SEPTEMBER 1992

Savannah River Technology Center

(U)

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 39808

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

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by the trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Savannah River Technology Center

MONTHLY REPORT (U)

September 1992

J. M. Ferrell, Compiler

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

Published in cooperation with WSRC Management Information Services
Section, Technical Publications Group.

Editors: Andrea Flowers
Manuscript Editor: Barbara Chapman

CONTENTS

Executive Summary 2

Reactor 2

Tritium 2

Separations 3

Environmental 3

Waste Management 4

General 5

Progress and Accomplishments 7

Reactor 7

Tritium 19

Separations 27

Environmental 32

Waste Management 45

General 62

Items of Interest 65

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

REACTOR

- The DOE Independent Review Panel (DIRP) met with NES personnel to review the status of the power limits program on August 25-27, 1992. (page 8)
- The final report (WSRC-TR-92-425) containing the acceptance criteria for flaws in the heat exchanger head, shell, and cooling water nozzles was completed and is under technical review. (page 9)
- Production libraries for the AUTOPROD computer code were created and validated against actual measured 200 Area separations results. (page 11)
- Comprehensive analysis of water and sludge samples from the K-Reactor Vertical Tube Storage Basin was completed. (page 13)
- Potential Issues (PI) are tracked with a database system and followed to resolution. New PIs include reactivity events after shutdown, in which a possible recriticality following a scram is being investigated and an error in the decay heat model of MARY 3.2 Code, which is being corrected. (page 14)
- Equipment and Materials Technology (E&MT) helium leak tested the last heat exchangers as part of a program to replace ten of the twelve K-Reactor heat exchangers. (page 18)

TRITIUM

- E&MT completed the shear valve system to unload 16 Materials Testing Facility (MTF) group II reservoirs (Zinfandel and Goblin) for Tritium. (page 19)
- Hydrogen Technology Section (HTS) personnel is working with Ionex Corporation to synthesize and procure Pd/k to be held as reserve material for Replacement Tritium Facility (RTF) processes. HTSs preliminary analysis of this material revealed several batches that were Pd deficient. Ionex reprocessed this material and HTS determined that they met the acceptance criteria for Pd content. (page 20)
- A review of the RTF Thermal Cycling Absorption Process (TCAP) piping and instrumentation revealed three items that require modification. RTF is reviewing the modifications for implementation. (page 22)
- Initial tritium equilibrium absorption isotherms were determined for NdCo_3 , a candidate material for a hydride-based inert separation system. Three isotherms were determined at 125°C, 150°C, and 175°C. (page 22)
- Recent short-term cyclic tests demonstrated the successful development of a fabrication technique to produce stable metal hydride composites by dispersing porous granules of $\text{LaNi}_{4.25}\text{Al}_{1.75}$ (LANA .75) in a porous copper matrix. The test results showed acceptable

EXECUTIVE SUMMARY

absorption/desorption rates and storage capacities for the metal hydride composite without damage to the matrix. (page 23)

- Functional testing demonstrated that the E&MT designed Leak Test System 2 can automatically perform a post load leak test on 12 H1616-1 shipping containers within 45 minutes. E&MT is scheduled to turnover Leak Test System 2 to Tritium on October 1, 1992 (an SRS milestone), 2.5 months ahead of schedule. (page 25)
- Tests with the SAES St 198 metal getter were conducted to determine its ability to remove hydrogen isotopes from flowing nitrogen. The getter successfully removed deuterium from flowing nitrogen in fair agreement with model calculations. After the completion of another test and modifications to the model, demonstration of a metal getter stripping technology for the tritium facilities will be examined. (page 25)
- Part two of the response to DOE-SR concerns on use of nominal source terms in non-reactor SARs was issued. F and H Canyons are among the five facilities with nominal source terms different from those documented. (page 27)
- Studies on methods for disposal of the americium-curium (Am-Cm) solution stored in tank 17.1 in F Canyon are underway. (page 27)
- The consequence analysis in the existing 221-H Canyon Safety Analysis Report (SAR) was updated with the ICRP-30 methodology. The updating resulted in increased accident consequences to the maximum offsite individual, the offsite population, and the onsite population. (page 28)
- The Analytical Development Section (ADS) developed a method to measure Np-237 holdup in "hot spots" in 235-F facilities. The method is based on exposure readings in places where the background is too high to use gamma PHA. (page 28)
- Revision 3 of the 5320 SARP, incorporating the design changes, analysis, and testing required to resolve issues, was issued for DOE-SR review and for Westinghouse Savannah River Company (WSRC) to satisfy a September 30, 1992 milestone. (page 30)
- Support for the TASP-Pu Flowsheet Simulation continued with updating the information for the PEIS for the BASELINE flowsheet and for submitting information on the Aqueous Nitrate Alternative flowsheet. (page 30)
- Tests of a flow-through liquid scintillation counter, for potential use used as a tritium effluent water monitor, were successfully completed at the SRTC A-1 Stripper Well. (page 32)
- The final Geology, Seismology, Geotechnical (GSG)/Geographic Information System (GIS) Program Plan for the development of an integrated sitewide GSG database was issued. (page 32)

SEPARATIONS

ENVIRONMENTAL

EXECUTIVE SUMMARY

- Seismology assistance was provided on an interim position statement on the seismic spectra for the Replacement Tritium Facility (RTF). SRTC concluded that for liquefaction studies, the use of spectra for a specific earthquake and site specific soil properties are recommended. Rather than envelope spectra, the Geomatrix local/Charleston spectra can be used and for calculations of the response of RTF, a duration of ten to 15 seconds can be used as a best approximation for the Charleston, South Carolina and local earthquakes. (page 32)
- The Radionuclide Assessment Program (RAP) document on Plutonium in the SRS Environment was completed and transmitted to DOE for review. (page 33)
- Sampling was completed for the Background Wetland Soils Study. This study collected surface soils (less than 3 m depth) at more than 75 locations on and off SRS to establish background concentrations of radionuclides and hazardous/non-hazardous constituents in wetland soils. (page 35)
- A Risk Evaluation for Remedial Alternatives (RERA) for the Low Level Radioactive Waste Disposal Facility (LLRWDF) closure was prepared. The RERA is a qualitative assessment of the closure activities for the LLRWDF and is intended to fulfill Comprehensive Environmental Response Compensation and Liability Act (CERCLA) requirements for the Resource Conservation and Recovery Act (RCRA) closure of the LLRWDF. (page 36)
- Demonstration of a utility industry horizontal drilling technology, which utilizes no drilling fluids, was successfully completed with the installation of a well designed for the thermally enhanced vapor extraction demonstration. The innovative drilling system, developed by Charles Machine Works (Ditch Witch) and Sandia National Laboratory-Livermore (SNLL), represents a potential for a relatively inexpensive system for installing horizontal wells to improve access to the subsurface. (page 38)
- Hastelloy G-3, a nickel-based alloy, was recommended as the construction material of for the Replacement High Level Waste Evaporator (RHLWE). Stress Corrosion Cracking (SCC) and immersion tests of G-3 in synthetic waste solutions are underway to ensure that it is acceptable for the RHLWE. (page 47)
- Fissile loading tests of monosodium titanate (MST) indicate that maximum loading will not exceed the infinitely safe value. Loading appears to decrease as a function of temperature, indicating that it occurs via an adsorption process. (page 50)
- Late Wash cleaning cycle demonstration tests were completed and transmitted to the Late Wash design team. (page 51)
- A preliminary review of the Z-Area Performance Assessment was presented to the DOE Performance Assessment Peer Review Panel

WASTE MANAGEMENT

EXECUTIVE SUMMARY

on August 17 and 18, 1992. The Panel praised the overall quality of the report and the presentation. The final report will be completed in December 1992. (page 53)

- Vendor demonstrations of the Synthetica Detoxifier were not encouraging. Other technologies, including the Westinghouse Pyroplasma Unit, chemical oxidation, and supercritical water oxidation, will be reviewed for potential application as Consolidated Incineration Facility (CIF) alternatives for the destruction of the DWPF organic product. (page 56)
- A program was implemented to develop a Design Review Package that supports SRTC's recommendation to the DWPF change to a nitric acid flowsheet in the Chemical Process Cell (CPC). This package will undergo the formal review process as described in WSRC Manual 1E. (page 57)
- The Product Composition Control System (PCCS) Version 2.0 was delivered to DWPF Technical Personnel, who successfully tested the system. The PCCS will serve as the main instrument to ensure that the properties of the waste glass produced in DWPF will demonstrably satisfy the applicable processing and repository constraints. (page 58)
- First Priority, a computerized implementation of a prioritization methodology, is under development. The windows, editors, and pull-down menus in the First Priority environment provide an easy-to-use interface that guides the user through the process of building a customized prioritization system that can evaluate lists of diverse entities such as projects, tasks, or documents. The initial release of the First Priority application is scheduled for October 1992. (page 62)
- The Scientific Computation Section (SCS) completed the software development portion of the organizational analysis task. Report formats, independent of the software, are being finalized through a committee review. (page 62)
- Equipment and Materials Management (E&MT) personnel wrote software codes for the Hornet remote controlled vehicle and its operator console to support wire and wireless communication. (page 62)
- E&MT is expanding the capability of its Rapid Response equipment by combining a high performance manipulator with a remote controlled mobile platform. (page 62)
- E&MT used radiographic testing (RT) for diagnosing internal hammering in a check valve. (page 63)
- E&MT initiated a design to install a facility for the development of specialized Non-Destructive Examination (NDE) techniques. (page 63)

GENERAL

PROGRESS AND ACCOMPLISHMENTS

REACTOR

Reactors

Expanded MELCOR Graphics

P. W. Wyatt

In June 1992, a programmer's interface for the Savannah River Core (SRC) data package of MELCOR was completed and demonstrated for the Safety Technology Section (STS) on August 14, 1992. STS asked that it be expanded to include control volumes, flow links, pumps, valves, control functions, radiation transport, and filters.

Monte Carlo Neutron & Photon (MCNP) Certification

E. F. Trumble

The Los Alamos National Laboratory (LANL) MCNP transport code was certified and it is expected to become high impact software for criticality and shielding applications. In developing a MCNP certification package, a test problem document and Software Test Report were written. The MCNP certification package, which summarizes and references the documentation associated with this task, was approved. MCNP was placed in "Certified" status under Software Control Management System (SCMS).

Validation of the code for particular applications in criticality and shielding will be performed before the code is released into production and used for such applications.

Pipeflow Conversion

D. A. Burge

By the request of the Nuclear Engineering Section (NES), the Safety Technology Section (STS) is converting the PIPEFLOW Version 1.0 model to the Version

3.0 format to eliminate certification requirements for Version 1.0. NES personnel's review of the STS results indicates near duplication of Version 1.0 using Version 3.0, except for nominal differences expected in a numerical solution. STS expressed concern with regard to a low emergency cooling system (ECS) flow comparison using the 1989 test configuration with one open valve. This area of concern was in a range close to the dead head pressure. Near the cut-off point or dead head pressure, a small change in the head for the ECS-A pump caused a large change in flow. It should be noted that this occurs in a pressure range outside the range used in limits and maximum ECS flow analyses. NES agreed that another comparison of the test loop configuration would be performed with more than one valve open. NES will provide a modified Version 1.0 input data set and results to STS for the comparison. The comparison of header flows for pumping and gravity conditions, under steady state conditions, are virtually identical and confirms the belief that the conversion from Version 1.0 to Version 3.0 does not require extensive benchmarking.

Idaho National Engineering Laboratory (INEL) Safety Rod Test Review

H. N. Guerrero

INEL performed natural convection cooling tests (prototypic setup) of a full length safety rod and thimble with cooled USH tubes. The purpose of these tests were to review and compare the INEL tests and a similar SRTC test with a short rod and no cooling tubes. The objective was to determine any significant impact of the INEL tests on the calculated gamma heating power limits based on the SRTC tests. The tests were performed in the following configurations: bare, inside a thimble with dry cooling tubes, and inside a thimble with a falling water film around the cooling tubes. To make a one to one comparison with the SRTC data, the raw data of the INEL tests was re-analyzed on the basis of property values, based on the average film temperature since INEL used the cooling tube temperature, and a correction factor based on the ratio of the hot rod to cold tube temperatures. Both sets of data, when normalized to flat plate conditions, fell on the same trend line and were above the McAdams flat

plate correlation. Thus, there is no impact on the gamma heating analysis. NES provided these results to the DOE Independent Review Panel (DIRP) at the review meeting on August 26, 1992. The data analysis will be repeated, using the INEL approach, to determine the best way to represent both sets of data.

