on D-Area Water Table Wells - K. Dixon, R. L. Nichols, T. Lovcamp

Air pressurized slug tests were performed on several water table wells in D-Area near the coal pile runoff basin. Data collected from these tests were analyzed using AQTESOLV and hydraulic conductivity values for each well were determined. These conductivity values will be used in conjunction with pump test data to describe the water table aquifer characteristics near the coal pile runoff basin.

NESHAP-Radionuclide Emission Monitoring at DWPF - D. L. Dunn

Post startup NESHAP monitoring was completed for the Defense Waste Processing Facility (DWPF) 291-S Zone 1 stack and the

Low Point Pump Pit stack emission points as required by 40 CFR 61, subparts A and H. The NESHAP test was completed on May 29, 1996 in accordance with the Environmental Protection Agency (EPA) approved sampling and analysis protocol. The DWPF NESHAP-Emissions Monitoring report, [WSRC-TR-96-0167], was issued June 25, 1996. This report satisfies the EPA requirement summarizing emission rates of all radionuclides detected during DWPF startup monitoring. During the time of the DWPF startup NESHAP monitoring, the facility was in "sludge only" operations. During this mode of operation a radioactive source term for precipitate operations in the Salt Process Cell (SPC) was not present. The SPC operation will commence in the fall of 1996. At that time additional NESHAP monitoring must be conducted to determine emission rates during full DWPF radioactive operations.

Upper Three Runs Creek Fluorescent Dye Tracer Study - D. L. Dunn

A dye study on the lower segments of Upper Three Runs Creek was performed by Adam Schwarzman, ORISE fellowship summer student, along with members of the ETS Radiological Chemistry field operations group. This work was performed in response to a request from the ETS/Environmental Transport Group. The results of the study will be used to estimate dispersion coefficients and velocities in the lower segments of Upper Three Runs Creek for the stream conditions during the study.

The study included the first time use of a portable, real time, field fluorometer. The field fluorometer was used to perform continuous fluorescence analyses in the flowing stream. The instrument's internal data logger permitted recording of the measured sample concentration, sample temperature, date, and time. This real time measurement capability provided a complete summary of the fluorescent dye transport and dispersion conditions.

A comparison of the field fluorometer data and the equivalent sampling with deferred analyses indicated that field fluorometer measurements would provide a more complete summary of the fluorescent dye transport and dispersion

conditions. The current study provides a very good indication of the capabilities of a field fluorescent measurement approach. The conclusion of the evaluation was a recommendation to use multiple field fluorometers as a more cost efficient method for future fluorescent dye tracer studies.

Risk Management Resources - **J. Stewart**

The ETS database of permissible workplace and environmental nonradiological exposure limits has been augmented. The 1996 American Industrial Hygiene Association (AIHA) Emergency Response Planning Guidelines (ERPGs) have been added. The database now contains:

American Conference of Government Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs)
National Institute of Occupational Safety and Health (NIOSH) Recommended Exposure Limits (RELs)
National Academy of Science (NAS) Exposure Guidance Levels (EGLs)
Occupational Safety and Health (OSHA) Permissible Exposure Limits (PELs)
Environmental Protection Agency Unit Risk Factors (URFs) from the EPA's Integrated Risk Information System (IRIS).

As available, limits are stored for all nonradiological air pollutants emitted at SRS.

Dose Modeling for 1995 Environmental Report Completed - W. H. Carlton and G. T. Jannik

Dose modeling of the 1995 environmental radioactive releases has been completed. The dose to the maximally exposed individual from atmospheric releases was 0.06 mrem and the population dose was 3.5 person-rem. These doses are about 40% lower than 1994 doses due to a significant reduction in tritium releases. The dose to the maximally exposed individual from liquid releases was 0.14 mrem and the population dose was 1.6 person-rem. These doses are about the same as the 1994 doses. Liquid releases and the Savannah River flow were slightly higher than in 1994.

SRS Annual Environmental Report Chapter Completed - G. T. Jannik

The final draft of Chapter 7, "Potential Radiation Doses" was completed on May 17, 1996, and submitted to the Environmental Monitoring Section for inclusion in the 1995 SRS Annual Environmental Report (AER). The final draft of the entire 1995 SRS AER is scheduled to be submitted to DOE-SR on June 1, 1996, and approved by July 1, 1996. Additional support will be provided to the Environmental Monitoring Section with comment resolution and technical review of the AER.

ETMOD Computer Model Reviewed for APAC Committee - A. A. Simpkins

The computer model ETMOD (Environmental Tritium Model) was evaluated and tested as part of the Atmospheric Phenomenology and Consequence Committee (APAC) review of codes used across the DOE complex. Documentation was reviewed in its entirety, and a test problem was executed. A summary of the code was documented and a detailed evaluation form was completed. Fifteen models that are used throughout the complex are being reviewed and ranked using standard criteria.

Helium Isotope Mass Spectrometer - G. Hall

A project was evaluated for measuring the deuterium to tritium (D to T) ratios for Reactor Area water samples to help determine the T source. High D-to-T ratios would be indicative of moderator contamination. The proposed measurements were evaluated on paper by using the reported sample (tritium) activity to calculate dilution factors from known moderator activity ranges. The dilution factors allowed computation of D concentrations, and these were compared to the natural background. Moderator D concentrations turned out to range from two to seven orders of magnitude smaller than natural background. The mass spectrometer system could probably measure one significant figure at a signal to background ratio of 1 to 100, making these measurements just possible at the lowest dilution levels.

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

The RADMAPS portable multichannel analyzer (SCOUT-MCA plus 3-inch x 3-inch NaI[Tl]) was used to demonstrate the technology and to train potential site inspection personnel who will verify the integrity of loaded spent nuclear fuel shipping casks from foreign research reactors prior to their shipment to SRS.

Critical Contaminant/Pathway -K. Chen

A critical-contaminant/critical-pathway analysis for routine environmental releases was performed as required by the SRS Environmental Monitoring Plan Corrective Action Plan (ESH-EMS-94-0129). The results of this analysis will serve as the rationale bases and design criteria for the SRS Environmental Monitoring Program. EMS requested ETS to perform the following tasks:

- identify, evaluate, and compile Savannah River data, aqueous contaminant sources terms, and river use data,
- calculate historic doses for the past ten years, prospective doses, and risks associated with the doses
- determine critical contaminants and critical pathways.

The risks for an individual who ingests Savannah River water downstream from SRS were estimated. Specifically, the risks arising from exposure to the contaminants released from the SRS facilities outfalls for 1991 were estimated. The estimated subchronic noncarcinogen hazard index is 1×10^{-2} , the estimated chronic noncarcinogen hazard index is 2×10^{-2} , and the estimated cancer risk is 2×10^{-6} .

**7Q10 Flow for Integrator Operable
Units - K. Chen**

7Q10 flows have been calculated for each of the six Integrator Operable Units (primary stream watersheds) at SRS. A draft report, WSRC-RP-96-340, was completed to document these calculations. The 7Q10 flow is the lowest average flow for 7 consecutive days that has an average recurrence interval of 10 years. To help prioritize and manage the SRS Emergency Response program, ETS was requested to predict these flows based on historical records. Most of the historical flow records for the SRS streams include the reactor coolant water discharged from the reactors and the process water released from the process facilities. The easiest way to estimate the stream daily natural flow is to subtract the measured upstream reactor and/or facility daily effluents from the measured downstream daily flow. Unfortunately, this method does not always work, as indicated by the fact that the measured downstream volumetric flow rates are lower than the reactor effluent volumetric flow rates. For those cases that cannot be analyzed with the simple subtracting method, an alternative method was used to estimate the stream natural flows by statistically separating reactor coolant and process water flow data.

The correlation between the calculated 7Q10 flows and the watershed areas for Four Mile Branch and Pen Branch agrees with that calculated by the USGS for Upper Three Runs and Lower Three Runs Creeks. The agreement between these two independent calculations lends confidence to the 7Q10 flow calculations.

**Radiological Impact of 1995 Operations
Document Issued - G. T. Jannik**

The Radiological Impact of 1995 Operations at the Savannah River Site report was issued on June 20, 1996. Highlights for 1995, taken from the report, include the following:

- Maximally exposed individual air pathway dose was 0.06 mrem.
- Maximally exposed individual liquid pathway dose was 0.14 mrem.
- Maximum potential drinking water pathway dose was 0.05 mrem.

- Total collective dose was 5.2 person-rem.

Site airborne radioactive releases for 1995 were dramatically lower than during 1994. Atmospheric releases of tritium oxide went from 107,000 curies in 1994 to 55,000 curies in 1995—a 49% decrease that resulted in a 33% decrease in the maximally -exposed individual dose. The reduction was due to reduced throughput in the tritium facilities, reduced maintenance and layup work in the reactor areas, improvements in tritium processing brought about by a full year of operations at the state-of-the-art Replacement Tritium Facility. Liquid pathway doses for 1995 remained essentially the same as in 1994.

Field Deployable Tritium Analysis System (FDTAS) - P. R. Cable, K. J. Hofstetter, D. M. Beals, J. Noakes

A request to perform an onsite tritium analysis of water being treated at the A-2 stripper was submitted to ETS recently by Environmental Restoration personnel. The FDTAS was transported to SRS and was installed in an outbuilding located in the A-2 stripper area. A back-ground analysis performed prior to sample introduction yielded a count rate of 1.4 cpm compared to 1.3 cpm normally achieved using this system at Center for Applied Isotope Studies (CAIS) at the University of Georgia. Water was collected from the influent and effluent sample ports, purified, then transferred to the detector. Each sample was mixed with cocktail then counted for 100 minutes. The preliminary results indicate tritium concentrations of 3.5 and 7.0 pCi per mL for the influent and effluent, respectively. The results of the analysis of the 400 dpm tritium standard deviated ~ 3% from the known value. Both column-treated and raw samples of the influent and effluent water were transported to CAIS for data verification analyses. Results of the cross checks agreed with the field data.

This field trial demonstrated the multi-port sampling and onsite low background capability of the system, the efficacy of the cleaning cycles, and the short sample turnaround time. Future field demonstrations are slated for

August following interfacing of the SRTC and CAIS components.

A purchase order was placed for procurement of the automated sampling device. Delivery of the system is expected late July.