DIRP Review of Power Limits Program

A. J. Garrett

DIRP met with NES personnel to review the status of the power limits program on August 25-27, 1992. The last DIRP meeting was in August 1991, therefore, a large amount of material was covered. NES and STS personnel described the more significant events during reactor restart, including the septifoil overflow problem and its resolution, the ink injection test, and the analysis of Axial Power Monitor (APM) Rod performance. NES also presented an overview of the cooling tower program, 2-D Gamma-Heating modeling, the status of experimental work that supports RELAP5 System Code Verification and Validation (V&V), and updates on other areas of ongoing work. The DIRP will issue a short report with its recommendations.

Available Decontamination and Decommissioning Capabilities at the Savannah River Technology Center (SRTC)

L. M. Polizzi, J. K. Norkus, I. K. Paik, and L. A. Wooten

The Safety Analysis and Engineering Services (SAES) group performed and documented a survey (WSRC-RP-92-845) of SRTCs technical capabilities, skills, and experience in Decontamination and Decommissioning (D&D) activities. The purpose of this survey was to identify the specific technologies that apply to D&D so maximum utilization of the SRTC capabilities can be achieved in providing technical support to D&D activities in the most cost effective manner.

The SRTC applied a large number of technologies at the Savannah River Site (SRS) that can be useful to the DOE D&D programs throughout the Department of Energy (DOE) Nuclear Complex. While many of these activities were performed as part of the SRTC mission to support production facilities under the Office of Defense Programs, the SRTC staff effectively employed existing technology to previous D&D prob-

lems and developed expertise in this regard. When the existing technologies were not available, innovative and creative research and development programs were conducted to provide cost effective, high technology, and state-of-the-art techniques. This report demonstrates the depth and wealth of technical capability in the SRTC in relation to these activities and the unique qualifications to supply technical support in DOE facility D&D activities.

FLOODNET Analysis Code and 105-K Specific Model

S. A. Martin

FLOODNET is a FORTRAN code that evaluates flood levels in a network of inter-connected compartments. Using an input deck modeling a specific building, FLOODNET produces data consisting of flood level vs. time for each compartment, the flow rate between connected compartments (path flow rate), and alarm signals to indicate specific water elevations in various compartments. In addition, FLOODNET is accompanied by a graphic post processor that gives an accurate visual representation of the flood levels as the event progresses. Currently, FLOODNET is being applied to the 105-K building. The 105-K physical model serves as the input deck for the FLOODNET code and defines the compartments, the flow paths connecting the compartments, and provides the source/sink information.

The training material and support documentation for the FLOODNET code and the 105-K specific model were also received with the code. The support documentation consists of a User's Manual, Programmer's Manual, Verification and Validation (V&V) Manual for FLOODNET, Development and Verification Manual for the 105-K physical model, and the training materials. The User's Manual describes how to use the FLOODNET code and the graphic display (FLOW-SIM). The Programmer's Manual provides the card definitions for the input deck to allow for refinement of the 105-K model or construction of a new model. The remaining manuals are part of the Quality Assurance (QA) documentation for the code and model. The training materials consist of a lesson plan with instructor and student activities, practice exercises and test problems (the User's and the Programmer's Manuals serve as support documentation).

Pipeflow

B. J. Shapiro

Conversion of the NES PIPEFLOW Version 1.0 models to PIPEFLOW Version 3.0 was successfully completed. Results using Version 3.0 appear to be comparable to the results of Version 1.0. A report (WSRC-TR-92-445) documenting this conversion was published.

Gamma-Heating Documentation

R. E. Cooper

NES prepared and reviewed the GAM-HEAT document in WSRC-TR-91-372, Revision 2 for publication, which will be released when the required signatures are obtained. This version will be used for K15.1 power limits. It computes limits for each component in the core (1/3 sector symmetry), including the tank wall. Due to minor changes in the code, the sample problem was executed to assure proper functionality. The results were reproduced within one unit of the fifth significant figure. These modified results are included in Revision 2.

Reactor Decay Heat Removal Through Saturated Boiling

G. P. Flach

In preparation for WSRC presentations to the Defense Nuclear Facilities Safety Board (DNFSB) on grouting in K Area, NES determined when reactor decay heat could be dissipated through saturated boiling in connection with a seismic event involving loss of 186 basin inventory, which causes secondary-side heat exchanger cooling. NES determined that a Mk22 assembly can conservatively dissipate 24kW, via natural convection in analyzing loss of disassembly basin cooling (WSRC-TR-90-522). This power level is reached within the first hour of reactor shutdown. After that time, the entire core requires a liquid makeup rate less than 50 gpm. Pulling plenum plugs, removing nozzle filler rings, or removing elbows in the ECS lines near the nozzles could provide steam vent paths. Additional information is given in NES-CDG-920161.

FLOWTRAN-TF

M. A. Shadday

NES is documenting efforts on cross-flow between parallel channels of a mechanistic model that reproduces the experimental results of Tapucu. Tapucu measured the pressure driven cross-flow through a narrow slot connecting two parallel channels, which is the basis for the rib cross-flow model in FLOWTRAN-TF. The experiment was single-phased, therefore, two-phased effects must be added to the model and be put in a form suitable for inclusion in FLOWTRAN-TF. NES committed to a January 1993 completion date for FLOWTRAN-TF certification.

Reactor Process Water System (PWS) Component Acceptance Criteria

R. L. Sindelar, D. M. Barnes, W. L. Daugherty, N. K. Gupta, P. S. Lam, G. E. Mertz, and R. F. Miller

The reactor PWS is a Nuclear Safety Class 1 system. Monitoring the pressure boundaries of the PWS components through in-service inspections is important in demonstrating the structural integrity against large break or leakage failures throughout the service life. Acceptance criteria or acceptable flaw configurations for the disposition of flaws reported in examinations of the PWS components are being developed for input into the reactor in-service inspection plan (WSRC-TR-90-42-141). Components with flaws exceeding the acceptable flaw configurations must be repaired or removed from service.

The development of the acceptance criteria involves the structural analysis of the pressure boundary regions of the component, evaluation of material properties, in-service degradation and degradation rates, flaw stability, and examination frequencies. The technical bases for flaw stability includes rigorous fracture mechanics analysis of postulated flaws to demonstrate safety or structural margins against failure under normal and emergency/faulted conditions of operation. The safety margins defined for the PWS for the analyses were adopted from Section XI of the ASME code.

Previously, the reports (WSRC-RP-89-208, Rev. 2 and WSRC-TR-92-11) containing the acceptance criteria for examinations for in-service inspection were completed for the record tank and the heat exchanger

PROGRESS AND ACCOMPLISHMENTS

staybolts. The report (WSRC-TR-92-10) containing acceptance criteria for the piping was recently issued; the acceptance criteria report (WSRC-TR-92-425) for the heat exchanger head and shell is being reviewed. Reports with acceptance criteria for the expansion joints, pumps, valves, plenum inlet nozzles, and reactor tank outlet nozzles are in preparation. The results from these reports are being codified for incorporation into the ASME Section XI Code Case for In-Service Inspection Requirements for Low Temperature Heavy Water Reactors (see the Materials Technology Section (MTS) August 1992 Monthly report).

Acceptance Criteria for the Process Water System (PWS) Piping

D. M. Barnes

Monitoring of the reactor PWS piping through in-service inspection is an important part of the structural integrity demonstration. Replacement criteria are established defining allowable flaw configurations for piping to remain in-service. If a flaw that exceeds the replacement criteria is detected, a location-specific evaluation or Acceptance-by-Analysis is required to demonstrate that the final predicted flaw size would not exceed defined safety margins to remain in-service. The defined safety margins are adopted from Section XI of the ASME BPV Code, Article IWB-3642 for austenitic stainless steel piping and are three times the normal operation loads and one and a half times off-normal loads. The methodology was prepared following the ASME Section XI and NUREG 0313 guidance. Flaw stability is determined with a J-integral based Limit Load Method for circumferential flaws and a Limit Load Method for axial flaws. This report also provides recommendations for crack growth rate and weld residual stress models for crack growth analyses.

Acceptance Criteria for PWS Expansion Joints

W. L. Daugherty, R. F. Miller, N. K. Gupta, and R. L. Sindelar

Efforts to develop acceptance criteria for in-service inspection of expansion joints are continuing. A computer code for fatigue crack growth predictions was prepared and applied to postulated cracks and dents in the convolutes. Finite element models are being developed for evaluating the effect on local stresses

of dents. These results will be combined with the fatigue predictions to develop acceptance criteria for denting.

Additional efforts to develop specific acceptance criteria for degradation of the internal flow sleeves is in progress. This analysis includes an assessment of the susceptibility of the flow sleeve to crevice corrosion. Acceptance criteria for the flow sleeves and convolutes are being developed in recognition of current inspection capabilities and plans. Additional inspection requirements will be recommended to ensure structural integrity, where necessary.

Systematic Evaluation Program (SEP)

T. A. Smith

Efforts are in progress to contribute to the development of the Technical Evaluation Plan (TEP) for the Instrumentation and Control (I&C) portion of the SEP. A review of the latest Electrical TEP was completed. Comments on the draft sections of the I&C TEP are being developed. Acceptance criteria was prepared and system descriptions for the ECS and REMACS were provided for inclusion in the TEP.

Setpoint Program Consultation For Waste Isolation Pilot Plant (WIPP)

C. L. Sossman

C. L. Sossman provided consultation services to the Waste Isolation Pilot Plant (WIPP) engineering personnel in Carlsbad, New Mexico. These services were performed under contract to the Westinghouse Waste Isolation Division and consisted of an evaluation and comparison of the WIPP status related to SRS experience in establishing a setpoint program. The evaluation was based upon a tour of all WIPP facilities and a snapshot review of calibration controls control room operations, system documentation, instrumentation lists, and systems classifications status. A presentation was made to WIPP Engineering Department personnel covering the required scope of a viable setpoint program, the importance of adequately addressing the safety analysis, regulatory commitments, setpoint analysis methodology, and a comparison of SRS experiences related to present the status for establishment of setpoint evaluation program bases.

Validation of the Reactor Simulator

J. E. Aull

The reactor simulation package runs on the Real Time Modeling Computer's (RTMC) Gould minicomputer, but an effort is underway to accelerate the simulation by running part of the software on a Northgate computer with a 80486 processor, following the lead of a similar effort in Reactors Training and Procedures (RTAP) department. The core model runs on Northgate in conjunction with the rest of the simulation package on the Gould. It also runs the simulation in real time, which is three times faster than Gould, but it freezes when changes are made to simulation parameters. RTAP was successfully running the actual simulator using a Northgate and they will make another attempt using the latest copy of their software.

As part of the simulator validation, output from the RTMC was compared to data gathered from the reactor during recent testing. The RTMC data compared well with the high level flux monitor output during a safety rod scram.

Reactor Monitoring System (RMS) Update Program Enhancements

J. J. Taylor

The RMS update program, which reads K-Reactor Control Computer data and converts the data to VAX binary form and stores the data in the RMS data base, was modified to store raw APM sensor readings. Previously, the APM sensor readings, which are taken at seven axial positions, were fitted using the K-Reactor Control Computer algorithms to produce normalized readings at 20 axial positions. The fit at 20 positions was stored in the RMS data base and the data was determined to be inadequate for analysis at low power. Therefore, RMS was modified to store the 20 fitted data points and the seven original APM readings.

Power Ascension Data Acquisition System (PADAS) Data Made Available

J. J. Taylor and T. G. Williamson

PADAS was installed in 105-K to collect data during the K-Reactor Power Ascension Testing. The Applied Physics Group (APG) requested that data from specific tests be extracted from the PADAS test data and be made available for analysis. The PADAS data

includes measured neutron fluxes and assembly temperatures.

The PADAS data from TEST-03 (approach to critical), TEST-04 (reactivity computer calibration), and from the remote shutdown and Supplementary Safety System (SSS) injection tests were converted to a useful format and stored using the Common File System (CFS).

Several utility programs were written to assist in accessing and processing the data stored on CFS. These utilities can retrieve selected PADAS data files, graphically verify and select appropriate data ranges, extract selected data from large data files, and reformat data for transfer to other computer platforms. The PADAS utilities are intended for use on the LAB1 VAX-cluster.

AUTOPROD Production Libraries

G. R. Cefus

Production libraries for the AUTOPROD computer code were created and validated against actual measured 200-Area separations results. The AUTOPROD computer code calculates isotopic production and depletion for various assemblies and lithium bearing (tritium producing) components other than control rods irradiated at the SRSs heavy water reactors. The production information from AUTOPROD is vital to SRSs material control and accountability processes. It utilizes charge loading information, observed axial power profiles, individual assembly exposures, and library production rate data to calculate total charge production as a function of total core exposure.

The AUTOPROD production libraries were created for the Mark 22 and Mark 60B assemblies and the sparjet components. They were derived from the JASON computer code libraries and contain specified contents for a given set of independent variables as a function of assembly exposure. In the past, the AUTOPROD production libraries may have been biased or corrected by comparing the calculated isotopics using the "unbiased" AUTOPROD library with actual separations results.

The AUTOPROD predicted results, using the newly created "unbiased" libraries, compare favorably with the actual measured 200-Area separations results.

These libraries also meet or exceed the predictions made by the previous "biased" AUTOPROD libraries.

New Mark 22 Power Dependent JASON Library

K. A. Niemer and C. R. Cefus

The JASON computer code is the primary tool used in reactor physics calculations to predict isotope production and charge reactivity and reactor power distributions. The execution of JASON requires data libraries that contain information pertaining to the type of assemblies being irradiated. Historically, SRS reactors operated at power levels of approximately 2500 MW; however, lower power levels are predicted for future reactor operations. Actually, K-15.1 will operate at much lower power levels. As a result, the existing Mark 22 JASON library is no longer adequate. Therefore, it was necessary to create a new power dependent JASON library to be utilized for the final physics analysis of the K-15.1 subcycle.

The information contained in the new library includes:

- assembly names
- independent variables for correlation of data
- cell macroscopic cross sections vs. independent variables
- cell isotopic contents vs. independent variables
- cell fission powers vs. independent variables
- default assembly staging instructions
- editing instructions for isotopic contents
- data for converting fission power to computer power
- 1-6 to total cell absorption ratios for tritium production calculations

The experimental design for a first stage library is completed and the GLASS depletion problems necessary for the correlation of the dependent variables was executed.

Core Operations Report (COR)

W. M. Massey

Reactor Engineering (RE) and NES personnel are co-authoring a document to propose a significant simplification of the COR and the amount of limits data input to the Control Computer. The K14.1 COR contained a large amount of data that was irrelevant to K14.1 operation, but required as input for earlier high power operation. Much of this data will be removed to simplify preparation and review of the COR. It is anticipated that these changes can be implemented for the K15.1 subcycle.

Septifoil Leak in K Reactor

J. L. Steimke

Previous experiments show that freeboard was marginal for the two septifoils containing a source rod when the septifoil flow was restored to the full flow 106 gpm and the full length control rods were scrambled. Largely in response to this experimental work, the decision was made to redesign the source rod to make it almost hydraulically identical to the full length control rods. Thus, the problem of marginal freeboards for the source rod septifoils should be solved.

Cooling Tower Program - 186 Basin Level Report

K. L. Barbour

In support of the safety analysis for the cooling tower program, NES determined the impact of 186 basin level on ECS performance. A draft report documents the minimum basin level calculations for 190 Building and ECS pumps to avoid pump cavitation. The preliminary results are:

- the 190 Building pumps can operate to basin bottom
- ECS A or B pumps need a full basin if operated as sole source
- the ECS booster pump can operate independently above a seven feet basin level
- any ECS pump combination can operate above a five feet level

The results reflect the pumps operating at their most limited conditions.

Acceptance Criteria for Heat Exchanger Shell & Head

P. S. Lam and R. L. Sindelar

The acceptable flaw size for the reactor heat exchanger head PWS inlet area (pipe region) was re-analyzed with an updated set of seismic piping reaction forces for seismic bracing analysis (EDP-SE-92-0076:63). A safety factor of 1.5 was applied to the emergency/faulted loading. The acceptable flaw length was calculated to be 23" (22" was reported in a previous report) with the J-integral based limit load analysis (JILLA) method. This procedure was also applied in calculating the acceptable flaw length at the cooling water inlet nozzle.

The final report on the Heat Exchanger Head and Shell Acceptance Criteria (WSRC-TR-92-425) was completed and is undergoing technical review.

Corrosion Consideration For K-Reactor Alternate Core Cooling Concepts

J. P. Howell

A task team was formed to evaluate ways to extend the lifetime of future reactor fuel and target cores. Four basic alternate core cooling concepts, with some variations, are being considered: Forced-circulating D₂O, natural-circulating D₂O, forced-air convection, and free-air convection. In these concepts, irradiation of the core is carried out at a maximum of 30 percent power or 720MW. After irradiation for up to one year, the assemblies will remain in the reactor tank under the alternate cooling concepts for up to 12 months before re-irradiation. Using these techniques, it may be possible to extend a reactor charge for up to five years.

An evaluation of the corrosion considerations for the aluminum fuel and target clad alloys under the alternate core cooling concepts was made. A memorandum (SRT-MTS-92-3082) was written reviewing the corrosion considerations for full power operations and the corrosion concerns expected from the four basic cooling techniques under 30 percent power operation.

For irradiation of the core, followed by in-tank forced- or natural-circulating D₂O cooling water, the

conditions are somewhat different from normal operations, but less severe. Corrosion of the aluminum is not expected to be a problem as long as purification of the moderator is maintained and the water remains within operating limits. If stagnant water conditions exist and are combined with a moderator out of operating limits, the natural circulating option may cause pitting corrosion concerns.

The forced- and free-convection air cooling options are significantly different from traditional operations. The proposed concept uses water cooling until the metal temperature is below the 100-150°C range, followed by forced- or free-convection air cooling. At these temperatures, corrosion problems in a dry atmosphere would not be expected. However, if moisture is in the tank, which may occur immediately after draining, concerns about corrosion from nitric acid formation from radiolysis of the water on the tank walls and the assemblies or from hydrogen blister damage could arise. Hydrogen damage occurs more readily at 350-400°C where hydrogen diffusion is more rapid.

An experimental corrosion program is recommended to confirm and support the technical bases for corrosion conclusions associated with the selected option. The proposed cooling operations are different from previous operations and could lead to unknown corrosion concerns. The corrosion program would be conducted at Oak Ridge National Laboratory (ORNL) and consist of corrosion loop tests under heat flux conditions combined with water- and air-cooled coupon tests to determine the aluminum response in simulated environments. Costs for this program are estimated to be \$400-\$500K over a one-year time period.

Analysis of K-Reactor Basin Water

E. W. Baumann

Water and sludge samples from the K-Reactor Vertical Tube Storage Basin were analyzed for the Reactor Corrosion Mitigation Committee. The purpose was to provide baseline data for storage and cleanup operations. Conditions that might promote corrosion of aluminum were addressed.

The water quality was within operating limits, but major dissolved components of sodium, calcium, nitrate, and sulfate were discovered. The sludge was primarily hydrous iron oxide with long-lived radionuclides

that reflect past reactor operation. Minimal amounts of metals for galvanic corrosion of aluminum were found. The data is reported in WSRC-TR-92-412.

Potential Issues (PI)

Guy H. Davant

PIs are used to determine whether identified conditions or concerns are issues that must be classified and reported per SRTC Procedure L1-1.03. They are entered into a tracking system and followed to resolution. Seven PIs are identified and are in the resolution process. The issues cover the following subject areas:

- **PI92-003 Maximum ECS Flow Effects**

Results from the most recent K-Reactor ECS flow tests were used to determine new maximum ECS flows for various accident conditions. The new flow rates impact three areas: roll anchor stress, building flooding, and polybor strainer bypass valves. Analyses of the results are in progress.

- **PI92-005 Partial-Length Control Rod Reactivity Insertion**

While manipulating partial-length control rods, the gang that was being inserted continued into the core when the operator released the controlling toggle switch. Some aspects of this variation of the reactivity addition event are not covered in Safety Analysis Report (SAR), Chapter 15 accident analyses. The Safety Analysis and Engineering Services (SAES) group is reviewing the event to determine if it is bounded by current accident analyses. The Safety Technology and Regulatory Analysis (STRA) group is reviewing failures that could impact rod speeds.

- **PI92-006 Simultaneous Movement of Full-Length and Partial-Length Control Rods**

From investigations of PI92-005, SAES determined that allowing simultaneous movement of full-length and partial-length control rods violates current safety analyses. Technical Specifications (TS) do not prevent such movement; therefore, the safety analysis is not preserved. SAES will provide a TS change to prevent simultaneous full-length and partial-length control rod movement or revise the SAR to allow such movement.

- **PI92-007 Measured Air Flow Discrepancy Noted During Assembly Test**

While testing Mark 22 assemblies, Babcock & Wilson measured a significantly different air flow than the Nuclear Engineering Section (NES). Different air flows could affect the liquid flow distribution to various channels under ECS conditions and affect power limit calculations. NES is evaluating the discrepancy to determine the impact.

- **PI92-008 Uncertainty in Average Void Fraction Measurements in Annulus Under ECS Conditions**

Precise closing times for the bladder valves in the void rig cannot be obtained. Lack of precise data causes a large uncertainty. The uncertainty may impact reactor power limits. Therefore, NES is taking steps to determine closing times and reduce the uncertainty.

- **PI92-009 Reactivity Event Following Shutdown**

Two situations may exist in which recriticality could be achieved after a scram.

1. During a scram, the potential exists for a limited number of safety rods to insert into the core. The number would be enough to "fool" the safety computer into passing the ABS/SC DROP test and shutting down after two minutes. This event could develop into the following scenarios:

- a. The core could remain critical with increasing reactor power due to Xenon-135 decay.
- b. Recriticality could be attained due to Xenon-135 decay after a scram from peak Xenon.

Both scenarios assume a total figure of the control system and would necessitate manual SSS injection.

2. During a loss of AC power to the PWS/CWS (blackout), the plant will be on DC powered flow after the partial scram described above. SAES analysis indicates that SSS actuation during the flow coastdown will successfully place the core in a long-term shutdown condition. However, manual SSS actuation could be delayed until steady-state DC conditions exist. SAES has no firm data on how rapidly SSS will

shut down the reactor under DC powered steady-state flow conditions. SAES is working to resolve this issue.

- **P192-010 Error Found in Decay Heat Model of MARY 3.02 Code**
The MARY 3.02 computer code may be incorrect for the analyses that simultaneously meet the following conditions:

- a. Decay heat model is utilized.
- b. Decay heat model is initialized to a user input power history.
- c. Input power history specified is by more than two input data points.

Chapter 15 transient analyses do not use the decay heat mode. However, SAES is reviewing it to determine if there is any impact. Corrections to the MARY code are expected to be completed and certified by October 20, 1992.

Technical Specification Change Requests (TSCR) TSCR 92-0008

C. Smith, B. Ingerto, and M. Layton

Efforts for incorporating the Plant Operating Specifications (POS) and the associated Bases being developed into the K-Reactor Technical Specifications (TS) continue. A package with the proposed disposition of each POS item is scheduled to be approved for distribution on September 30, 1992. The package will include a revised or new TS with associated upgraded bases for each POS item proposed for inclusion in the TS or a justification for why the POS should not be included. Thirteen POS items will be incorporated into TS. The electrical POS items will not be included.

TS Related Items

J. S. Lietzow

The TS Bases Upgrade Program was established to satisfy a DOE Post-Restart commitment. Scheduled completion for the program is set for July 1993. The program consists of a review and approval of three TS Bases each month. The approval process will be identical to the TS Certification Review completed in 1991.

Bases approval packages will be sent to the responsible review groups for review and comment by the first week of each month. The following week will allow time for the review and comment process. The third week will be used to obtain the required approval signatures of the appropriate managers (RE, ESH&QA, and STRC). The final week allows for a ROSC and ROISRC meeting for a complete WSRC approval. DOE is not required to approve the upgraded Bases.

The three packages sent out this month were 3.6.1 Airborne Activity Confinement System (HGAs and 3.6.2), Airborne Activity Confinement System (no HGAs and 3.4.8.3), and Process Water Quality (pH and conductivity). The project is on schedule.

RE identified several issues involving the safety computer and REMACS. The majority of the issues involve assumptions in the accident analysis and Probabilistic Risk Assessment (PRA) and the need to clarify these requirements in the TS. These changes are being evaluated to facilitate reviews within Nuclear Reactor Technology and Scientific Computations (NRT&SC) department is being provided.

Human Factors (HF) — Partial Job Analysis of Emergency Operations Facility

A. B. Beyer and L. Goff

SRTC's HF analysts performed several steps of a job analysis under the direction of the Emergency Management Training Unit in the Safeguards and Security and Emergency Preparedness Division. Job analysis observes the duties or responsibility areas and tasks that make up a job. The analysis consists of the following steps:

- development of task listings
- validation of the task listings
- prioritization of tasks within the listings
- identification of applicable training in environment (i.e., suggestions for further analysis).

HF analysts assigned with the first two steps of the job analysis process.

This partial analysis of Emergency Response Organization positions within the Emergency Operations

Facility represents one part of the entire job/task analysis endeavor being planned and instituted by Emergency Management. Emergency Management started the job/task analysis process in an effort to bring the training program into compliance with the requirements of the 5500 series of DOE Orders. DOE Order 5500.3A requires that training be based on an analysis of tasks to be performed during emergency events.