Canyon Stack Operation Studies - E. Villa, R. J. Kurzeja, and A. H. Weber

The restart of the Savannah River Site canyons offers a unique opportunity to develop the technology and methodology to identify gaseous effluents released to the atmosphere. F Canyon is processing existing inventories of plutonium solutions and dissolution of targets. Analysis of the gaseous effluents from the canyon stack should provide important information regarding proliferation activities by other nations. A tethered balloon was used to lift an air sampler 60 meters above ground and 300–500 meters downwind from the F-Canyon stack to collect air samples. The air samples were collected during the dissolution process of the targets on June 3, 1996, and analyzed in the ground using a 9.8-meter multipath cell and a Fourier Transform infrared spectrometer (FTIR). Allen Weber at the ETS Weather Center directed the plume team for the location of the tethered balloon. Robert Kurzeja controlled the position of the tethered balloon.

Gold-Coated Mirror Frame and Video Camera Assembly - E. Villa J. C. Piercy, R. Crane and R. Easler B. Blackman

The FTIR open path spectrometer can be used to examine the plume from a smoke stack. The original setup is for the instrument to be on a tripod and the barrel can be adjusted to a maximum angle of 30 degrees. This all has to be line of sight in other words the instrument has to be aimed at the plume. There are circumstances where this line of sight would not be practical or possible. A mirror assembly was designed and built as an accessory to the telescope/FTIR. The mirror assembly consists of two 8-inch by 10-inch gold-coated mirrors assembled in a plane frame. The 16-inch by 10-inch gold-coated mirror area was attached to the telescope of the FTIR. A video camera

mounting was designed and attached to the mirror assembly. The newly designed mirror assembly allows the study of gaseous plumes at 90 degrees with respect to the telescope plane. The mirror/telescope/FTIR instrument was tested using a blackbody (hot plate) at 50°C and releasing chlorodifluoromethane as a monitor gas. Work continues to develop methodology to monitor plumes using the skies as a background (passive detection of gaseous plumes).

Underground Counting Facility (UCF) Activities - W. G. Winn

Plant Vogtle/SRS river samples continue to be analyzed, where only Shell Bluff and Hwy 301 samples are now taken due to limited funding. The 1995 annual report for these studies was revised based on earlier comments; it will be issued as WSRC-TR-96-0188 after final management approval.

S. H. Reboul reported the results of the EML inter-laboratory quality comparison study, which included measurements with the UCF HPGe detectors. The UCF values agreed well with EML and the other labs for all activities in water and natural activities in vegetation and soil. Agreement with EML for man-made isotopes spiked into the soil, vegetation, and an air filter was not as good; for these, the UCF values agreed better with averages of the other labs, suggesting that EML sample inhomogeneities may have existed.

Design work has begun to provide a liquid nitrogen line to the UCF. The new liquid nitrogen services will significantly reduce the time involved in filling the UCF detectors.

Storage options are still being sought for the large number of Marinelli beakers for the new large detector (166% HPGe).

Analysis of DWPF Canister Material by TOF-SIMS - P. R. Cable and D. C. Carlson

The TOF-SIMS is currently being used to analyze glass and canister samples obtained from the "cold runs" at the DWPF vitrification facility. Metallic deposits on the glass/canister

surface boundaries were observed upon inspection of the glass cylinders and the inner canister walls in contact with the molten glass. The identification and potential origin of these deposits must be determined to assess leaching and grain boundary transport phenomena associated with the vitrification process. Originally, the samples were to be sent to ORNL for analysis but are now slated for surface analysis by ETS.

Gamma Data Acquisition System - K. J. Hofstetter, D. W. Hayes, R. F. Eakle

The gamma data acquisition system (GDAS) was used to survey the C/S Area in an attempt to find a low background area for conducting future experiments on the detection of depleted and natural uranium. The surveys revealed elevated backgrounds in the area due to the storage of some radioactive materials. These data are under review and several follow up surveys have been conducted by vehicle and by manually walking the area. These experiments further demonstrate the capability of the RADMAPS software to collect data and to produce contour plots and isopleths of the dose rates in the area.

Technology Development: DOE SCAPS Truck Support - J. Rossabi, B. E. Pemberton, C. A. Eddy-Dilek, T. R. Jarosch, Brian D. Riha, Bruce Triplett

The objective of this program is to support the demonstration and testing of innovative characterization and monitoring technologies using the cone penetrometer as a delivery platform. Argonne National Laboratory is the lead organization in this project with SRTC providing technical and logistic support.

During this quarter three cone penetrometer-based soil moisture probes were tested. These probes measured various electrical properties of the subsurface media to determine the volumetric soil moisture content of vadose zone sediments. Measurements of the dielectric and electrical conductivity of the sediments were processed to yield information about the volumetric fluid content. The cone penetrometer

measurements were verified using laboratory analysis of soil samples.

Several vadose zone piezometers were installed near the 321-M solvent storage tanks using the cone penetrometer. Soil samples were also taken using the cone penetrometer to support the characterization of the area in anticipation of a 6-phase heating remediation experiment scheduled for FY97.

Program Review for the Department of Interior - J. B. Gladden

A program review and field tour of activities was conducted for the Department of Interior, including the National Biological Survey. The tour focused on ecological restoration activities in the Pen Branch and Lost Lake wetlands, demonstrating SRTC capabilities and experience in two different types of Coastal Plain wetlands with differing histories of impact. Discussions also included the use of remote sensing techniques for environmental assessment at SRS and recent development and testing of rapid bioassessment methodologies for evaluating stream quality.

Interceptor Well Pump Test - M. A. Phifer, B. E. Pemberton, F. C. Sappington

The D-Area Interceptor Well (DIW-1) has an innovative design which includes a 30-foot deep by 240-foot long, subsurface vertical high density polyethylene (HDPE) barrier immediately downgradient from and in direct contact with a continuous gravel pack with both vertical and horizontal (lateral) screens. The Interceptor Well innovative design should maximize the even distribution of upgradient groundwater collection, while minimizing the collection of downgradient groundwater. DIW-1 was installed using Barrier Member Corporation's (BMC) guidebox construction techniques.

All actual testing on the Interceptor Well itself was completed on April 25, 1996. The last two tests were a maximum flow test and sampling of the laterals for chemical analysis. The data produced during all the testing is being evaluated and an interim report is being

prepared. Advanced copies of the summary test results have been provided to the Colorado Center for Environmental Management for inclusion in the BMC Technology "Green Book".

The following are initial results from the Interceptor Well testing:

- The laterals did flatten out the drawdowns produced and increase the maximum flow rate possible. This indicates that DIW-1 does maximize the even distribution of upgradient groundwater collection.
- The maximum flow rate produced was approximately 11.6 gpm. This low flow rate is primarily due to aquifer formation restraints rather than DIW-1 itself. However a higher flow rate would probably have been possible with more efficient lateral design.

Additional aquifer testing is underway in order to better evaluate the performance of DIW-1. Well DCB-25 installation was completed on June 21, 1996. This well will be used to determine the hydraulic conductivity profile of the watertable aquifer. A pump test of DCB-25 was initiated on July 15, 1996 and a borehole flowmeter test is planned to begin on July 30, 1996.

Interceptor Well 3-D modeling will be conducted in FY97 based upon the test results in order to more fully demonstrate the impact and effectiveness of the Interceptor Well design.

Demonstration of Innovative DNAPL Characterization and Remediation Technologies - B. B. Looney, J. Rossabi, D. M. Tuck, K. M. Jerome, R. M. White, C. A. Eddy-Dilek, R. A. Sigg, J. E. McCarty, R. S. Van Pelt, J. J. Kubar, D. G. Wells, M. Simmons

The overall objective of the SRS DNAPL program is demonstration of a coordinated suite of characterization and clean up technologies for DNAPL in soil and groundwater. DNAPLs are chemicals that have a low water solubility and a density greater than water, such as the industrial solvents used in M Area. Disposal of DNAPLs

results in formation of distinct areas of residual pure solvent contamination in soils and groundwater. The activity supports the DOE Office of Technology Development Plumes Focus Area.

An important DNAPL remediation technology subtask is identification and testing of remediation technologies that reduce energy use and minimize secondary wastes. An interesting class of technologies in the program are systems based on preferential interactions of DNAPLs with hydrophobic surfaces. In cooperation with Environmental Restoration, an "oleofilter" was installed and operated on A/M Area groundwater.

The central themes emphasized in developing environmentally responsible remediation methods are: careful targeting of the thin discrete areas of DNAPL accumulation, minimizing wastes, improving remediation safety and speed, and emphasizing lifecycle costs/impacts. Based on these criteria, in situ destruction represents one of the most promising DNAPL remediation approaches. Subsurface access can be designed to optimize DNAPL-reagent contact and typical DNAPL layers (thin and laterally extensive) can be treated without the inefficient removal step. Screen zones in the access wells are placed in the DNAPL zone (<1 m thick) providing efficient access while minimizing treatment chemicals needed and minimizing waste generation. A Cooperative Research and Development Agreement with GeoCleanse International has been placed for a full scale field demonstration of in situ oxidation of a known DNAPL target in an aquifer at SRS. Detailed pretest site characterization, well installation and permitting are scheduled for FY96 and initiation of the demonstration of a controlled Fenton's Reagent addition is scheduled for mid FY 1997. Post-test characterization and reporting will be completed by the end of FY97. If the test is successful, SRS ER would have data to support continued use on other DNAPL target zones.

In June, SRS presented a five hour short course on DNAPLs to the staff of the Minnesota Pollution Control Agency. Over fifty PCA

employees attended and we have received correspondence that they are already using information from the course in their regulatory decision making.

Several innovative DNAPL characterization tests are underway. Notably, the alcohol injection extraction tests are complete at three wells. This test uses a small volume of ethanol solution injected into an existing well to determine if there is DNAPL near the well. If DNAPL is present, the concentration in the solution when it is re-extracted increases sharply as the DNAPL dissolves into the alcohol solution. If there is no separate phase DNAPL near the well, then the concentrations will not increase substantially (i.e., there is no source of solvent to dissolve). Four of the six wells scheduled for testing were completed during the quarter. Key to the success of the characterization tests were, collaboration with Environmental Restoration, Waste Management, and Environmental Protection. The second round of DNAPL mobilization tests, led by Dave Tuck, using the synchrotron facility at Cornell were completed.