Based on requirements of the first two job analysis steps, HF analysts formulated task listings for each Emergency Operations Facility position, gathered additional job information from interviews with subject matter experts, and ensured validation of the task listings by Emergency Management procedure writers. In addition to these deliverables, HF analysts developed valuable tools for Emergency Management's job analysis process, such as a formal questionnaire for subject matter expert interviews, job analysis forms for data collection, a simple computerized database of job and task information, and duty areas that are applicable to emergency response facilities in the building. A report documenting HF's effort will be issued at the end of this month.

Operator Action Analysis — Loss-of-Pumping Accident (LOPA) and Loss-of-Cooling Accident (LOCA) With Cooling Tower

C. van Buijtenen

Operator action times for LOPA and LOCA events are being analyzed to support the Cooling Tower Task Team efforts. Some of the key issues are concerned with actions that must be performed by the Power Department (PD) to supply the necessary river water to the 186 Basin. PD engineers and dispatchers are confident that required river water can be supplied within 30 minutes of notification; however, no data is available to substantiate this information. Arrangements are being made to verify action times when the 186 Basin is refilled for K Reactor restart.

Traveling Wire Flux Monitor (TWFM)

T. A. Smith

Efforts continue to evaluate the uncertainties associated with the TWFM system, which is used to configure the reactor flux shape.

Meetings were held between Safety Analysis, Safety Technology and Regulatory Analysis, RE, and Reactor Physics on September 15, 1992 to discuss the TWFM uncertainty and the relationship to APMs and the Non-LOCA analysis during the K14 reactor operation.

The consensus of this meeting was that actions taken on APM bias adjustments based on TWFM data was bounded by the non-LOCA analysis. A follow-up report addressing the vents of K14 operation, level of conservatism, and the possibility of dropping APM biases for future cycles will be issued.

A follow-up meeting between RE and Instrumentation Systems Uncertainty personnel was held on September 26, 1992. The data (SRT-EMT-920024) presented to the Defense Board was reviewed and the TWFM data for K14 operation was presented. Additionally, the basic operation and physics of the TWFM data process was reviewed. RE reconfirmed that no TWFM system hardware specifications sheets are available. Efforts to obtain calibration procedures and data for the TWFM data system and other pertinent information to evaluate TWFM system performance, using the industry accepted uncertainties methodology continue.

Cooling Water Basin Level Instrumentation

E. Y. Hwang

Cooling water basin level instrument uncertainties are being evaluated in support of the Cooling Tower Task Team efforts. Six level measurement circuits were analyzed and the results are being tabulated and compared.

The cooling water basin level instrumentation uncertainties efforts are being coordinated with RE, PD, and Engineering and Project Division (E&PD) personnel to collect and examine the relevant engineering specifications, DuPont Standard Operating Log (DPSOL) Work Instructions, vendor literature, drawings, and operations and calibration procedures for the basin level instrumentation. The uncertainties for each element in the circuit are being evaluated and an engineering report is being prepared. New instrumentation was installed for the level alarm associated with the Safety Analysis Limits and the basin level inputs to the Distributed Data Acquisition and Control System.

(DDACS). Basis calculations of the instrumentation uncertainties were completed and the basis reports are being prepared for review by interfacing analysis, project, and designer organizations.

Cooling Tower – SRTC Task Team

T. E. Britt, J. Buczek, and K. J. Lansaw

In December 1991, the SAES group identified potential problems associated with operating K Reactor with the cooling tower. An SRTC task team was formed in March 1992 to assess the impact of the cooling tower on the SAR Chapter 15 accident analyses. As part of the cooling tower safety analysis, a memorandum (SRT-SAE-920315) documenting required operator actions in the event of a LOCA or LOPA was released for comment.

The operator actions will include the restoration of river water supply for the major LOCA and LOPA events. This will entail a coordinated response from reactor and power plant personnel to start river water pumps, open manual valves, and restore the 186 basin supply. The required actions must be accomplished within approximately two hours of the initial event.

Charge and Discharge Machine (C&D) Input Order Computer Replacement, Project S-2760

J. D. Jones, M. E. Farrar, and C. K. Fulghum

The C&D machine's on-line computer system provides automatic control of movement in X and Y directions. Project S-2760 was initiated to replace the current system, which became obsolete and difficult to maintain. The new state-of-the-art system provides improved reliability and improved functionality. E&MT was asked to develop the hardware and field interfaces for the project.

Fabrication of the L-Area system was completed and testing is underway. This milestone will mark the completion of all hardware deliverables for this project. Testing will be completed by September 30, 1992.

Reactor Ventilation Systems Test

H. T. Sessions and J. B. McIntosh

The Code of Federal Regulations 40CFR.61 National Emissions Standard for Hazardous Air Pollutants, Appendix "C", requires that K Area have a continuous air flow monitoring system for the stack exhaust. Prior to reactor restart, hot wire anemometers were installed in the M, S, and G air ducts that feed the building exhaust stack to determine total stack flow and comply with the federal regulation. The EPA requested that this system be certified within 90 days after reactor restart.

Equipment and Materials Technology (E&MT) delivered a functional SF₆ analyzer, calibration gas standards, and a calibrated mass flow controller for the ventilation test. The test was successfully completed before the September 6, 1992 deadline. The Reactor Environmental Department will issue a report of the results to EPA in October 1992. Preliminary results showed that the hot wire anemometer measured the stack flow within the required ten percent.

Filter Housing Assembly Replacement, Building 105-K

B. Young

Design Engineering requested that Weld Engineering evaluate the welding problems that American Air Filter was having when welding the filter housing assembly for 105-K. This filter assembly housing was fabricated in Louisville, Kentucky and seismic and leak test were performed in Huntsville, Alabama. Crater cracks and lack of fusion, due to fabrication configuration, were the cause of the leaks that were discovered during leak testing.

Approximately 140 feet of welds made on another assembly were visually inspected and accepted per design acceptance criteria (Nuclear Construction Issues Group-01). However, seven spots on these welds were evaluated as high potential for leaks. All welds were made with the gas metal arc welding short arc process.

Recommendations were made to grind out and repair the seven areas using the gas tungsten arc welding (GTAW) process and to purchase a post flow shielding device to add to the welding machine to eliminate crater cracks. A suggestion was also made to use the

PROGRESS AND ACCOMPLISHMENTS

GTAW process to make a first pass, followed by a final pass to mend the areas with the greatest potential for leaks. All parties agreed to these recommendations.

P-11/K-15 Fuel Ultrasonic Testing (UT) Inspection

A. Placr, B. D. Howard, M. T. Ferencz, G. D. Teese, and T. J. Miller

Although it is expected that no corrosive damage to the Mark 22 fuel assemblies of the K-15 charge will be found, an inspection program that includes a visual examination of all assemblies and, if required, an ultrasonic inspection capability will be defined. A proposal for the inspection program addresses a visual examination of outer surfaces of Mark 22 outer target tubes for a presence of mechanical damage and corrosive pitting. A predetermined amount of the outer and inner fuel tubes will be destructively examined for a corrosive type of damage. In the event that corrosion is detected, an ultrasonic immersion technique will be used to non-destructively inspect both surfaces of the outer and inner fuel tubes. The following summarizes the status of the project:

- The Institute for Science and Technology, Inc. (IST) in Ft. Lauderdale, Florida developed a focused array transducer system (FATS). It utilizes an immersion method and was initially demonstrated on an assembly of the outer target and outer fuel tubing with holes drilled to different depths as reflectors.
- Reactor Materials supplied a sufficient amount of the Mark 22 assembly samples to make at least two complete sets of reference standards.
- High speed drill bits of 0.006", 0.010", and 0.015" in diameter were ordered to drill holes in the reference standard assemblies.
- A requisition was written to purchase three five element focused transducers from IST. The optimum transducer for the pitting detection and sizing will be determined in a practical manner.
- A design for the ultrasonic reference standards was completed and the drawings and materials were transferred to the E&MT Machine Shop for fabrication.

- IST will scan the reference standards to determine the detectability of the simulated defects.
- Data will be collected to determine the technique sensitivity and the signal to noise ratio using actual fuel assemblies in 322-M for UT baseline work.
- A correlation between UT response from drilled holes and actual pitting could be determined from corrosion study samples containing pitting vs. the reference standards. These samples would be characterized non-destructively to verify the UT result and to provide confidence that the UT technique is functioning properly.

Reactor Operations personnel and the Procurement Department are working with E&MT to expedite the procurement process. Delivery of the UT focused array transducer system is set for mid-October 1992.

Leak Testing Replacement Heat Exchangers for K Reactor

D. J. Trapp, H. B. Hoover, J. H. Ouzts, T. L. Usry, and R. L. Yongue

The Reactor Department requested that E&MT provide technical assistance in vacuum drying ten heat exchangers and to perform an overall helium leak test of each heat exchanger after it is dry. These heat exchangers will replace the K-Reactor heat exchangers.

On September 17, 1992, E&MT technicians completed helium leak testing of the tenth, and final, heat exchanger two days ahead of schedule to meet the milestone. Eight of the replacement heat exchangers were installed in K Reactor. Construction is currently installing the ninth unit.

100 Area Heavy Mark 16B Storage Limits

J. F. Mincey

A draft response to a DOE draft letter was prepared. The DOE draft letter proposes that members of DOE-SR investigate the applicability and validation of criticality safety codes at SRS. A 1990 Technical Safety Appraisal Tiger Team conducted such an investigation and recommended a *Noteworthy Finding* (May 1992) for the J70 criticality code validation.

TRITIUM

Zinfandel and Goblin Unloading

C. E. Sweeney

Tritium requested that Equipment Engineering Section (EES) design, fabricate, and test tooling to unload 16 MTF Group II reservoirs. A new door, hold downs for the reservoirs, and tools for unloading are also required.

Tritium approved a design for the shear valve to unload the secondaries. This valve was fabricated and is being tested. A new door for the PC station was fabricated and successfully helium leak tested. Hold downs were also fabricated.

Special Secondary Unloading

C. E. Sweeney

Tritium requested that EES develop a system to unload 25 MTF secondaries. It should also feature a high pressure feed-through to connect the unloading device to the unloading tanks and a modified door for the PC station to allow the unloading operation.

Tritium successfully used the system to unload four secondaries. EES is assisting Tritium with the unloading operation.

ASME Code Qualification for Pinch and Reclamation Welding

J. Morin and B. J. Eberhard

Since the early 1950's, most manual and some automatic welding processes met the Section IX of the ASME Boiler and Pressure Vessel Code. In the last few years, most areas onsite have come into compliance with this program. Presently, the automatic welding processes in Tritium and the Replacement Tritium Facilities (RTF) are in the process of being qualified to Section IX under the direction of the E&MT Weld Engineering group.

Even though these automatic resistance welding processes were proceduralized in the past, they have not conformed to a national consensus code. They do not easily lend themselves to code compliance, al-

though we are adapting the variables of the processes to the requirements of the code. This common approach will establish a baseline for uniformity of resistance welding procedures in the Tritium and RTF. This will also bring the welding program into compliance with DOE Order 6430.1A.

Investigation of Failed Damper Handle

C. L. Shelor, S. B. Rhodes, and G. D. Creech

Tritium Engineering submitted a stainless steel HVAC damper handle to the MTF for a failure analysis. The handle adjusts the position of a damper in the HVAC ductwork, in which air is exhausted at ~20,000 cfm. This airflow rate was not constant, therefore, the damper and handle continuously vibrated. The handle was installed when the building was constructed 35 years ago. At the time of failure, it was being turned.

A visual examination of the handle determined that complete failure occurred at the shaft connecting the handle to the damper. Approximately 80 percent of the fracture face was covered in oxide, indicating that the failure mode was developing for some time. The remaining portion of the fracture face was shiny, denoting the region of final failure.

Closer examination revealed that the shaft was actually a thin-walled seamed pipe. The weld seam contained an undercut that acted as a stress riser that lead to the initiation of the fracture. Radial lines point back to one side of the weld seam. These radial lines, called shear ridges, normally point to the crack initiation site and are typical of fatigue failures, such as this one. It was concluded that the initiation of the crack and the subsequent failure of the handle was a direct result of a poor quality weld. Currently, there are similar damper handles in the ductwork and it was recommended that these handles be replaced to avoid potential complications in their operation.

Reserve LaNi₄.25Al_{0.75} for the Replacement Tritium Facility (RTF)

W. C. Mosley

In March 1991, RTF requested that the Hydrogen Technology Section (HTS) procure fifty kilograms of LaNi₄.25Al_{0.75} alloy as reserve for the RTF. The original RTF LaNi₄.25Al_{0.75} alloy was purchased as a custom alloy from the sole source supplier, Ergenics,

Inc., on a Level 1 procurement. Since Ergenics, Inc., designated LaNi_{4.25}Al_{0.75} alloy as a standard item (HY-STOR 210), the order for reserve RTF LaNi_{4.25}Al_{0.75} alloy was placed in August 1991 as a Level 2 procurement. However, in May 1992, Ergenics, Inc. informed HTS that their hydride metallurgist resigned and delivery of RTF reserve LaNi_{4.25}Al_{0.75} alloy was uncertain. Ergenics, Inc. did not officially notify the WSRC buyer until September 2, 1992.

In May 1992, because of the uncertainty of obtaining reserve RTF LaNi_{4.25}Al_{0.75} alloy from Ergenics, Inc., HTS identified eight candidate suppliers interested in making LaNi_{4.25}Al_{0.75} alloy for WSRC. A new purchase requisition and revised specifications for Level 1 procurement of RTF reserve LaNi_{4.25}Al_{0.75} alloy were initiated. Difficulties arose in developing supplier quality program requirements so that many candidate suppliers could be put on the Evaluated Supplier List. In September, HTS requested that RTF Procurement assist in obtaining the reserve RTF LaNi_{4.25}Al_{0.75} alloy. RTF Procurement is currently requesting uncontrolled copies of QA manuals from the candidate suppliers to assist in preparation of procurement specifications. HTS plans to purchase one kilogram of LaNi_{4.25}Al_{0.75} alloy as research material from candidate suppliers to evaluate their capabilities.

HTS made an inventory of available LaNi_{4.25}Al_{0.75} alloy suitable for RTF reserve if procurement from Ergenics, Inc. or an alternate supplier, can not be made by the time it is needed. About 45 kilograms of original RTF LaNi_{4.25}Al_{0.75} alloy remains in HTS storage. About 12 kilograms of HTS LaNi_{4.25}Al_{0.75} alloy that may be qualified for RTF use are available. Thus, sufficient LaNi_{4.25}Al_{0.75} alloy is available to serve as RTF reserve.

RTF Reserve Palladium Deposited on Kieselguhr (Pd/k) Meets Palladium (Pd) Content Acceptance Criteria

J. S. Hölder, W. L. Moyer, and W. C. Mosley

The Ionex Corporation is in the process of synthesizing Pd/k to be purchased by HTS personnel for the RTF reserve material. The acceptance criteria includes the requirement of at least 55 percent Pd by weight. Prior to the final reduction step in the process, Ionex shipped seven batches of Pd/k to HTS for evaluation, three of which were determined to be light in Pd

content. Ionex reprocessed those batches and returned the samples to HTS for analysis.

Measuring the hydrogen uptake of the material under specific conditions where the hydride composition is known determined the palladium weight percent (Pd wt %) of Pd/k samples. These measurements were carried out on a hydrogen gas handling manifold that is dedicated to this technique. The results are listed in Figure 1, along with those from the initial Pd wt % analyses. The results show that Ionex was able to increase the Pd content of all of the batches, such that they meet the acceptance criteria and continue with their final processing step. HTS will perform another Pd wt % analysis to verify that the final product meets the acceptance criteria for RTF reserve Pd/k material.

Batch	Initial Pd wt %	Final Pd wt %
B	52.8	56.8
C	51.3	58.1
E	42.8	60.2

Figure 1. Initial and final Pd wt %

RTF Catalyst Decomposer (DE Vessel) Information Meeting

A. S. Horen, J. E. Klein, and R. A. Malstrom

On September 9, 1992, RTF Technical and Testing, SRTC (HTS/ADS), and Tritium Technical personnel met to discuss general information about the DE Vessel in the RTF. Important operating parameters and areas of concern for RTF operation were noted. Certain parameters must be defined for process requirements. The current TS limits for DE Vessel operation must be verified before RTF can use these limits for Process Requirements.

While some differences exist between the DE Vessels in the tritium facility and the RTF, many of the operating conditions will be the same. The safety concern that drives the use of DE Vessels in the process is lessened in the RTF, but RTF personnel should be aware of the impact on the operation of the tritium facilities. Other issues discussed include placing administrative controls on process lines, examining temperature limits and heater control operation on the DE Vessel, and determining the DE Vessel flow limits. RTF Technical and Testing and SRTC will resolve these issues.

Maximum Tritium Concentration for RTF Storage Bed Leak-Checks

J. E. Klein

Leak-checking of the RTF metal hydride storage beds will be performed with tritium/deuterium mixtures of one percent (nominal) tritium, balance deuterium. The impact this may have on the accuracy of the hydride storage bed in-bed accountability method must be resolved.

Conservative estimates showed that tritium/deuterium mixtures up to 11 mole % tritium can be used under certain leak-test conditions and not impact tritium accountability in the storage beds. This tritium concentration exceeds the nominal one percent concentration to be used. Furthermore, the calculations are conservative, since they were based on protium (versus tritium) desorption (versus absorption) isotherms for the LANA.75 (LaNi_{4.25}Al_{0.75}) hydride storage material. WSRC-TR-92-424 summarizes these calculations and the conditions where the leak tests can be conducted.

RTF Technical Issues Tracking

A. S. Horen, T. Motyka, L. K. Heung, J. S. Holder, I. A. Fisher, J. E. Klein, R. A. Malstrom, G. S. Nichols, F. B. Ramirez, J. H. Scogin, and J. R. Wermer

HTS is tracking RTF requests for technical assistance. Benefits to RTF and HTS personnel include definition of the problem, scope, timing, resources required, and less duplication of efforts for problems previously addressed. The status of RTF issues generated and completed, along with the total manhours spent

addressing RTF issues, are reported in the RTF Monthly Project Status Report.

SRTC/HTS provides technical consultation and assistance for RTF Startup activities. RTF technical issues are tracked by the number of technical issues generated and resolved, and the total manhours involved. Specific RTF issues, typically requested by RTF personnel, are tracked in this manner; general RTF issues and technology topics are not included.

The number of hours spent on specific RTF issues increased during August 1992. Key RTF Technical Issues for August 1992 include:

- a technical review of the Final Safety Analysis Report (FSAR) (including TSRs)
- Hot and Cold Nitrogen insulation issues
- a TCAP (tubing) modification proposal

Forecasted activities in support of RTF will increase through Tritium introduction and War Reserve (WR) production, process requirements and system-specific Technical, and Operating guides.

A year-to-date summary tracking RTF issues and the total manhours spent addressing these issues are shown in Figure 2.

Figure 2. Summary tracking RTF and total manhours.

RTF Thermal Cycling Absorption Process (TCAP) Modification

L. K. Heung and A. S. Horen

A review of the of the RTF TCAP piping and instrumentation diagram and subsequent field walk-down revealed three items that require modification. These modifications are required for separation performance and proper operation and control of the TCAP process. Request for the modifications were made to RTF. Bechtel Design is preparing a cost estimate for the Change Control Board to consider their implementation.

The first modification involves the elimination of dead volume in the gas transfer line between the Pd/k column and the plug flow reverser (PFR). Calculations indicate that this dead volume will cause the tritium concentration in the raffinate to increase from the original goal of one percent to five percent. This level of tritium will exceed the 1.6 percent maximum allowed in the D2 storage beds for accountability purposes. The D2 storage beds do not have in-bed accountability capability.

The second modification involves the relocation of a pressure transducer outside of the inlet of the PFR to the far end of the PFR. Calculation and Advanced Hydride Laboratory (AHL) data show that the line pressure, as measured by the current transducer location, is different from the PFR pressure and will be a poor indication of the amounts of gas transferred to or from the PFR. This modification was implemented in the AHL TCAP and the TCAP. The current demonstrated control scheme is based on the pressure at the far end of the PFR. Without this pressure transducer, a new control scheme will have to be developed and demonstrated.

The third modification requires the addition of a pressure transducer at the far end (product end) of the column. This pressure indicates how full the column is during gas transfer and when to end the transfer phase of the control program. This modification was also implemented in the AHL and the TCAP. Without the pressure transducer, the demonstrated control program will have to be modified and demonstrated.

These modifications are necessary for the proper separation performance and control of the TCAP process. Refer to, "RTF TCAP Process Line Modification

Justifications" (SRT-HTS-92-0151), for additional information and justification for these modifications.

Alternative Container Material Recommendation for the Hydride Transport Vessel

E. A. Clark

MTS recommended that the SRTC Packaging and Transportation (P&T) group of SRTC design a Type 316 stainless steel, with a minimum of 0.04 wt. % carbon, for the container material of a uranium hydride tritium transport vessel. However, the use of Type 316 in this application would require a post-weld heat treatment to solutionize carbides that could precipitate during welding. Performing this heat treatment onsite would be impractical. The American Society of Mechanical Engineers (ASME) Code, to which the transport vessel is being designed, allows the use of Type 347 stainless steel under the design conditions of the vessel. MTS was asked to comment on substituting Type 347 stainless steel for Type 316 in this application.

The American Iron and Steel Institute (AISI) Type 347 stainless steel has a chemical composition similar to Type 304 stainless steel, with the addition of niobium and tantalum. Niobium and tantalum form carbides more readily than chromium; the niobium/tantalum carbides do not reduce the resistance to intergranular stress corrosion cracking like chromium carbides (when formed at grain boundaries) during "sensitization". Thus, Type 347 is termed a "stabilized" grade of austenitic stainless steel. Because of this, no post-weld heat treatment of Type 347 is required. Although extensive experience using Type 347 in tritium service is lacking (Type 347 is used in a few tritium containment applications at SRS), sufficient mechanical testing data in hydrogen shows that Type 347 is similar to Type 304L stainless steel in hydrogen service. Type 347 is relatively immune to gaseous hydrogen in tensile, fatigue, and fracture mechanics testing. In addition, one study of creep rupture properties at 678°C indicated no effect of hydrogen compared to helium. Based on the literature, Type 347 is recommended as a substitute container material of construction.

Initial NdCo₃ Tritium Isotherms

J. R. Wermer, D. E. Moseley, and M. L. Johnson

Three equilibrium absorption isotherms were run on NdCo₃ at 125°C, 150°C, and 175°C. This NdCo₃

material is a candidate hydride for a hydride-based separation system that will remove hydrogen isotopes from a stream of inert gasses. The three absorption isotherms are consistent with previous hydrogen and deuterium isotherms and have two plateau regions with a

total capacity of approximately $T/M = 0.8-0.9$. After determination of the last isotherm, the sample was not unloaded and placed in storage. Additional isotherms will be run at later dates to determine tritium aging effects. The three isotherms are shown in Figure 3.

Nd Co₃ Tritium Absorption Isotherms

Figure 3. NdCo₃ Tritium absorption isotherms

Development of Metal Hydride Composites

J. W. Congdon

Dispersing porous granules can be used to fabricate stable metal hydride composites of LaNi_{4.25}Al_{1.75} (LANA .75) in a porous copper matrix. The unsintered copper matrix can be cold pressed to sufficient strength for this application.

These composites survived short term cyclic tests (hydrogen absorption/desorption) without any observable damage to the matrix. The Hydrogen Technology Section's (HTS) testing indicates that the absorption/

desorption rates and storage capacities for the metal hydride composite are acceptable. Some metal hydride powder on the surface of the pellets was removed during cycling. Additional losses might be expected in long-term tests.

Several coating techniques will be evaluated to help contain the LANA .75 within the pellets. The initial test results for sol-gel coatings are promising. It may also be possible to alter the die loading and pressing operation to minimize the amount of LANA .75 exposed on the surface of the composite.

Life Storage Inventories and Five Year Schedule for Design Agencies

K. A. Dunn

The design agencies—Sandia National Laboratory-Livermore (SNLL) and Los Alamos National Laboratory (LANL)—prepared Life Storage inventories for review. The inventories included a list of all reservoirs in storage for each design agency by reservoir type and serial number. Other information in the inventory includes original fill pressure, current pressure, original grams of tritium and deuterium, date of original fill, and various dates associated with elevated or ambient temperature storage for each reservoir. This information will be transmitted to DOE-SR after comments are received from the design agencies. In addition, a five year test schedule for reservoirs in the Life Storage Program for each design agency was prepared. This document provides a projected work schedule for each reservoir in the Life Storage Program over a five year span. SNLL was visited September 14, 1992 and LANL was visited September 23, 1992 to discuss the inventories and test schedule. Input from each design agency will be incorporated into the documents before the final issuance.

Life Storage Program

H. D. Brown, M. W. Daniel, B. W. Waller

The Life Storage Program is an on-going stockpile surveillance program designed to assure reservoir reliability. This involves loading, unloading, reclamation, and destructive testing of production and developmental reservoirs.

Tritium Operations began unloading 25 special reservoirs for the MTF. Six reservoirs were transferred to 234-H and three were unloaded.

Ion-Current Measurements (ICM) of tritium permeation into secondary containers are run on a monthly basis. No reclamations or refills were done this month.

Storage Test Parts

W. R. Kanne, Jr.

Final preparations were made for loading twelve upset welded reservoirs for the program to develop resistance welding technology for reservoir fabrication.