In-Well Vapor Stripping at TNX R. L. Nichols and R. M. White—ESS

A new groundwater technology "In-Well Vapor Stripping" (IVS) is being evaluated by SRTC at TNX. The IVS system is used to treat groundwater contaminated with chlorinated volatile organic compounds (CVOCs). A well for testing the IVS has been installed and developed at TNX. Construction of the IVS was completed in July 1996. The Underground Injection Control division of SCDHEC granted approval to operate the IVS on July 9, 1996. Preliminary tests of the IVS have been conducted and minor changes to the IVS were made following the tests. Testing is expected to continue throughout August and into September 1996.

Mag*Sep Demonstration - J. G. Sonnenberg, R. M. White, M. A. Phifer, and F. C. Sappington

An extension of the duration of the existing Mag Sep Demonstration to October 18, 1996 has

been approved by SCDHEC. However due to the degradation of the existing particles, new particles will have to be produced by Selentec prior to the completion of the existing demonstration. This requirement for new particles may place the continuation of the demonstration into the September time frame. Another extension may have to be sought from SCDHEC.

Selentec and Argonne have indicated that additional testing of the Mag Sep system will be performed utilizing nitric acid recycle and some blend of groundwater from the Interceptor Well (DIW-1), which has higher concentrations of contaminants than the current groundwater being treated (DCB-4A). Mag Sep testing using nitric acid recycle and a blend of DIW-1 groundwater will require that a new Wastewater Approval Letter be sent to SCDHEC. SRTC/ESS is waiting for information from Selentec and Argonne associated with the anticipated waste form and volume prior to final preparation of the new Wastewater Approval Letter.

Stabilization/Containment Systems -

M. A. Phifer, D. M. Tuck, C. B. Fliermans, R. Brigmon, and M. G. Serrato, A. L. Kielpinski

The following TTP funding changes have been made:

- Transfer of 72K from Task F, Monitoring Geosynthetic Materials Test Pads, to Task H, Viscous Barrier Demonstration Systems Integration and Support. This transfer required the deletion of milestone F.1 associated with Task F.
- Conversion of 100K in Capital Equipment funds within the TTP to Operating funds.
- Transfer of 219.8K in FY95 carryover from TTP SR1-6-LF-52 to TTP SR1-6-LF-51. These FY95 funds were slated for the EnerTech CRADA work which is now being performed under TTP SR1-6-LF-51.

- Transfer of 87K from TTP SR1-6-WT-31 to SR1-6-LF-52. 87K for the transport of a melter from Germany to the US was temporarily charged to Task C, Demonstrate In Situ Plasma Vitrification, of TTP SR1-6-LF-52, rather than to TTP SR1-6-WT-31 where the charge belongs. This transfer took about 8 months, and this delay could impact the ability of this task to be completed in FY96.

Only one of the TTP tasks (Task H, Viscous Barrier) received continued FY97 funding according to the FY97 PEG guidance. Therefore the PIs for each task are currently evaluating the current scope and spend plans to determine if this lack of FY97 funds should effect the FY96 scope and funding plans.

Task A: (Tuck, Phifer) Demonstrate Surface Containment Systems Repair: Laboratory studies of three potential landfill clay cap repair techniques will be conducted in FY96: colloidal silica or polysiloxane injection, geosynthetic clay liner (GCL) emplacement, and recompaction. It was planned to field demonstrate the most promising repair technique(s) at SRS in FY97, however this task was not included in the FY97 PEG. Therefore a field demonstration is no longer planned. Additionally the FY96 scope associated with preparation of a Field Demonstration Test Plan, Field Characterization, and Field Site Preparation will not be performed, since these items were in preparation for a FY97 field demonstration. However in order to continue with approved scope and obtain additional information consistent with the approved scope, the following activities are being considered:

- Expansion of the current laboratory electrical geophysical measurements for detecting cracking.
- Laboratory test to determine the radius of influence of low-viscosity grouts for the repair of clay caps.

Landfill Stabilization Focus Area
Radionuclides Removal in Vegetation -
E. Wilde, C. Murphy

A review of literature relevant to the remediation of radiologically contaminated vegetation continued during March. However, this review and the document associated with it were not completed by the end of the month as projected in TTP # SR-6-LF-51C. The delay was caused by an unscheduled delay in the process of having DOE transfer funds to facilitate planned USFS collaboration on the review process. A series of ground and aerial photographs were taken at the H-Area Retention basin. These will help provide a baseline for the remediation of this site which is scheduled for 1996.

Institute Of Environmental Solutions Landtech Initiative - J. B. Gladden

A meeting of the Institute of Environmental Solutions (IES) Committee on Technical Standards and Policy was held in Sacramento, CA. Representatives from the California Department of Toxic Substances and Water Resources Board were in attendance, as were representatives from the Redevelopment Authority and California Legislature. SRTC (Gladden) and ANL(Wilkey) represented the DOE Laboratories; INEL could not attend. Status reports were provided on all ongoing projects and proposals. A proposal to support a petroleum leak clean-up in Avila Beach, CA was not successful. Funding has been secured for IES participation in the 'Duck Pond' project near San Diego, CA. A proposal is being prepared for submission to the City of Los Angeles to participate in an urban Brownfield project. It is anticipated that the Los Angeles initiative will serve as the field test of the generic strategy and guidance being prepared by IES under the LandTech program. The DOE Office of Science and Technology has provided supplemental funding to IES for continued program development and increased DOE Laboratory participation. Opportunities continue to be sought for implementation of DOE developed technologies for characterization and remediation through this Brownfield initiative.

Poland Initiative for Plumes Focus Area K. Lombard, T. Hazen, M. Franck, C. Fliermans

In order to maintain this valuable momentum generated by our increased presence in Poland, a ten day working trip to the Savannah River Site was planned and implemented in April for two representatives of the Polish Institute for Ecology of Industrial Areas (IETU) and the Chief Engineer of the Czechowice Oil Refinery. Working with Ken Lombard, the SRTC Project Manager, Drs. Laczny and Worsztynowicz from IETU and Mr. Jagosz from the oil refinery were able to complete the preliminary design criteria and start the detailed design on a bioremediation system that is scheduled to be installed this summer in a process waste lagoon contaminated with polycyclic aromatic hydrocarbons (PAHs) at the Czechowice Oil Refinery. This critical design information was also used as support documentation for an application, by the oil refinery, to the Polish National Fund for money to support the project. To expedite the process, all of the design and supporting documentation necessary to complete the application was prepared and submitted by the team while at the Savannah River Site. The unique interaction and cooperation between the team has enabled the remote management of this project to remain successful.

On May 12th, Mr. Lombard returned to Poland to continue training the IETU staff on the operation and maintenance of the environmental monitoring equipment that will be used to support the ESC and the bioremediation demonstration. The successful completion of this training completed the first milestone task for TTP No. SR1-6-PL-21. The work was accomplished on schedule and under budget. On May 25th, Dr. Terry Hazen returned to Katowice to help finish the set-up of the treatability study and complete the training of the IETU microbiologist on florescent staining procedures and microscopy techniques that will be used during the remediation phase of the project. Drs. Hazen and Ulfig with the assistance of Dr. Gryzna Plaza completed the initial set-up of the treatability study. Four (4) aqueous phase bench scale Virtis® bioreactors, supplied by SRS, were set-up using PAH contaminated water from the refinery waste lagoon. Various treatment strategies are being

applied to the bioreactor systems to determine the most effective methods to optimize the microbiological parameters for the remediation demonstration.

The Visitor's Day was planned by the Institute and the Czechowice Oil Refinery to showcase the collaborative effort between the U.S. Department of Energy and the Polish Institute emphasizing their partnership in international technology transfer. Approximately 150 visitors were expected to attend, but nearly 300 government officials, scientists, engineers and private company executives from Poland and neighboring countries arrived. The Czech Republic, Hungary, Belarus, Ukraine and Russia were in attendance. Clearly this would indicate, based on the number of participating countries and their broad range of interests relating to environmental issues, that a significant impact will be made on the Eastern European environmental marketplace from information disseminated from this project. Media coverage including more than 40 journalists from newspapers, magazines and radio and 6 local and national TV stations were actively seeking interviews and potential articles for publication. The Visitor's Day activities were televised on Polish National TV the same evening.

Global Positioning System Recorder -
K. J. Hofstetter and D. W. Hayes,
R. F. Eakle

A fully executed licensing agreement was completed between WSRC and Savannah River SRT, Inc. for the global positioning system recorder (GPSR) technology. The licensee has begun the assembly of the units at their local manufacturing facilities.

Multi-packer Tests near Lake Karachai
in the Western Siberian Basin - R. L.
Nichols, B. B. Looney, C. A. Eddy-
Dilek

Historical operations at a nuclear processing plant in Russia has resulted in the contamination of groundwater similar to that which as occurred at the Savannah River Site. SRTC engineers and scientists were requested to assist Russia in the characterization of their

groundwater contamination near Lake Karachai. Several multi-zone pumping tests will be conducted to study the hydraulic conductivity of contaminated fractured rock aquifers. All of the equipment for the packer tests has been purchased and tested. The equipment was been packaged and shipped to the test site in July 1996. Final test design being completed and work is scheduled to begin September 1, 1996.

Sample Analysis for the US Geological
Survey - D. M. Beals

Plutonium isotopic analyses by mass spectrometry were completed on bottom sediment samples collected by the USGS in the Ob River, Russia. The USGS still has size fractionated suspended sediment samples which were collected at the same time as the bottom sediments that it would like ETS to analyze. Additional funding and an extension of the period of performance is being negotiated to cover this additional request.

Southeastern Technology Center
Bioremediation Demonstration at
Jimbo's Gas Station, Aiken -
T. C. Hazen

Using PHOSter, a SRTC Group Patented Technology, STC subcontracted Vaughn and Associates to demonstrate the technology at Jimbo's, a local abandoned gas station site. The initial results of the demonstration (April to July) indicate that the site will be cleaned up by the biostimulation process before the demonstration is complete in October.

Southeastern Technology Center
Bioremediation Demonstration at
Columbia County Landfill -
T. C. Hazen

ESS initiated a review of the Columbia County Landfill at the county's request. This evaluation provided a number of bioremediation enhancements that would: increase the biodegradation rate, increase subsidence, eliminate the need for leachate treatment, stabilize refuse mass sooner, decrease long-term liability and monitoring costs, decrease leaching of metals and organic contaminants, and decrease methane generation. T. C. Hazen

Progress and Accomplishments

made a presentation to the Georgia solid waste regulators resulting in the reclassification of new Subtitle D facility as a bioremediation facility, thereby allowing air nutrient injection and leachate recirculation. The STC demonstration with American Technologies Inc. for recirculation and nutrient injection in subtitle D started in July.

WASTE MANAGEMENT

Continuous Emissions Monitoring (CEM) - D. B. Burns

Continuous emissions monitoring (CEM) of mixed waste thermal processes is desired for verification of emissions compliance and process control. SRTC is involved in two CEM test programs. The first is a joint DOE/EPA funded effort to conduct long-term performance testing of several mercury and particulate matter continuous emissions monitors. Nine different CEM's will undergo six months of testing at two commercial thermal waste treatment facilities. In the second test, SRTC contracted with the Sky+ Company to test a German-built dioxin CEM at Research Triangle Park in North Carolina.

Off-gas Components Test Facility (OCTF) Air In-leakage - D. L. Speed

The TNX Off-gas Components Test Facility (OCTF) is a 1/10 scale pilot facility used to evaluate the operating performance of the Consolidated Incineration Facility (CIF) off-gas system. Excessive water accumulation at the off-gas HEPA filters was attributed to condensation from lower temperatures at the HEPA housings. One source of the lower temperature at the HEPA housings was thought to be air in-leakage. Regasketing of flanged joints and repair of a small duct hole reduced the measured OCTF air in-leakage from 7.9 cfm to 0.22 cfm. Future plans include repeating selected portions of previous water accumulation tests to measure the impact of the reduced air inleakage.

Tank 49 Slurry Pump Rebuild and Test - M. J. Dalmaso, D. B. Stefanko

In September, testing was successfully completed on the tank 49 V1 slurry pump. This pump was the first pump pulled from radioactive service at SRS, decontaminated by ChemNuclear of Barnwell, SC, rebuild at TNX, and tested in the TNX full tank test facility. All operating parameters, pressures, flows, and vibration readings were within acceptable ranges. Three additional pumps

from tank 49 will be rebuild and tested at TNX in FY97.

Cesium Tetrphenylborate Solubility - D. J. McCabe

To reduce the sodium tetrphenylborate (NaTPB) usage in Tank 48H during the In-Tank Precipitation process, it is necessary to accurately predict the cesium tetrphenylborate (CsTPB) solubility. Predicting the maximum CsTPB solubility during the slurry washing cycle will minimize the addition of excess (NaTPB). This excess NaTPB decomposes to yield benzene. Equations used at SRS have been derived from published literature reports, but experiments at SRS with radioactive waste samples frequently indicated lower than expected cesium solubility. This task seeks to define and quantify the parameters that impact CsTPB solubility.

During the ITP wash cycle, the ionic strength of the solution decreases. The agreement between calculated and measured cesium solubility diverge at low ionic strength. Most of the testing completed to date focused on the low ionic strength region. The solubility product constants (K_{sp}) for CsTPB and KTPB have been determined. The cesium concentration calculated from these equilibrium constants agree with the observed cesium activity during the precipitate washing phase of the In-Tank Demonstration. At high ionic strength, the cesium activity is much lower than calculated. The reasons for this discrepancy are not yet known. Observations thus far include:

- Above 1.5 M sodium ion, the CsTPB precipitation reaction time can exceed 120 hours, depending on the excess tetrphenylborate concentration.
- The ratio of potassium to cesium may impact the solubility of CsTPB in salt solutions, although more analyses are needed to confirm this observation.
- The solubility product constant of KTPB determined in this task agrees with that reported in the literature.

- Organics (i.e., phenol, benzene, phenylboric acid) do not impact the solubility of cesium in salt solutions with tetraphenylborate.
- If the activity coefficients are corrected for the variability in composition, the ratios of the anions (e.g., sulfate, nitrate, etc.) do not significantly impact the solubility of CsTPB in salt solutions.

Tank 43H Organics Determination - D. T. Hobbs

Two wire-mesh basket samplers containing a solid membrane impregnated with activated carbon were delivered to HLWE this month. These samplers will be used in an attempt to obtain a representative sample of the organic phases on the surface of the Tank 43H waste. Previous testing indicated the device can be lowered into a system containing two liquid phases and successfully sorb the organic phase. The bulk of the salt solution drains through the mesh away from the membrane. The basket dimensions are such that it is easily placed inside a dip bottle for transport to the laboratory for analysis in the currently used doorstep.

Tank 41H Waste Removal - D. T. Hobbs

Saltcake dissolution initiated in Tank 41H during July. Inhibited water addition completed on July 4 with a total of 16,792 gallons added to the tank. During the month, five dip supernate samples taken from the tank were analyzed at SRTC. Three of the samples were taken from the G riser (7/10/96, 7/18/96, 7/28/96) and one each from the B2 and B3 risers (7/11/96). The samples taken on July 10 and 11 indicated that the supernatant liquid was not homogeneous in composition. The G and B2 riser samples had a lower density than the sample taken from beneath the B3 riser. Analytical results indicated that the G riser and B2 riser samples were below the minimum levels required by the Process Requirements for inhibitors. The 7/18/96 and 7/28/96 samples from the G riser confirmed that salt dissolution is continuing. The 7/18/96 sample was determined to have sufficient hydroxide and

nitrite to meet the corrosion inhibitor process requirements. Analysis of the 7/28/96 sample has not completed, but was observed to have the same density as that found for the sample taken from the B3 riser on 7/11/96. However, the nitrate and sulfate concentrations are significantly different between the two samples. This suggests that the supernatant liquid at the top of the tank remains inhomogeneous 24 days after the addition of inhibited water.

Tank 20F Closure - M. S. Hay

In support of the closure of Tank 20F, samples of the material remaining in the tank after removal of ballast water were sent to SRTC for analysis. Two samples from Tank 20F were received in the Shielded Cells on 7/10/96. One sample was obtained using a mudsnapper sampler. The sample contained about 200 g of dark-brown granular solids. The second sample was an atomic wipe dragged across the bottom of the tank. The wipe appeared saturated with a dark brown slurry. Analytical results on the mudsnapper sample indicate the presence of a small amount of sludge. However, the bulk of the sample was identified as Na_3AlF_6 . The atomic wipe sample was determined to have a composition similar to the material in the mudsnapper sample based on the ratio of elements.

DNFSB Recommendation 94-2 Composite Analysis - J. R. Cook

One of the recommendations of the Defense Nuclear Facilities Safety Board was that DOE Performance Assessments on new disposal facilities include an analysis of the impacts of existing DOE generated radioactivity in the dose calculations. The effort to satisfy this recommendation is known as a Composite Analysis.

J. R. Cook participated in a workshop set up by DOE-HQ on the composite analysis program by presenting the approach being taken by SRS. He also co-authored a white paper on Radiological Capacity of DOE sites.

A report was written that compiles the best available estimates of residual radioactive

inventories for all known and planned facilities within the General Separations Area. The draft of the Composite Analysis report will be completed in 7/97, with the final due at the end of 9/97.

Report Titled "Modeling The Effects Of Organic Matter On The Mobility Of Radionuclides As It Relates To The Disposal Of Wood Products In E-Area Slit Trenches" Completed For Solid Waste - J. Myers and S. M. Serkiz

A report documenting the results of geochemical modeling to estimate the impact of the disposal of wood products (e.g., railroad cross ties) in the E-Area slit trenches on the mobility of radionuclides also in the trenches was issued. Geochemical modeling was used in conjunction with transport codes to attempt to account for the processes of enhanced transport (organic complexation), degradation, and dilution.

Numerous laboratory and field studies have shown that the chemical form (i.e., speciation) of many metals and radionuclides is affected by the presence of naturally occurring organic matter (NORM) and its degradation products. The effects of OM (e.g., wood products) on the speciation and, therefore, the mobility of Am, Cs, Ni, NpO₂, Pd, PuO₂, Rb, Sr, UO₂, and Zr were estimated through use of geochemical and groundwater flow modeling. Due to the complex mixture nature of naturally occurring OM, the OM system was simplified through use of surrogate compounds (citric acid and ethylenediaminetetraacetic acid (EDTA)) to estimate effects of OM on radionuclide mobility. Using this approach, OM was found to have no effect on the inventory limits for Cs, NpO₂, Rb and Zr. The inventory limits for the isotopes of Am, Cf, Cm, Bk, Ni, Pd, PuO₂, Sr, and UO₂ calculated in the presence of OM decreased over a range of 26% for U-233 to 48% for Pu-240. The information in this report will be included in the next revision of the E-Area Vaults Performance Assessment.

Demonstration and Evaluation of the Corpex Nuclear Decontamination Process - 235-F Old Met Lab - C. G. May

MELE Associates has informed WSRC that the Corpex 921S chemistry planned for use in the 235-F glovebox decon will be ineffective on high fired (sintered or ceramic form) plutonium. This insoluble form is the primary source of the plutonium contamination in the Old Met Lab glovebox.

This information was discovered by Corpex at the last Spectrum meeting when the Argentines presented a paper about their experiences with insoluble plutonium. Evidently Corpex realized that there may be problems with our glovebox after the presentation.

Corpex proposed resolution is to use a surfactant that will remove the insoluble particles not removed by the Corpex 921S. The 921S will remove iron and plutonium oxides. Its effectiveness will depend upon the amount of insoluble plutonium removed with these oxides. The surfactant, Smearaway, will be used on remaining hot spots after the 921S application is complete. It will be applied manually using spray bottles and brushes, and removed by wiping.

The approved decon plan does not include the use of Smearaway. WSRC must revisit the USQ, safety analysis, SAR addendum, waste streams, and possible other procedures and documents to evaluate the addition of Smearaway to the process. The change also requires an additional filter in the decon system; therefore, another WSRC design review is required.

Presently the demonstration is on hold while WSRC evaluates the revised decontamination plan. The demo will not be completed this fiscal year and will carry over to FY97.

Waste Management Support
- Malcolm Kyle

EES completed a 24-hour test of the waste tank interior inspection system with no failures or problems. All system functions were operated every thirty minutes, and the lights were kept on during the entire test, except for a few minutes. All testing, modifications, and documentation are complete, and the system is ready for delivery.