A test authorization for loading the reservoirs was written and approved in coordination with the HTS. It includes information on qualification, procedures for loading and handling the parts, conditions for storage, later destructive evaluation of the reservoirs, and safety of the operations. Additional information and records needed for loading were supplied to the Tritium Department and they are completing their procedures. Loading of the six spherical and six reinforced design reservoirs should take place this month. LANL provided funding for reservoir loading.

Additionally, microhardness traverses across the upset welds were completed as part of the destructive examination of companion storage reservoirs. Knoop hardness readings show that in these upset welded 21-6-9 stainless steel reservoirs, the hardness remains essentially the same across the weld area as in the base metal. In contrast, the hardness of fusion welds significantly decreased the strength in the weld area. The spherical reservoirs and the reinforced design reservoirs have hardness in the weld center equal to the base metal with a slight drop on either side of weld center. Forged base metal hardness varied from about Knoop 275 to 340 (Rockwell-C 21 to 31).

Addition of ^3He Purification to the Tritium Consolidation Proposal

W. N. Posey

DOE requested that SRS add the ^3He purification process to other T₂ processes tentatively planned for transfer from Mound Laboratories to SRS. Mound Laboratories' process consists of passing SRS purified ^3He through a column assembly packed with activated carbon and cooled with liquid N₂ to remove tritium and other non-radioactive impurities. The He^3 purity obtained is 10^{-11} mole T₂ per mole ^3He .

Bechtel will estimate the cost of adding the ^3He purification process, which will be included in the revised Conceptual Design Report for Tritium Consolidation at SRS.

RTF Stripper Regeneration

A. K. Birchenall

The catalytic oxidation to tritiated water and the capture of the water on a zeolite bed strips the RTF nitrogen gloveboxes of trace tritium. Heating the beds

and cracking the resulting water vapor on a hot uranium bed periodically regenerates the zeolite beds. The uranium beds must be disposed of in an above ground repository. Substitute technology, such as electrolysis, could eliminate the need for uranium disposal.

A QA Level 1 purchase specification was prepared with assistance from Robert Young for the procurement of a solid oxide electrolysis cell. The Westinghouse Science and Technology Center (WSTC) is the selected vendor for this operation. Since the vendor is affiliated with Westinghouse, the purchase requisition is in the form of an Interdepartmental Work Request (IWR). The basis for selection of the technology was the reduction of tritium in the exhaust oxygen stream after tritiated water vapor is decomposed. The bases for selection of the WSTC as a vendor were a history of successful manufacture of fuel cells of similar design, improved ceramic-to-metal joints incorporated into the system compared to other potential vendors, and experience and equipment developed in the production of a similar electrolysis cell for NASA.

The Production Capability Assurance Program (PCAP), Waste Minimization initiatives, is funding (FY93) this activity.

Improved Tritium Stripper Development

A. Nobile

Tests to determine the ability of the SAES St 198 metal getter to remove hydrogen isotopes from flowing nitrogen began on an apparatus built at LANL. Tests involve flowing nitrogen containing 100 ppm D₂ through a tubular reactor containing 10.5 grams of 1 mm metal getter granules. In one test, where the bed temperature was 350°C and the gas flow rate was 400 std. cm³/min, a breakthrough of D₂ was detected after about 5.2 days (125 h).

Before the breakthrough, no D₂ was detected. A breakthrough curve was calculated from a model of the deuterium absorption process in the metal getter bed. The experimental breakthrough curve was broader and did not have the same shape as the model curve. Deviation between the experiment and the model is probably the result of one or more of the following phenomena:

- inhibition of the absorption kinetics by impurities

- disproportionation of the metal getter material
- a slow reaction of N₂ with the getter, which decreases the getter capacity, may be occurring to possibly broaden the curve

X-ray diffraction analysis of the samples will most likely indicate which of the above effects is occurring. The model equations are being appended to include the effects of the slow disproportionation reaction. The next and last scheduled test will be conducted at a lower temperature (250°C), where it is believed that the disproportionation reaction will be much less significant.

After completing of the model development and the last test, efforts can proceed on the design of a tritium stripping demonstration for the tritium facilities.

Leak Test Systems for the Container Management Facility

J. V. Cordaro, W. D. Thompson, S. Sommers, J. W. Anderson, G. E. Reeves, D. D. Rucker, S. Eckstein, D. L. Varble, V. G. Hughes, and J. A. Gietek

In September 1991, EES received authorization from the Tritium Projects Management Department to begin work on the Leak Test Systems for the Container Management Facility (CMF) project S-4655. EES is responsible for the design, installation and checkout of the systems. The CMF must be built so that Tritium Production can handle the new H1616-1 and H1616-2 shipping containers. DOE mandated that all loaded reservoirs be shipped in the new Sandia Albuquerque designed shipping containers.

The EES designed Leak Test Systems will automatically perform the 1×10^{-3} Post Load Leak Test and the 1×10^{-7} Yearly Certification Leak Test required by DOE. The Post-Load Leak Test System 2 was originally scheduled to be complete by December 1992, however, Tritium Projects requested that EES complete System 2 by October 1, 1992. The Yearly Certification/Post-Load Leak Test System 1 is scheduled to be complete by April 1993. EES met all milestones necessary to meet the October 1, 1992 deadline for Leak Test System 2.

Equipment & Material Technology (E&MT) completed the instrumentation and volume calibrations associated with Leak Test System 2. Functional testing

PROGRESS AND ACCOMPLISHMENTS

demonstrated that the E&MT designed Leak Test System 2 can automatically perform a post load leak test on 12 H1616-1 shipping containers within 45 minutes. Testing of H1616-2 containers will be completed by September 28, 1992.

Modifications to RTF Stripper System Ion Chambers

M. B. Wood, J. V. Cordaro, H. B. Hoover, R. L. Yon-
gue, J. S. Martin, V. G. Hughes, and D. E. Worrall

The RTF stripper system ion chambers (built by the Nuclear Research Corporation) measure the tritium content of the gas stream to determine the efficiency of the stripper process. The original specification did not require that the ion chambers be leak tight.

RTF requested that E&MT modify the ion chambers such that they could hold 1000 Torr for ten minutes with less than a 1 Torr drop in pressure.

E&MT made several modifications to the ion chamber design after determining the major leak points. The modifications included machining components, welding, and replacing electrical feedthroughs. After the modifications were complete, the chambers were successfully leak tested. The work was completed on an emergency basis, which allowed RTF startup activities to remain on schedule.

SEPARATIONS

General

Nominal Source Terms

P. L. Fisk

Part two of the response to DOE-SR concerns on the use of nominal source terms in non-reactor Safety Analysis Report (SAR) was issued. This second phase of the response to DOE includes a preliminary assessment of non-reactor facilities, a methodology for determining maximum credible source terms, and a schedule. Five facilities were identified as having nominal source terms most likely to differ from those documented, including F and H Canyons. Documentation of maximum source terms will be in the form of a Justification for Continued Operation (JCO).

F Canyon

Americium-Curium (Am-Cm) Solution

D. F. Chostner, J. H. Gray, and R. W. Wainwright

Kilogram quantities of Am-Cm are stored as a solution in tank 17.1 in F-Canyon. This material must be removed before F-Canyon is cleaned. Two alternatives are being investigated: addition of a neutron poison, neutralization and disposal in the waste tanks, and solidification and shipment to ORNL.

A trace amount of Am-Cm was added to a synthetic non-radioactive solution containing gadolinium as a neutron poison. The objectives of this addition are to determine how much of the Am-Cm will be removed from the solution during neutralization with excess caustic, if there is any Am-Cm element separation during precipitation, and how much of the Am-Cm will redissolve during storage.

The optimum result would be all, none, and none respectively. However, the solubility limits for these elements could complicate the interpretation of the results.

In place of sending the material to waste, this solution would be solidified and sent to ORNL for eventual use in their isotope production program. A review of candidate separation and solidification processes was started.

F-Canyon Support Activities

J. H. Gray and R. W. Wainwright

A laboratory investigation of the effects of adding MP-7 to dilute nitric acid solutions, neutralizing with excess caustic, and boiling to reduce volume was completed. MP-7 is an alkaline cleaning agent containing manganese and phosphorus compounds that dissolve rust and other metals. Results indicate that problems are not expected during the lab waste processing operations due to the presence of a few wt. % MP-7.

Materials to encapsulate the leaking EBR-II container was received for laboratory testing. These materials include a different type of aluminum and iron (carbon steel) component. The objective is to verify that these materials will dissolve during EBR-II fuel processing.

FB Line

Plutonium Storage Facility (PSF) Startup

R. Lopez, P. L. Fisk, H. S. Smiley, and J. A. McCormick

Nuclear Process Safety Research (NPSR) is providing support for PSF startup, with the following items in progress:

- Potential SAR changes are being compiled to enable page change SAR revision and JCO development.
- WSRC is reviewing the Operating Safety Requirements (OSR). OSRs converted to TSRs will be issued for WSRC review at a later date.
- The 6430.1A Compliance Report is undergoing review for potential open issues that may impact the SAR page change.

Stability of Cation Product During Phased Startup

E. A. Kyser

FB Line plans call for a phased startup where portions of the facility will be started up over several months. FB-Line Technology contacted the Chemical Technology Section (CTS) about the stability of the product from cation exchange for a month or more. This solution will contain 0.3 M sulfamic acid, which degrades to sulfuric acid and could potentially result in the formation of Plutonium (Pu) sulfate solids. Experiments were performed with Pu in nitric acid/sulfamic acid solutions and no evidence of solid formations were seen after one month. However, samples that contained ascorbic acid (used for Pu valence adjustment) formed a reddish brown precipitate after three to four weeks. This should not affect FB-Line plans as it was anticipated and valence adjustments should be performed just prior to precipitation. Efforts are continuing to determine the composition and mechanism of the formation of these solids.

235-F

Building 235-F Safety Analysis Report (SAR)

R. Lopez, S. M. Patel, and L. P. Modenos

The Process Requirement (PR) Team (SRTC, Separations Technology, and 235-F Operations personnel) is reviewing a draft of the original PRs to facilitate issuance for WSRC Review by October 1992.

The 235-F SAR was issued for WSRC review on Sept. 10, 1992. This revision included the AB-Line new shutdown status.

The Nuclear Criticality group is analyzing the use of the Rule of Fractions, and calculations are nearing completion. Results will be included in the OSRs.

235-F Holdup Measurements

R. A. Dewberry

ADS is assisting Scott Zapor with data collection, system calibration, and data interpretation of gamma pulse-height analyzer (PHA) holdup measurements in

the 235-F facility. He was also requested to review and sign the final report. As an independent check, the Np-237 holdup in ten "hotspot" locations was estimated from exposure measurements that required considerable effort in modeling the system represented by each location. Although several approximations and assumptions exist in the calculations from these models, this method has the benefit of being based on exposure readings collected close to the holdup locations, which was not possible with the PHA system due to excessive detector deadtimes. For the locations compared, which ranged from 0.4 to 8 grams Np-237, the maximum difference in Np-237 content calculated by the two independent methods was 50 percent. This is considered to be an extremely good agreement.

H Canyon

221-H Canyon SAR Update

J. M. Low and N. M. Hassan

The consequence analysis in the existing 221-H Canyon SAR is being updated from the ICRP-2 to the ICRP-30 methodology. In the SAR, doses are calculated for the maximum offsite individual, the offsite population, and the onsite population. Accident consequences to these groups increased by factors of 4.7, 2.5 and 6, respectively. This effort was completed and documented in a *Calc-Note*. NPSR is preparing SAR page changes to reflect the new consequence and risk values.

Because of increased interest in accident consequences to onsite personnel, NPSR also calculated doses to the facility operator at the site of the accident, personnel in the adjacent areas to the facility, the maximally exposed individual in the area (excluding the initiating facility), and area population (excluding the initiating facility). This effort was completed and documented in a *Calc-Note*.

Work is temporarily discontinued until the nominal source term issue is resolved.

211-H Outside Facility SAR

J. M. Low

- The Analysis and Justification Report (AJR) to support the OSRs for the UN Storage Tank is complete. Separations, Separations Technology, and NPSR personnel's final review of this document is complete. The AJR documents the thought process and the design basis used to develop the OSRs.
- DOE-SR provided additional comments on the 211-H SAR. These comments do not affect the safety envelope described in the SAR, therefore, they are not considered significant. These comments were incorporated per DOE-SR request.
- DOE-SR provided additional comments on the UN Tank OSRs. They do not affect the safety envelope described in the SAR, therefore they are not considered significant. These comments were incorporated per DOE-SR request.
- DOE-HQ delegated start-up authority for the UN Storage Tank to DOE-SR. DOE-SR is routing the SAR and OSRs for approval.