EES met with ITP representatives to discuss future work on a variable depth sampler (VDS) for waste tanks. EES submitted an estimate for the three phases of this work: study of the existing VDS on Tank 48, modification of the existing VDS system to make it functional, and develop an advanced VDS system for use on multiple types of tanks.

EES developed a tool to extract a sludge sample from the bottom of Tank 20. The 'praying mantis' sampler was successfully utilized by F Tank Farm operations, and a 30 ml sample was taken.

EES has delivered the new camera housing for the direct photography (DP) rig to HLWE. The housing was redesigned to accommodate a new, automatic camera. EES completed design of the wide angle camera system housing, and the housing is being fabricated at an off-site machine shop. The wide angle camera system and the DP rig use the same components, including the 33mm camera and strobe lamps. Instead of fabricating a separate operator control unit for the wide angle camera system, the control units for the DP rig are being modified to accommodate both systems. One of the control units has been modified, and the second is currently being modified.

EES has successfully demonstrated the scrape sampling tool for obtaining a sample of the anomaly on the inner wall of the Tank 15 annulus. The scrape sampling tool is composed of a main pole with an arm and a scrape sampling head attached. The scrape sampling head consists of a sampling vial, a camera and light for locating the scraping head and for close observation of the anomaly, and multiple electromagnets to hold the scraping edge to the wall. The main pole is made of tubing sections which are connected by quick disconnect pins for easy operation. The scrape sampling tool is inserted into the tank annulus using a platform assembly designed to prevent the tool from falling into the annulus space.

EES was requested to evaluate intermittent failures of the Victoreen area radiation monitors (VAMPs) that recently occurred in FTF. The

monitors were examined and found to have evidence of arcing in the area of the high voltage trace on the circuit board. EES was initially supplied with one monitor for testing. The monitor was placed into a temperature and humidity chamber, and the temperature and humidity were increased until the monitor failed. This was performed several times, and the monitor consistently failed under these conditions. Next, a conformal coating was sprayed onto the back of the circuit board to determine if this would improve performance. Results of testing showed that the coating improved the performance up to a point, but failure still occurred at higher temperatures. Three additional monitors have been delivered for testing to determine if the results are consistent for all monitors.

EES conducted a tracer gas test on the Tank 34-F annulus exhaust CAM stack. Results indicated possible air flow issues with the positioning of the CAM shrouded probe.

Defense Waste Processing Facility - Malcolm Kyle

EES was requested by DWPF to develop a tool for cleaning glass accumulation from beneath the knife edge areas of the pour spout. Over time, glass is deposited behind and beneath the knife edge. If the deposit is not removed, it causes the glass to stay attached to the pour spout rather than releasing at the knife edge. EES designed and fabricated two types of cleaning tools to be used with the manipulator. The tools were delivered within one week of the request in order to be used during a short shutdown schedule.

The revised optics design for the DWPF melter interior viewing borescope has been successfully tested. The new design, by the University of Alabama at Huntsville, required the fabrication of new lens elements of specialized materials to accommodate the specific optics in conjunction with the high radiation environment. The new design combines 16 lens elements of 10 different types. The new lenses were successfully tested in a proof of concept arrangement to confirm the

lens placements, mountings, and capabilities. The results of the test will be incorporated into the final development prints and transmitted to DWPF. This completion is on the critical path of the DWPF melter #3 acquisition. A complete borescope assembly will now be prepared based on the above and demonstrated by 11/1/96.

EES was requested by DWPF to review and comment on the Halmar Current Measurement System (HCMS) calibration procedure written by CSWE. The HCMS is used for measuring the weld current for the DWPF canister closure welder. Because it is a critical parameter of the weld, it has an annual calibration requirement. Once this procedure is approved, CSWE will be able to perform all future calibrations.

DWPF Canister Handling Model - R. A. Dimenna

At the request of DOE, the DWPF organization funded development of a preliminary model of glass canister handling operations in DWPF from the melter to the Glass Waste Storage Building (GWSB) using the EXTEND manufacturing simulation software package. EXTEND is a PC based package which provides a convenient, icon based environment to simulate typical manufacturing processes, including material flows, equipment and labor availability, equipment failure rates, repair logic and repair time, and statistical packages to help interpret calculated results.

The DWPF model is an initial simulation which includes nominal process times for individual operations such as pouring, leak test, decontamination, welding and transport of filled canisters to the GWSB. It uses estimates of equipment availability, failure rates, typical repair operations, and typical repair times to represent realistic interruptions in a normal manufacturing line. Storage locations within the DWPF are included to accommodate interruptions to the normal canister flow paths.

Because of the preliminary nature of the model, it is currently being run to identify those work locations, processes, and operations where more accurate or more detailed information is needed, so that the model can be validated against actual operations. As more operating

experience is gained in DWPF, more accurate data can be included in the model. Ultimately, DOE intends to use this model to better understand normal material flows, identify sensitivity to particular pieces of equipment, characterize potential bottlenecks in the operation, and estimate total throughput in DWPF.

ProdMod Support of DOE Ten Year Plan - M. V. Gregory and P. K. Paul

The Production Planning Model (ProdMod) played an essential role in the HLW Division's recent re-baselining of the HLW System Plan to provide input to the new DOE EM-1 Ten Year Plan. This required the generation of a complete scenario out to the end of HLW processing (i.e., "clean tanks") with a newly accelerated schedule for all elements of the HLW complex. The simulation verified the feasibility of the accelerated schedule and identified several pinch-points in out-years which will have to be analyzed further. Demonstrating its maturity as an analysis tool, ProdMod was able to generate an accelerated waste processing schedule out to "clean tanks" within a week of the customer's request. The customer expressed satisfaction in being able to respond to a major DOE request in such short order.

A Statistical Study of Wall Thickness Measurements of DWPF Canisters - T. B. Edwards

DWPF canisters that were manufactured by Coors Fabrication Services of the Coors Brewing Company were procured under specification OPS-DTE-910008. One feature covered in this specification was the thickness of the canister walls in three areas: cylinder, top head, and bottom head. Specifically, the wall thickness for each of these areas was to be at least 0.340 inches. The Applied Statistics Group (ASG) has reviewed historical thickness measurements for the cylinders from the most recently purchased Coors canisters. The desire was to reduce the number of such measurements required of the vendor but still provide compelling evidence (through the use of statistics) that the specification is being met by the vendor's products.

The analysis led to the conclusion that thickness measurements taken close together on the cylinder of a Coors canister were redundant and provided little additional information on wall thickness. Thus, the number of measurements should be reduced, and the grid locations at which the measurements are taken should be well-spaced to minimize the correlation among the resulting values. A grid pattern based on every 12 inches of the cylinder would provide representative and sufficient information for a good decision (based upon the statistics of the resulting 56 data points) regarding the acceptability of the wall thickness. A statistically-based, graphical rule was provided to judge canister acceptability for the new vendor's manufacturing process.

This analysis was provided in document SRT-ASG-96-0024.

Power Distribution For An AM/CM Bushing Melter - C. Gong

Decades of nuclear material production at the Savannah River Site (SRS) has resulted in the generation of large quantities of the isotopes Am243 and Cm244. Currently, the Am and Cm isotopes are stored as a nitric acid solution in a tank. The Am and Cm isotopes have great commercial value but must be transferred to the Oak Ridge National Laboratory (ORNL) for processing. The nitric acid solution contains other isotopes and is intensely radioactive, which makes storage a problem and precludes shipment in the liquid form. In order to stabilize the material for onsite storage and to permit transport of the material from SRS to ORNL, it has been proposed that the Am and Cm be separated from other isotopes in the solution and vitrified.

Vitrification will be effected by depositing a liquid feed stream containing the isotopes in solution, together with a stream of glass frit, onto the top of a molten glass pool in a melter. The glass is non-conducting and the melter is a Platinum/Rhodium alloy vessel which is heated by passing an electric current through it. Because most of the power is required to evaporate the liquid feed at the top of the glass pool, power demands differ for the upper and

lower parts of the melter. In addition, the melter is batch fed so that the local power requirements vary with time. In order to design a unique split power supply, which ensures adequate local power delivery, an analysis of the melter power distribution was performed with the ABAQUS finite element code. ABAQUS was used to calculate the electric potential and current density distributions in the melter for a variety of current and potential boundary conditions. The results of the calculation were compared with test data and will be used to compute power densities for input to a computational fluid dynamics model for the melter.

The Defense Waste Process Technology (DWPT) Section of SRTC is responsible for evaluating and redesigning the bushing melter for the Am/Cm stabilization project. Based upon the concept in the fiber glass industry, a melter (designated as melter no. 1) was designed by DWPT and fabricated by an off-site vendor, GAFtech, Inc. located in Nashville, Tennessee. This melter was tested at Multi-purpose Pilot Plant (TNX) by DWPF for eventual use in the F-canyon separation area to stabilize several radioactive products through vitrification.

A Statistical Plan for Evaluating a New DWPF Laboratory Analytical Method - C. P. Reeve

The current method of analyzing the elemental composition of a SME (slurry mix evaporator) sample is to vitrify the sample, dissolve it by either the sodium peroxide fusion or mixed acid microwave method, and measure elemental weight percents in the resulting solution with the ICP instrument. A new method has been proposed whereby the slurry would be analyzed directly, without the vitrification process.

GENERAL

SRTC BCP Status - L. R. Chandler

The end of FY96 status of the Site-Level Baseline Change Proposal (BCP) packages developed by SRTC for the FY96 Annual Operating Plan is: sixty-seven were prepared; one was not approved by DOE; seven are awaiting DOE approval; fifty-two have been approved by DOE; seven were cancelled by SRTC; and fifty-two have been entered into the FY96 AOP electronic data base.

Two division-level BCP packages were approved and issued during FY96.

Statistical Analysis of Tritium Measurements from the Roof of 232-F - T. B. Edwards

A statistical analysis of tritium measurements derived from samples of the 232-F roof has been completed. These measurements were supplied by B&W Nuclear Environmental Services, Inc. (B&W NESI), in support of the effort to dispose of this roof material. B&W NESI performed systematic volumetric sampling and fixed tritium analysis of the built-up and concrete portions of the 232-F roof.

There is an allowable threshold limit of 414 pico-Curies of tritium per gram (pCi/gm) of waste for the unrestricted use of this waste (e.g., for it to be considered as sanitary waste). The objective of this study was to characterize the population of possible tritium levels for the material comprising the 232-F roof based upon the available sample results. The characterization of this population was in the form of an upper confidence limit for the mean tritium level over all of the waste material (a mixture of tar, gravel, and concrete). A simple unweighted average of the contamination measurements over the three materials (tar, gravel, and concrete) was used as the basis of the analysis since the collection of all three types of sample measurements was thought to provide the best (most representative) sample of the waste to be generated by the disposal of the 232-F roof.

The upper 90% confidence limit is given by 384.3 pico-Curies/gram, which is below the allowable threshold limit of 414 pico-Curies/gram for the unrestricted use of this waste.

This analysis was provided in document SRT-ASG-96-0027.

CLWR INEL Transportation and Packaging Support - R. N. Lutz

E. K. Opperman and R. N. Lutz of the Packaging & Transportation Group (PTG) attended a meeting late July at Idaho Falls to present information on packaging and transportation requirements and their application to the CLWR Tritium Production Program. WSRC presentation topics included packaging fundamentals, legal weight truck cask evaluations for shipping LTA-1, trade offs between consolidated and unconsolidated irradiated target rod shipments, Tritium Extraction Facility issues, and transportation plan development. Separate discussions were held with Lockheed Martin Idaho employees on the days before and after the main meeting.

INEL requested inputs and comments on a submittal to the Request For Quotations being developed for irradiation services supporting the CLWR Program. PTG received and responded to a number of facsimile messages and telephone calls the week of August 12. These activities enabled INEL to submit suggested RFQ items within their schedule. INEL is responsible for issuing a draft Transportation Management Plan to the DOE Headquarters customer.

LR-56 S Onsite Safety Assessment - Allen Smith

The LR-56, a radioactive liquid cask manufactured in France and having French Type B certification, is being procured for the purpose of transferring the intermediate process solutions presently held in H- Canyon to F-Canyon for processing to a stable state. The draft Onsite Safety Assessment for this application has been reviewed by an independent review team. The comments developed by the review team have been incorporated into the draft and, where needed,

additional information is being prepared. The usability of the LR-56 for the intended purpose is dependent upon resolution of questions about a redundant means of insuring subcriticality.

The schedule for completion of the OSA has been revised to address the remaining activities.

9965/68/72-75 SARP Revision 2 Submittal - T. K. Houghtaling, P. S. Blanton, and M. N. Van Alstine

The Packaging & Transportation Group (PTG) has slightly enlarged the Primary Containment Vessel (PCV) for the 9972 through 9975 packagings to receive a 4.9-inch diameter Plutonium storage container. The storage containers are designed for anticipated material processing addressed in DNFSB strategic 94-1 material stabilization plans. In addition to this change, the SARP was revised to conform with the 1995 regulatory changes to 10 CFR 71 and the underlying 1985 edition of the International Atomic Energy Agency regulations. Following DOE SR concurrence, PTG assisted DOE SR in submitting the SARP to DOE EM-76 for certification review. The DOE EM-63 program office has also been provided copies.

EM-76 has given priority to reviewing the 9965/9968/9972-9975 packagings. EM-76 is expected to provide PTG comments on the SARP submittal within six months.

A Statistical Analysis of the Elemental Concentration Measurements of the TVS Shakedown Samples - T. B. Edwards

The TVS Shakedown at Clemson has been completed and samples taken during this testing have been analyzed for chemical composition. Samples were taken of the B&C Surrogate Slurry (in the Weigh tank), of the Surrogate/Additive Blend (at the Weigh or Feed tanks), of the glass containers, and of the offgas for most of the batches processed during the shakedown run. The chemical compositions of some of these samples (excluding all of the offgas samples) were determined via analytical procedures conducted at the TNX laboratory. The data produced from these analytical procedures have been analyzed.

One of the major objectives of this analysis was the investigation of the components of variation: batch-to-batch, sample-to-sample, and analytical variabilities for the feed (both slurry and blend), and of container-to-container and analytical variabilities for the glass. For the Slurry and Blend samples, batch-to-batch variation is the dominant contributor for most of the elements. This is as expected due to differences among the batches processed during this test. For each of the two sets of samples, the sample-to-sample variation appeared to be a relatively minor contributor to the variability of the data; the residual variances for the elements were almost always as large or larger than the between sample variance. For the glass samples, only container and residual variabilities were investigated. The container-to-container variance dominated these measurements for all of the elements (except Ce).

Another area of interest that was investigated concerned differences among the slurry, blend, and glass sample results. To judge the significance of the differences among the elemental averages across the three sample types (slurry, blend, and glass), a multivariate analysis of variance (MANOVA) was conducted. These multivariate tests indicate that the three sets of samples have different mean elemental concentrations for the samples analyzed.

This analysis was provided in document SRT-ASG-96-0028.

Site Robotics & Remote Systems Support - Ivan Lewis

EES specially designed, built, and installed two video camera units for the glovebox based arc melter which is now entering operation in 773-A. One camera is used during melter operation to view the melt pool. A previously built viewing port was adapted to a miniature chip camera and new camera control unit. A start-up camera was designed, with the assistance of the SRTC Glass Shop, that allows proper setup of the melter prior to operation. The camera probe is positioned inside of the melter and through a 32mm diameter access port to view the

positioning of the glass heating arc probes. The camera probe is withdrawn prior to melter operation. Both cameras are supported from new "in glovebox" support electronics and are coupled to the glovebox exterior through sealed connectors.

EES assembled a suitcase portable video system and underwater video camera for use in Brazil during the in-situ examination of irradiated fuel elements that may be sent to SRS. The system can be operated at 110 or 220 VAC and will provide a means to both view and record the surface condition of the fuel.

EES personnel made two trips to ORNL to assist in modifications of and verify testing for the HFIR fuel handling tool. After successful testing, the tool was returned to 723-A where EES coordinated RBOF operator training and load testing of the tool before sending it to RBOF operations at 244-H. The first HFIR fuel shipment has been unloaded and the tool performed successfully.

EES was asked by High Level Waste Engineering to develop a camera system that would be capable of inspecting the 2" drain line for pump pits 5 and 6 located in H-Area. The drain line contains five 90 degree bends in less than 10' of run. Also, the drain line is located in a high contamination area and in a valve house with air temperatures well above 100 degrees. The drain had become plugged and earlier attempts to unplug it had been futile. It was hoped that a camera inserted into the drain line would be able to identify the material blocking the drain so that appropriate tools could be applied to unplug the system. A small diameter camera and light system was developed and demonstrated in a drain line mockup. Additionally, a variety of auger tools were purchased that might be useful in unstopping the drain. The pipe line video system and auger tools were used with limited success. A blockage was found in the first 180 degree bend or trap. However, the standing water in the pipe was so murky that it made it impossible to identify the material causing the blockage. Personnel could not push the camera system past this blockage. The camera was retrieved and the new auger tools were used. The workers observed a decrease in the water level

in the drain. Additional water was poured into the drain and it slowly drained. The auger tools were used again, but no further improvement was apparent. The HLW engineer in charge of the facility was going to review the results of the work and determine if any further actions would be taken.

EES successfully tested the revised optics design for the DWPF melter interior viewing borescope. The new design, by the University of Alabama, Huntsville, required fabricating new lens elements of specialized materials to accommodate the optics and the high radiation environment. The new design combines 16 lens elements of ten different types. The new lenses were successfully tested in a proof of concept arrangement to confirm the lens placements, mountings, and capabilities. The results of the test will be incorporated into the final development prints and transmitted to DWPF. This completion is on the critical path of the DWPF melter #3 acquisition. A completed borescope assembly will now be prepared and demonstrated by 11/1/96.

Office of Science and Technology Mixed Waste Focus Area - Ivan Lewis

EES, as a member of the Transportable Vitrification System (TVS) operations team, and Georgia Tech's Material Handling Research Center completed installation of the feed material handling system, the glass handling system, and TVS camera/video systems at the Oak Ridge K-25 site. Surrogate testing of the TVS and field training of ORR operators will commence shortly.

Work for Others - Ivan Lewis

EES is nearing completion on remote video systems being developed for the Hanford Site. All major subsystems have been received and final assembly is in progress. EES is building two high resolution stereo video system end effectors, two optical alignment system end effectors, one overhead video system, and all required support electronics. All assemblies will be at Hanford and start-up completed by 10/1/96. A previously supplied still photography system end effector is also being upgraded in the same time frame.

EES made recommendations to West Valley Nuclear on equipment and a methodology that could be used to resolve a processing problem in their radioactive melter. The offgas line from the melter appears to be plugging and an in-situ inspection is required. The system EES suggested would allow them to view a portion of the problem area from outside the melt cell using low cost, one time use, video components.

An organization has expressed interest in establishing a CRADA to develop a prototype 137 cesium monitor based on EES developed sampled data spectroscopy technology for reactor spent fuel basins. Typical customers for such a monitor would include DOE spent fuel storage facilities, as well as commercial power reactors. Proof-of-concept testing in the L-Area disassembly basin, performed in 1995, demonstrated that the cesium activity could be monitored continuously and with greater precision in-situ than by the standard practice of water sampling and laboratory analysis. INEL estimates that in-situ monitoring will save as much as \$200,000 per year for the water quality monitoring program in just one of its fuel storage facilities.

Accelerator Production of Tritium - **Ivan Lewis**

EES assisted in conducting a trade study on remote handling for the Accelerator Production of Tritium (APT) target/blanket facility. A major outcome of the study was the selection of the area shielding concept for remote handling over point shielding, underwater transfer and delay transfer. Area shielding uses a remote controlled crane inside a shielded facility to make the transfers of highly radioactive spent modules. Point shielding uses bottom loaded casks and a manually operated crane to make the transfers. Underwater transfer would flood the facility to 26 feet deep to make the transfers with a manually operated crane. Delay transfer would delay moving the modules for about a year so that cooling is not required and a lighter cask could be used. The report on this study is being finalized.

Commercial Light Water Reactor **Production of Tritium - Ivan Lewis**

EES assisted with the completion of the receiving, handling and storage system design description (SDD) for the commercial light water reactors (CLWR)-tritium extraction facility (TEF) and issued it on 9/23/96. This SDD defines the front end processes for receiving target rods from CLWR at the TEF. The unloading, handling, storage and preparation of the highly radioactive rods has been defined as a remote/robotic workcell. All of the high radiation processes are included in this portion of the facility.