H-Canyon Stack Operational Readiness Review (ORR)

C. W. Jenkins

C. W. Jenkins, ADS, is serving on the three man Readiness Review Board (RRB) for the ORR held for the H-Canyon stack USQ closure.

Identification of H-Canyon Evaporator Plugging Material

M. E. Summer

The ADS contained scanning electron microscope (SEM) analyzed a solid material that was plugging the low activity waste evaporator tubes in H Canyon. The analysis, performed by the site's only SEM capable of handling radioactive material, determined the substance to be calcium sulfate (gypsum). Based on the analysis, John Gray, of the Chemical Technology Section (CTS), recommended an increase in acid concentration in the evaporator to prevent the pluggage problem.

211-H Enriched Uranium dibutyl phosphate (DBP) Content

E. A. Kyser and K. J. Kalbaugh

Uranyl nitrate samples from two tanks were analyzed for DBP. DBP, measuring 28 and 35 ppm, was found in the respective samples upon the extraction of the DBP into 2-ethyl hexanol. Acid hydrolysis of soluble tributyl phosphate (TBP) from the solvent extraction cycles from DBP. Large amounts of DBP could pose a mechanism for precipitation of U-235 in storage tanks. Previous work shows that up to 100 ppm of DBP posed no problem with solids formation. Seven months ago, analysis of samples from these tanks found 29 and 37 ppm of DBP respectively (rather than 298 and 27 reported previously). Storage tanks are sampled periodically to ensure that problems do not develop over time.

HB Line

HB-Line

D. P. Eisele

Contracted work on the HB Line Consolidated SAR continues with the subcontractor drafting Chapters 3, 7 and 8. Comments on Chapter 5 are still being resolved for issuance to NPSR.

WSRC personnel are developing Chapters 6 and 9 and restructuring Chapter 4.

NPSRs assistance to the HB-Line restart continues with the following contribution:

- The Instrument Air and Domestic Water Failure Modes and Effects Analysis (FMEA) was completed and issued to Separations Technology.
- The hydrogen generation rate issue was analyzed and a Technical Memo was issued for ORR review.
- The Process Air Purge OSR was analyzed, rewritten, and issued for WSRC review.

HB-Line Direct Support

M. A. Whitney and A. G. Eggers

The P&T group reviewed six HB Line procedures. The system and concept for helium leak testing of the EO-61 was reviewed and modifications were suggested and implemented. In addition, an acceptance criteria for the inspection of the structural welds in the outer aluminum shield tank was recommended.

Laser Raman Hydrogen Monitor for HB-Line

S. E. Nave, P. E. O'Rourke, and R. A. Malstrom

A laser Raman system is being developed for the online measurement of hydrogen in HB Line dissolver off-gas. The system should have sensitivity in the 0.1 percent hydrogen range without being subjected to interferences from other gases. To provide this level of sensitivity with a reasonably sized laser system requires that the off-gas sample be pressurized. A gas booster that will deliver a 1 cc sample of gas at a pressure of 1500 psi was acquired. The device is being assembled for testing in the laboratory with various gas mixtures containing hydrogen.

SAR for the Uranium Solidification Facility (USF)

J. M. Low, V. F. Serrano, and T. L. Slaven

Submission of the SAR for the USF in January 1993 is a DOE milestone. New and revised DOE orders and review criteria, in place since the November 1990 SAR draft submission, represent a significant change of scope from the time the milestone was set. Discussions were initiated to clarify requirements and, if necessary, reschedule the milestone. Per DOE-SR direction, NPSR initiated comment resolutions for the USF SAR. NPSR received 578 comments to date. NPSR prepared draft responses to 108 comments.

9970 & 9971 Packaging Development for USF and NF

G. A. Lucky, R. S. Maurer, and K. M. Stawney

The final certification test report was reviewed and appropriate comments are being incorporated before it is issued. The editing and titling of the testing video

will continue when access to the editing equipment is available.

Separations General

Onsite Packaging Inventory

G. Lucky, A. Eggers, and B. Jackson

A draft document entitled, "Criteria For On-Site Transfers of Radioactive Material", is being reviewed and refined by the P&T group. It includes functional requirements, quality assurance, operating procedures, thermal, structural, radiation protection, criticality safety, providing hazards information, and criteria for the package design conditions. A meeting to present a summary of these criteria to cognizant WSRC employees to obtain responses and comments is planned for early October 1992.

Compilation of 5320 Safety Analysis Report Packages (SARP)

M. A. Whitney, K. M. Stawney, and A. G. Eggers

The revised 5320 SARP (now Revision 3) was completed. The SARP incorporates the design changes, analysis and testing required to resolve the various issues of concern raised by reviewers of the previous submittal. The revised SARP was transmitted to DOE-SR as a draft for review. WSRC management is reviewing the draft parallel to DOE-SR. This submittal satisfies a P&T group's September 30, 1992 milestone.

Complex 21

TASP-Pu Flowsheet Simulation

W. B. Sumner and S. D. Fink

Recently, the Collaborative Modeling Effort focused on collecting additional data to support the Preliminary Environmental Impact Statement (PEIS) for the Complex 21 Pu processing facility. Information collected for the PEIS in January 1992 and transmitted to the Architectural Engineering (AE) firm must be revised to reflect alterations in the BASELINE operations that resulted since January 1992 due to:

PROGRESS AND ACCOMPLISHMENTS

- suggested improvements by the various technology groups
- reduction in the proposed scale of the facility
- consideration of the treatment of existing complex residues in the facility
- development of several additional alternative processing schemes (i.e., flowsheets representing two variations of Chloride Recovery operations and the Aqueous Nitrate alternative)
- various identified inaccuracies in the January 1992 data

Several meetings were held at LANL – with participation of personnel from LLNL, Rocky Flats Plant (RFP), WSRC, and LANL – during which the data was collected and a format was standardized and encoded into the simulation models. The objective was to issue a revised Design Guidance Manual package to DP-40 by mid-September 1992 with preliminary analyses of the BASELINE flowsheet.

Development of the simulation code for the Aqueous Nitrate Alternative flowsheet was placed in a lower priority, relative to support of the BASELINE data collection effort, so the new data package could be prepared in a timely fashion. The WSRC resources used to support the simulation effort contributed significantly to the data collection for the BASELINE Nitrate Recovery operations and to an effort to ensure adequate compatibility between the various data sets for the individual modules (i.e., Manufacturing, Nitrate Recovery, Chloride Recovery, Disassembly/Metal Purification, and Solid and Liquid Waste Management). After completion of the BASELINE flowsheet, the data set for the Aqueous Nitrate Alternative was completed for inclusion in the PEIS package. A package of information (SRT-CTS-92-200) describing the Aqueous Alternative Flowsheet was transmitted to LANL. The package included an EXCEL version 4.0 database defining the individual unit operations and various associated graphics. The defining document (WSRC-RD-92-003) for the Aqueous Alternative Flowsheet was issued.

Another objective of the LANL-hosted meetings was to identify and rank the research and development efforts needed to support the Complex 21 facility. Each of the technology groups prepared a ranking of

the R&D programs identified for operations within their assigned facility area. These listings were forwarded to the Pu Working Team for approval prior to submittal to DP-40. Some potential FY93 funds were identified for developmental programs and the listing will presumably help determine disbursements.

A meeting of the Collaborative Effort participants was held at LANL on September 22 and 23, 1992 to discuss the complete data and the preliminary analyses for the BASELINE flowsheet. A presentation of the work for the BASELINE and Alternative data sets was presented.

DP-40 routed the draft of the Lead Laboratory Protocol for comment. As reported, DP-40 and the design laboratories (LANL, LLNL, and SNLL) agreed to distribute the responsibility for technical areas associated with reconfiguration activities among the organizations. Under this organizational format, the individual Lead Laboratory assigned responsibility for a given technical area will provide coordination of support activities throughout the complex. The Lead Laboratory Protocol defines the roles and responsibilities for the various participants, discusses funding mechanisms, and addresses the transition of current roles (i.e., the shifting of duties assigned to Technology Assessment Selection Panel to the Lead Laboratory). The protocol not only addresses the R&D activities, but defines roles through the start of operations at the Complex 21 site.

Complex 21 Storage Facility T. S. Rudisill

Design criteria for the Complex 21 Storage Facility (vault) were developed by considering accident initiators evaluated in the Final Safety Analysis Report (FSAR) for the Plutonium Storage Facility. The intent of this process was to systematically identify the design criteria necessary to mitigate potential accidents associated with vault operations. Criteria were developed for the storage facility building and storage container(s). Criteria were also included for material acceptance and surveillance when applicable. In many cases, different criteria were specified for pits, plutonium metal, plutonium oxide, and residues, as dictated by the accident initiator.

ENVIRONMENTAL

Reactor Restart

Site Specific Response Spectra

R. C. Lee

The University of Texas at Austin placed a purchase requisition for dynamic testing of SRS soil samples on September 3, 1992. Testing on several shallow (less than 300') soil samples collected as part of the Confirmatory Drilling program began. Deep (300' - 1,000') samples for dynamic testing are being collected. The dynamic measurements are the key to the development of ground motion prediction at SRS.

Pen Branch Fault (PBF) Confirmatory Drilling

R. C. Lee and A. L. Stieve

The project field work is close to completion and the holes are completed and geophysically logged. Richard Lee and Alice Stieve are developing a computer program for well log interpretation that is being used in the analysis of the geophysical logs obtained during this study. Approximately 2.5 cores will be logged in the lab before the task is complete. Currently, the data is being analyzed and interpreted.

Quaternary Investigation

A. L. Stieve

A draft of the final Quaternary Investigation report was received from Geomatrix. Copies were sent to Tilford, Crone, Hatcher, and the Earth Sciences Advisory Committee (ESAC) for review. Tom Cardone is also reviewing the document in place of Jeff Kimball.

Sitewide Environmental

Completion of Tests at the SRTC A-1 Stripper Well

R. A. Sigg, J. E. McCarty, and M. A. Sanders

Tests of a flow-through liquid scintillation counter at the SRTC A-1 Stripper Well were completed. This technology is being tested for future use as a tritium effluent water monitor. The monitor performed reliably during the 2.5 months of near continuous operation. The sample pretreatment system, consisting of a coarse cross-flow filter and a continuous distillation apparatus, operated without blockage. Monitor sensitivity for tritium is more than 20 pCi/mL for data averaged over five minutes and one day respectively. The liquid-scintillation based monitor is being relocated to a shed at L Lake to test pretreatment methods using surface water.

Geology, Seismology, Geotechnical (GSG)/Geographic Information System (GIS) Program Plan Issued

R. C. Lee

The final GSG/GIS Program Plan for the development of an integrated sitewide GSG database was issued. The plan outlines GSG data types, organizations that historically collected or used GSG data, and how the data may be incorporated on a geographic information system. The plan completes a milestone for the Defense Nuclear Facilities Safety Board (DNFSB).

Interim Position on Seismic Spectra for the Replacement Tritium Facility (RTF)

D. A. Stephenson and R. C. Lee

The WSRC Structural Mechanics Section requested assistance on an interim position statement on the seismic spectra for the RTF. The statement is based on the assumption that the current peak acceleration of 0.19g, as recommended in UCRL 15910, is DOE's position for non-reactor facilities. Recommendations of spectral shape for analysis of the RTF were based on recommendations made in the URS/Blume, Inc. (1982) report and the Geomatrix (1991) evaluation for

PROGRESS AND ACCOMPLISHMENTS

the K Reactor. SRTC concluded that use of the spectra for a specific earthquake and site specific soil properties are recommended for liquefaction studies rather than the envelope spectra design, recommended in the Blume report. The Geomatrix local/Charleston spectra should be used because the site specific soil data incorporated into this study was not available for the Blume analysis and for calculations of the response of RTF; a duration of 10-15 seconds should be used as a best approximation for the Charleston and local earthquakes.

Par Pond Aerial Gamma Survey Preliminary Results

H. E. Mackey

The last of three aerial gamma surveys was completed on Par Pond in early September 1992. Preliminary analysis of count-per-minute data for gross gamma and 137-Cs indicates that the count rates increased slightly overall, relative to measurements taken in August 1991 with more areas showing increased count rates than areas showing decreased count rates. Approximately one-third of the area surveyed showed no change in count rates. The increase is attributed to drying sediments over time.

Radionuclide Assessment Program (RAP) Plutonium (Pu) Completed and Transmitted to DOE

Evans, Carlton, Murphy, Strom, Geary, and Pinder

The RAP document on Plutonium in the SRS Environment was completed and transmitted to DOE for review. This is the fifth in a series of eight documents on individual radioisotopes released from SRS. The earlier documents describe the environmental consequences of tritium, iodine (I), uranium (U), and cesium (Cs.) Documents on strontium (Sr), carbon (C) and technetium (Tc) are being prepared.