MUSC/ASET Biomedical Imaging Study **- Ivan Lewis**

The latest imaging experiments (conducted on phantoms in Charleston) confirm that SRTC's digital radiography technology is essentially equivalent, and in some ways superior, to presently available filmless imaging systems. Approval to conduct further tests at the Medical University of South Carolina using human volunteers was granted by MUSC's Internal Review Board on September 3, 1996. These human tests are scheduled to be conducted on September 10 - 11.

Office of Science and Technology **Robotics for Plutonium Processes** **- Ivan Lewis**

EES is leading a newly formed focus group, Robotics for Plutonium Processes, within the EM-50 OST Robotics Technology Development Program. Problem definition and conceptual design for a system to automate the opening of plutonium oxide and metal storage containers is underway. These containers are currently opened in a hands on fashion within gloveboxes throughout the complex. FY96 funding from the Plutonium Focus Area (PFA) supports this activity in preparation for a FY97 program that will develop and demonstrate the automated opening system.

EES has begun an investigation of the impacts related to the current manual method of container opening. Time and motion studies

from planned facilities at Savannah River and Rocky Flats indicate that the opening activity is one of the highest contributors to worker exposure within plutonium processing lines. For fuel grade oxide, opening a typical plutonium storage container may result in a 30 mrem dose to the extremities. The Office of Environmental Management has an estimated 15,000 of these containers that will require opening. The exposure savings from an automated opening system could be significant, and would help meet the intent of 10 CFR 835 which mandates the use of engineered systems to achieve ALARA. In addition to exposure, the opening task is an industrial safety and contamination risk. Current procedures for container opening stress the importance of going slowly and protecting the hands and gloves from the sharp edges of the container.

The first meeting of the Plutonium Container Unpacking System (PCUS) subteam was held at Savannah River to discuss concepts involved with opening plutonium containers. Members from Sandia National Laboratory, Idaho National Engineering Laboratory, Los Alamos National Laboratory and Savannah River Technology Center participated. The participants of the meeting agreed that the draft functional performance requirements were too broad for the purposes of a technology demonstration. It was agreed that a specific subset of container configurations would be chosen and the performance requirements finalized based on the specific needs of this subset.

Pit Manufacturing - Ivan Lewis

EES recently submitted cost estimates to LANL for development programs associated with pit manufacturing. Proposals included CO₂ snow decontamination, magnetically coupled linear transport, squeeze casting, modular glovebox calorimetry, and laser engraving. Previously, ten scopes of work were transmitted to LANL for funding consideration in assisting LANL with upgrades to their plutonium facility to meet minimum pit manufacturing capabilities. These scopes included systems associated with pycnometry density measurement, heat treat furnace, oxide roast furnace, lag storage glovebox, in-line storage glovebox, material

feed preparation, tool storage, hemi transport basket, vacuum transfer and material transport.

Office of Science and Technology Tanks Focus Area - Ivan Lewis

EES completed on schedule the remote video systems developed in support of the DOE complex underground storage tank development program. The systems included a variety of visual end effectors for the light duty utility arms (LDUA) and stand alone devices that are deployed in conjunction with the LDUA's.

The systems completed are the 1) portable overview video system (POVS), 2) two optical alignment systems (OAS), 3) two close-up stereo video systems (CSVS), and 4) a revised still photography system. The POVS provides a standoff position view of the LDUA as it is deployed into a waste tank. The OAS is the initial entry unit used to confirm final LDUA and waste tank alignment, with multiple positional sensing lasers, visual alignment indicators, and visual feedback. The CSVS is a high predictable, magnification unit used to provide detailed stereo inspection of anomalies, and to independently provide multiple general tank views. The SPS is a second generation unit to replace the previously provided device for obtaining stereo 35mm film images of the interior of waste tanks, and includes real time images of the film camera views.

Most units were delivered directly to the Hanford Cold Test Facility for interfacing to the LDUA. Several units are being shipped directly to the Idaho site, per a last minute programmatic revision. The Hanford systems were checked out at Hanford the week of September 16 and turned over to the LDUA startup team.

Office of Science and Technology Robotics for D&D - Ivan Lewis

Modifications to the gantry crane at the Argonne National Laboratory, CP-5 reactor are underway. Whiting Services will be adding the Convolve Inc. swing reducing control system, a radio control system, and a rotating hook to the Argonne National Lab CP-5 polar crane. SRTC and Whiting personnel completed site training, pre-job meetings, and began work on August

30. Whiting removed the existing bridge and trolley motors, removed the original electronics box, and installed the swing control components. Work on the radio control system and rotating hook installation started the week of September 9. All crane modifications, inspections, and testing are scheduled to be complete by September 21.

Convolve, Inc. and Whiting Services, Inc. are responsible for the first commercial implementation of a swing reducing control system on an AC powered crane in the United States. This installation at Savannah River Technology Center was used to develop and test algorithms for use at the CP-5 reactor. In addition to the installation currently under way at Argonne National Laboratory's CP-5 reactor, Convolve and Whiting are scheduled to install a swing reducing control system on a crane at the Massachusetts Port Authority. If the system works well, the Port Authority will purchase a control system for each crane.

Technology Transfer - Ivan Lewis

EES continues with preparations for the ANS 7th Topical Meeting on Robotics and Remote Systems to be held at the Augusta Radisson in April of 1997. A record number of abstracts (185) from ten countries have been accepted into the conference. A total of 26 vendor display booths have already been reserved for the exhibition which will be held in the Augusta-Richmond Civic Center. The conference preliminary program will be issued in November.

Reactor Support - Malcolm Kyle

Fabrication of the L Basin prototype basin chemistry monitoring system, formerly known as the online water monitoring system, is approximately 95% complete. Design of the probe support housing is 90% complete with fabrication drawings scheduled to be issued around the first of the month. EES procured NIST traceable standards for calibration of the pH analyzer and continues to search for a supplier for the conductivity standards. Progress on the user interface and data acquisition software has been slowed by

problems with incompatibilities between the EG&G Ortec and National Instruments' data acquisition software packages and the Microsoft Visual Basic 4.0 operator interface. EES is currently working with engineers from both companies to resolve these issues.

ITEMS OF INTEREST:

Meetings and Presentations:

R. A. Dimenna traveled to San Diego, Calif. to attend the 1996 ASME Fluids Engineering Division Summer Meeting, July 7-11. Dimenna presented a paper co-authored by S. Y. Lee entitled, "Validation Analysis for a Computational Fluid Dynamics Calculation of a Turbulent Free Jet in Water." (WSRC-MS-95-0350X).

S. J. Hensel, R. J. Gromada, and N. K. Gupta traveled to Montreal, Canada to attend the 1996 ASME PVP Conference, July 21-26. Three papers were presented entitled, "Hypothetical Accident Conditions Thermal Analysis of the 5320 Package," (WSRC-MS-95-0504) "Estimation of Stresses Near Edges & Corners in Large Spent Fuel Shipping Containers," (WSRC-MS-96-0142) and "Simulation & Analysis of the Plutonium Shipping Container Subject to 30-Foot Drops." (WSRC-MS-95-0527).

R. C. Tuckfield traveled to Seattle, Washington, Aug. 20-23, to attend the SPECTRUM '96 Conference. Dr. Tuckfield presented a paper with the LLNL Environmental Sciences Division on cost-effective groundwater monitoring technology.

F. D. Martin—ESS presented a paper titled "Distribution and Movements of Nerodia Fasciata in a Recently Restored Carolina Bay, Lost Lake" (WSRC-MS-96-0213) at the American Society of Ichthyologist and Herpetologists meeting in New Orleans.

T. R. Jarosch—ESS presented a paper titled "In Situ Heating for Thermal Enhanced Soil Vapor Extraction of Chlorinated Solvents in Clay-Bearing Sediments: Field Demonstrations of Radio Frequency and Six-Phase Joule Heating"

at the IBC Environmental Technology Symposium: Novel Approaches to Remediation, May 13-14, 1996, Arlington, VA

H. E. Mackey—ESS presented a paper titled, "Bathetry as a Controlling Factor in Macrophyte Development: Thirty Years of Change Detection in a Former Reactor Cooling Pond," (WSRC-MS-95-0389X) at the Annual Conference of the American Society of Photogrammetry and Remote Sensing, Baltimore, Maryland, April 22-25, 1996.

H.E. Mackey—ESS presented an invited paper entitled, "Multisensor Environmental Monitoring Update of Savannah River Site Wetlands," (WSRC-MS-96-0031X) at the Annual Meeting of the American Nuclear Society, Reno, Nevada, June 16-20, 1996.

H.E. Mackey—ESS represented WSRC at the annual meeting of the Kathwood Lake Technical Working Group concerning status and continuing monitoring and research needs for the Birdsville Wood Stork Colony, Millen, Georgia, and the use of the Kathwood Lake wood stork mitigation site near Jackson, SC.

E.A. Nelson—ESS gave a presentation at the request of Liz Goodson (DOE-SR) to the NRCC meeting on lessons learned from inter-agency activities which have taken place in the Pen Branch Reforestation effort.

E.A. Nelson—ESS gave an invited seminar titled "Re-establishing Biodiversity in a Thermally Impacted Forested Wetland Ecosystem" (WSRC-MS-93-607X) to faculty and graduate students at the Institute of Ecology, University of Georgia.

L. D. Wike—ESS presented a paper titled "Amphibian and Reptile Recolonization of Lost Lake, A Restored Carolina Bay" (WSRC-MS-94-0135X) at the Society for Ecological Restoration 1996 International Conference.

T. C. Hazen—ESS Invited Chairman. Groundwater Session. May, 1996, Washington, DC. IBC Conference on Innovative Remediation Technologies.

T. C. Hazen—ESS Invited Presentation. Groundwater technologies. May, 1996, Washington, DC. IBC Conference on Innovative Remediation Technologies.

T. C. Hazen—ESS Invited Chairman. Biostimulation vs Bioaugmentation Workshop. May, 1996, Washington, DC. IBC Workshop on Bioremediation vs. Bioaugmentation.

T. C. Hazen—ESS Invited Seminar. In Situ Bioremediation Field Demonstration. May, 1996, Chicago, Illinois. Northwestern University.

M. M. Franck, T. C. Hazen, K. H. Lombard, D. J. Altman, R. L. Brigmon, and C. B. Fliermans, The use of immunoassay techniques for TPH and BTEX with diesel contaminated soils in a prepared bed bioreactor. May, 1996, New Orleans, Louisiana. Annual Meeting of the American Society for Microbiology. (WSRC-MS-95-0496P)

R. L. Brigmon, M. M. Franck, J. Bray, D. Scott, K. Lanclos, and C. B. Fliermans, Fluorescent Antibody and Enzyme-linked Immunosorbent Assays for TCE and PAH Degrading Bacteria. May, 1996, New Orleans, Louisiana. Annual Meeting of the American Society for Microbiology. (WSRC-MS-95-0495)

C. De Ridder, and R. L. Brigmon. A Symbiotic Relationship Between Spatangoids (Echinoidea) and *Thiothrix* spp. May, 1996, New Orleans, Louisiana. Annual Meeting of the American Society for Microbiology. (WSRC-MS-95-0493P)

E. W. Wilde, J. C. Radway, J. Santo Domingo, R. G. Zingmark and M. J. Whitaker, and R. G. Zingmark. Bioremediation Of Aqueous Pollutants Using Biomass Embedded In Hydrophilic Foam. May, 1996, New Orleans, Louisiana. Annual Meeting of the American Society for Microbiology. (WSRC-MS-96-0377CX)

J. C. Radway, J. W. Santo Domingo, C. J. Berry, E. W. Wilde, and T. C. Hazen. Degradation of Trichloroethylene And Benzene by Embedded *Burkholderia cepacia* G4. May,

1996, New Orleans, Louisiana. Annual Meeting of the American Society for Microbiology. (WSRC-MS-96-0376X)

M. J. Parker presented "A Fiber Optic Wind Vane: A Conceptual View" (WSRC-MS-96-0228), at the Fourth Nuclear Utility Meteorological Data Users Group (NUMUG) Meeting in San Francisco.

P. R. Cable presented FDTAS status at the Regional Environmental Monitoring Program Meeting in Evans, Georgia. (WSRC-MS-96-0296)

D. M. Beals presented "Savannah River Site Tritium Analysis System" at the EICrom Industries, Inc. User's meeting detailing the development of the ETS Field Deployable Tritium Analysis System. Co-authors were P. R. Cable and K. J. Hofstetter. (WSRC-MS-96-0255)

W. G. Winn, D. L. Dunn, and P. J. Bresnahan co-authored "Distribution of Lake Bottom Radionuclides Measured with an Underwater HPGe Detector," (WSRC-MS-96-0283), which was submitted for presentation at the 1996 ANS winter meeting.

M. J. Parker presented "Meteorological Monitoring at the Savannah River Site in 1995 (U)" WSRC-MS-96-0170, at the Annual Meeting of the American Nuclear Society in Reno, NV June 19, 1996.

D. P. Griggs presented "Forecasting Long-Range Atmospheric Pollutant Transport and Diffusion: Approaches and Issues" (D. P. Griggs and Robert Addis) at the Annual Meeting of the American Nuclear Society in Reno, NV June 19, 1996. A summary of the paper was published in ANS Transactions, Volume 74, pp. 54-58. (WSRC-MS-96-0015)

C. H. Hunter presented "Sharing Meteorological Resources with the Local Community at the DOE's Savannah River Site" at the Annual Meeting of the American Nuclear Society in Reno, NV June 19, 1996. (WSRC-MS-96-0174)

K. J. Hofstetter and P. R. Cable of WSRC, M. Wasyl of Packard Instruments, and J. R. Noakes and J. Spaulding of the Center for Applied Isotope Studies of the University of Georgia prepared "Development of a Remotely Operated, Field-Deployable Tritium Analysis System for Surface and Ground Water Measurements", an invited paper for presentation at the Fifth Annual Low-Level Liquid Scintillation Counting Conference, in Yokohama, Japan. The paper was delivered by Dr. Noakes. (WSRC-MS-96-0365)

K. J. Hofstetter presented: "Field Deployable Tritium Analysis System" at the DOE-SR OTD Project Review.

K. J. Hofstetter and P. R. Cable of WSRC, M. Wasyl of Packard Instruments, and J. R. Noakes, M. P. Neary, and J. Spaulding of the Center for Applied Isotope Studies of the University of Georgia are scheduled to present an invited paper, "A Remotely Operated, Field-Deployable Tritium Analysis System for Surface and Groundwater Measurements", invited paper for DOE-NV Field at the Sampling Workshop in Las Vegas, Nevada. The paper is to be presented by Dr. Noakes. (WSRC-MS-96-0384X)

K. J. Hofstetter, P. R. Cable, D. M. Beals, and J. Jones are scheduled to present a paper entitled, "A Programmable Autosampler for a Field Deployable Tritium Analysis System", at the ANS winter meeting, in Washington, DC. (WSRC-MS-96-0385)

An article authored by Bob Fogle, Kevin Kuelske, and Bob Kellner titled "The Visual and Radiological Inspection of a Pipeline Using a Teleoperated Pipe Crawler" was published in the July 1996 issue of *Radwaste Magazine*. The article describes the use of a pipe crawler to investigate the integrity of abandoned process sewer lines leading to the old F-Area seepage basin. (WSRC-MS-94-0628)

Publications:

T. C., Hazen, B. B. Looney, M. Enzien, J. M. Dougherty, J. Wear, C. B. Fliermans, and C. A. Eddy—ESS; In Situ Bioremediation Via

Horizontal Wells published in *Biotechnology in Industrial Waste Treatment and Bioremediation*, eds. R. F. Hickey and G. Smith, p 79-86..

Feature Article in *International Groundwater Technology* 2:7-9. April, 1996. How methane Injection attacks Chlorinated Solvents by J. A. Sutfin (SRTC patent licensee).

K. H. Lombard, and A. Worsztynowicz;. 1996. *Bioremediacja ; (BIOREMEDIATION: Advancements in Biotechnology)*. Ekoprofit. Nr 2(3) 44-46. PL ISSN 1425-1094.

D. L. Dunn—ESS; Mapping Radionuclide Distribution in Surface Sediments Using GIS and an Underwater HPGe Detector, WSRC-MS-96-0321, submitted for presentation and proceedings publication 1996 ANS National Meeting, June 7, 1996.

D.L. Dunn—ESS; Radionuclide Distribution in Surface Sediments, WSRC-MS-96-0409X, submitted for presentation at The Fifth Symposium on Field Screening Methods for Hazardous Wastes and Toxic Chemicals sponsored by the U.S. EPA, July 1, 1996.

D. M. Beals and D. W. Hayes—ETS; J. P. Bibler and D. A. Brooks—IWT; and N. Swift and A. Hendawi—Selentec, Use of Selectively Coated MAG*SEPSM Particles for Improved Radionuclide Field Sampling (U)" (WSRC-MS-95-0428) was submitted to Publications for DOE review prior to publication. .

K. J. Hofstetter—ETS; submitted an article "Portable Radiation Detector and Mapping System", to the *Arms Control and Nonproliferation Technologies Journal*. (WSRC-MS-95-0203)

ETG personnel had an article, "Predicted Versus Measured Tritium Oxide Concentrations At The Savannah River Site", accepted for publication in *Health Physics*. (WSRC-MS-95-0505)

K. J. Hofstetter and D. W. Hayes—ETS; are authoring "Positive Identification of Radiation Sources using Dual Gamma-Ray Detectors".

K. Chen—ETS; WASP5 Benchmarking with US EPA 1990 and 1991 Dye Tracer Study Data (WSRC-MS-96-0301), co-authored with Mark Koenig of the USEPA, will be submitted to the *ASCE Journal of Environmental Engineering*, pending DOE approval.

An article authored by Bob Fogle, Kevin Kuelske, and Bob Kellner titled "The Visual and Radiological Inspection of a Pipeline Using a Teleoperated Pipe Crawler" was published in the July 1996 issue of *Radwaste Magazine*. The article describes the use of a pipe crawler to investigate the integrity of abandoned process sewer lines leading to the old F-Area seepage basin. (WSRC-MS-94-0628)

Recognition and Awards:

B. B. Looney, T. C. Hazen, and K. H. Lombard—ESS received a 1996 R&D 100 Award for their work on PHOSter, a bioremediation process which eliminates or reduces many of the shortcomings associated with phosphoric acid vapor by providing the controlled addition of a relatively safe form of organic phosphorus to the injected air. This process received a patent in 1995 and is being used by several companies under limited use agreements. This prestigious award will be presented at a ceremony later this year in Philadelphia and will be featured in *R&D Magazine*.

E. A. Nelson—ESS received an elected appointment as Adjunct Senior Research Ecologist in the Institute of Ecology of the University of Georgia.

E. A. Nelson —ESS participated in the dedication of the Wetland Education Facility at Aiken Elementary School as the Parent Representative on the project. The Ecology Group was acknowledged and thanked for their participation in the design and construction of the project.

H. E. Mackey—ESS was a co-recipient of the third place ESRI Award for Best Scientific Paper in *Geographic Information Systems* in 1996. The award was presented at the Annual Conference of the American Society of Photogrammetry and Remote Sensing

(ASPRS), Baltimore, Maryland, April 22-25, 1996.

H. E. Mackey—ESS was a recipient of an ASPRS Presidential Citation for 1996, "...for meritorious contributions to the operation or advancement of the Society and its interests....," presented at the Annual Conference of the American Society of Photogrammetry and Remote Sensing, Baltimore, Maryland, April 22-25, 1996.

P. R. Cable—ETS has been invited to chair the Elemental Interest Group meeting at the 44th ASMS Conference on Mass Spectrometry and Allied Topics.

Inventions, Patents, and Licenses:

D. M. Tuck, B.B. Looney, J. Rossabi—ESS Invention Disclosure SRS-96-0062, "PIX - Precision Injection/Extraction Characterization for Non-Aqueous Phase Liquids (NAPLs)" was recommended for patent application by the Patent Committee.

K. J. Hofstetter was informed that the license was granted to Savannah River SRT, Inc. to manufacture and sell the Global Positioning System Recorder, License Agreement No. LA-96-002.