RAP Tritium, Rev 1, Addendum 1 Issued

C. E. Murphy, and Jr. W. H. Carlton

The RAP document on Tritium in the SRS Environment (WSRC-RP-90-424, Rev 1) contains tritium monitoring data through 1988. An addendum that updates the monitoring data through 1990 and discusses major releases and public concerns through

1991 was issued. The document will be revised by June 30, 1993.

New Sanitary Landfill Siting Studies

L. D. Wike, R. K. Aadland, and J. S. Haselow

The approach used in selecting and evaluating candidate sites for the New Sanitary Landfill was presented to WSRC and DOE-SR Waste Management. No modifications were requested. It is anticipated that the first phase of the evaluation will be completed in early October 1992 and the results will be presented to Waste Management, DOE, and the South Carolina Health and Environmental Control (SCDHEC). The initial studies will rank the seven candidate sites based on surface features and identify the most favorable candidate sites for subsurface geotechnical characterization.

Seismic Monitoring Network

D. A. Stevenson

Seismic monitoring at SRS during September 1992 continues with four onsite remote recording stations. Right-of-access permission for the last offsite seismic upgrade station was received. The background noise surveys were completed, allowing the US Army Corps of Engineers (COE) and DOE to begin final negotiations with land owners for long term leases. Teledyne Geotech technical personnel visited the site to provide training and an initial system checkout on portions of the new instrumentation they provided.

Seismic Attenuation Report

R. C. Lee

The purpose of the Seismic Attenuation study was to determine the seismic attenuation (Q) in the basement below K Reactor for use in the calculation of seismic hazard. A report documents that the modeled attenuation in the sedimentary rocks of the Dunbarton Basin yielded a Q of 40. This Q value is high, compared to that for the soil column above the basement, but it appears to be consistent with the effect of overburden pressure on the deep soil layers. The Q value reduces the ground motion above the Dunbarton Basin, compared to what would be experienced above crystalline bedrock.

PROGRESS AND ACCOMPLISHMENTS

Dosimetry Technical Support

D. M. Hamby

Technical support of SRTC's dosimetry function for this month included:

- conducting dispersion calculations for RTF and assisting with responses to DOE on dispersion modeling and downwind dose estimation
- modeling concentrations of Offgas Component Test Facility (OCTF) releases for Laboratory Services Section (LSS) (the OCTF, located at TNX, is a mock-up of the Consolidated Incineration Facility (CIF))
- calculating as low as reasonably achievable (ALARA) dose-release factors for aqueous curium in response to the Environmental Monitoring Section's (EMS) request
- reviewing the Quality Assurance (QA) report for the Reactor Accident Program compiled by the Risk & Source Term Technology group
- performing atmospheric modeling using AX-AIR89Q for the Waste Analysis group of Nuclear Processes Safety Research (NPSR).

TNX Diesel Spill Remediation

R. L. Nichols, C. J. Berry, and N. L. Turner

As a result of an August 1992 meeting between DOE-Environmental Compliance Division (ECD), Environmental Protection Department (EPD), Environmental Services Section (ESS), and TNX Operations Section (TOS) to determine the path forward concerning Area 3 of the 678-T diesel spill, a two-inch well casing was installed in the subsurface at the diesel spill area. The wells will be utilized in an experimental program to evaluate the enhancement of the natural biodegradation processes. The wells will provide air circulation to the subsurface due to natural barometric pumping. The increased air flow is expected to promote the natural biodegradation of the small amount of residual fuel. The project will last two years, at which time the site will be cored to evaluate the effectiveness of the enhanced biodegradation process. Samples of soil gas will be collected periodically to measure for degradation products. The site will be further characterized in 1995. Any residual contamination will be ad-

ressed when the building is scheduled for Decontamination and Decommissioning (D&D).

Lost Lake Tour for Environmental Advisory Committee (EAC)

H. E. Mackey and J. B. Gladden

Representatives from SRTC, EPD and the Savannah River Forest Station gave Drs. Ruth Patrick and John Cairns, of the EAC, a tour of the Lost Lake wetland restoration site. They commended the SRS effort for restoring the wetland habitat.

Support of Regional Hydrogeology/Microbiology Studies

C. B. Fliermans, M. M. Franck, R. K. Aadland and R. Van Pelt

DOE initiated a joint project with the city of Hilton Head, South Carolina to collect hydrogeologic and microbiologic data during the drilling of a deep water production well on Hilton Head Island. Samples of 98 sidewall cores were collected for geological, paleontological, and microbiological analyses. The data will be utilized to enhance the regional hydrostratigraphic program. Extensive microbiological analyses will be conducted to characterize the microbial population in deep aquifers.

New Production Reactor

Pen Branch Fault (PBF) Program

A. L. Stieve

Updates on the PBF/Quaternary Investigations, joint programs between New Production Reactor (NPR) and Reactor Restart, are included in the Reactor Restart section of this report. (page 32)

Environmental Restoration

Wetland Soils Study Sampling Completed

V. A. Rogers and K. L. Dixon

Sampling was completed for the Background Wetland Soils Study. This study, jointly funded by ER, collected surface soils (less than 3 m depth) at more than 75 locations on and off SRS to establish background concentrations of radionuclides and hazardous/non-hazardous constituents in wetland soils. Sampling was stratified by major wetland soil types. Samples were shipped to subcontractor and WSRC laboratories for analysis.

Quarterly F & H Areas Seepage Sampling Completed

V. A. Rogers and K. L. Dixon

The second round of quarterly samplings to measure tritium, specific conductivity and pH in water along the F & H Areas seepage downslope from the seepage basins was completed in September 1992. Approximately 50 locations were sampled and the results will be transmitted to Environmental Restoration Department (ERD) in early October 1992. The results are expected to confirm earlier findings that tritium concentrations and specific conductivity values declined at most seepage locations in relation to sampling results from 1989. Initial evaluations of specific conductivity data confirms this expectation.

F and H Area Groundwater Remediation

R. N. Strom

The mercury speciation project was initiated as a result of an analytical subcontract with the University of South Florida. The purpose of this investigation is to study the species of mercury (oxidized, reduced, or elemental) in soils and groundwater in the F/H Area as a factor in designing remediation systems, such as groundwater "pump and treat". The actual species of the mercury will likely control many factors in the design of the remediation system. The biggest stumbling block in completing this type of analysis is developing an excellent analytical technology for determining ultra-low levels for different mercury species. Speciation of mercury in soils will first be investigated through a

new method developed by Drs. Robert Braman and Dean Martin. A recent visit to SRS resulted in excellent interactions with ERD, Analytical Development Section (ADS), and Environmental Technology Section (ETS). In the future, they will work to develop groundwater speciation methods that can be used at SRS.

A and M Area Groundwater Remediation

J. S. Haselow and B. B. Looney

Plans are underway to investigate an innovative groundwater remediation technology developed in Germany. The Unterdrucken Verdampfen Brunnen (UVB) process relies upon circulating groundwater within a single vertical wellbore using an upper and lower screen. A vacuum pulls air through the contaminated water in the well, stripping volatile organics (VOC) without having to pump the groundwater to the surface. This in-situ technology has the advantage of lower costs because groundwater does not need to be pumped to the surface for treatment. An ideal location for demonstration of this new technology is the Metallurgical Laboratory Basin in the 700 Area. SRTC and ERD personnel are working together to plan this field demonstration using funds from EM40 and EM50.

A two dimensional axisymmetric groundwater model of the vacuum vaporizer well was completed. The model will be used to determine the optimum internal pumping rates for the well and to assess the zone of influence at this specific location at SRS.

Soil Gas Probe Development

L. C. Baylor and B. R. Buchanan

Ken Karp, of Chem Nuclear Geotech (Grand Junction, Colorado under DOE-Albuquerque), visited SRTC in late September 1992 to display and discuss a soil gas probe he developed. Though not a screening tool, the probe is useful for long-term investigations. It functions in saturated and vadose zones by absorbing gases through a water-impermeable and into a carbon solvent. The sorbent cartridge may be pulled and replaced with fresh cartridges without removing the probe from a well or bore hole. Gas chromatography water desorbed the gases for analysis. Pairs of passive surface flux collectors, also at Grand Junction, were developed at four locations on the Sanitary Landfill for a one week test. At the end of this period they will be col-

lected and analyzed for a variety of volatile organic compounds, one of each pair is located at Grand Junction and SRS. These collectors work with the same sorbent as the soil gas probe, are inexpensive to make, and reusable.

Barometric Damping Test to Monitor the Cap at the Dynamic Compaction Test Facility

B. B. Looney

Dynamic compaction using controlled impacts of a large weight is proposed as one element in closing low level radioactive waste burial trenches. The compaction operation is intended to compress the waste and minimize the potential for future subsidence. Such subsidence could compromise the low permeability cover and necessitate long term maintenance and repairs. Some of the proposed dynamic compaction would be performed in areas surrounding a facility that is closed and capped, such as the Mixed Waste Management Facility (MWMF). Preliminary engineering tests of dynamic compaction in such a setting are planned as a prudent step in the closure process. A Dynamic Compaction Test Facility (DCTF) was constructed to evaluate the compaction process in terms of the compression of waste trenches and potential impacts to nearby facilities. Careful testing and documentation of a clay cap at the DCTF and the effects of the adjacent compaction operations on the cap are important considerations supporting the development of final closure plans for trenches surrounding the MWMF. During compaction, a tracer test was performed using helium to supplement the detailed geophysical monitoring performed by ERD. Following the active compaction period, ERD installed several infiltrometers to determine if there were long-term impacts on the permeability of the cap. ESS designed simple probes to observe the propagation of barometric pressure fluctuations through the cap to provide an alternative to the complex infiltrometers. If successful, the probe tests will provide similar data at a lower cost.

Risk Evaluation for Remedial Alternatives (RERA)

M. S. Williams

A (RERA) for the Low Level Radioactive Waste Disposal Facility (LLRWDF) closure was prepared. The RERA is a qualitative assessment of the closure activities for the LLRWDF. It is intended to fulfill the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements for the Resource Conservation and Recovery Act (RCRA) closure of the LLRWDF. The RERA will be revised as a result of the alternate technologies task teams study for the alternate closure options. The alternate technology team was formed to evaluate other stabilization methods, however, dynamic compaction is still considered to be the best alternative for most of the Engineered Low Level Trenches (ELLT) and the slit trenches.

Separations Equipment Department (SED) Decontamination and Decommissioning (D&D) Support

J. L. Hansen

Development of a specific set of safety documentation requirements for the SED D&D characterization activities continues. Accident analysis, excluding the pending criticality results, are complete. A final report of the safety analysis and the Unreviewed Safety Question (USQ) evaluation is expected by October 16, 1992. The accident analysis for the SED facility indicated a potential for a new accident initiator. Evolution of hydrogen by radiolytic decomposition was postulated and quantitatively supported as a potential initiator for an explosion accident. Four of the facility columns were subsequently sampled for hydrogen. Three of the columns had no detectable hydrogen and the fourth column was 0.46 percent hydrogen. Explosive concentrations of hydrogen are not indicated and no further sampling is anticipated.

Burial Ground Inventory

M. L. Hyder and N. D. Woody

ERD requested that an inventory of material in the old burial ground be developed. The purpose of the inventory is to obtain a better description of the contents of the Burial Ground utilizing records and

PROGRESS AND ACCOMPLISHMENTS

sources of information that may not have been adequately reviewed in previous studies (e.g., process knowledge). The quantity and location of radioactive material is to be compiled in a form suitable for future use. A work plan for FY93 was developed and is under review. In the meantime, a variety of potential sources of information were identified and several people familiar with the early operations were interviewed. An initial meeting with burial ground supervision was held and the administrative log for the old burial ground has been obtained. The first part of the study will concentrate on tritium burials, particularly 200-H Area. A search for tritium records on the COBRA database was performed and is being reviewed.

Office of Technology Development (OTD)

Integrated Demonstration (ID) for Cleanup of Organics in Soils and Groundwater at Non-Arid Sites

Looney, Eddy, Haselow, Hazen, Rossabi, Jarosch, Berry, Kaback, Walton, Bergren, Kirr, and Barnard

Operations and Management

The FY93 budget request for the Savannah River ID (VOCs in Non-Arid Soils) was submitted to DOE-SR for review and forwarded to the OTD for consideration and action. The ID budget request for FY93 was structured around four remediation systems—in-situ bioremediation, off-gas treatment technologies, in-situ thermal, and enhanced bioremediation (bioreactor systems and vegetation enhanced bioremediation)—with a significant portion of the budget dedicated to support technologies, including monitoring and sensor development, characterization activities, and directional drilling demonstrations. In an effort to ensure that the technologies recommended for funding in FY93 addressed Environmental Restoration (ER) needs at SRS and throughout the complex, technology selection efforts were coordinated with ER staff members and a Technical Support group leader from ID. Thirty six technical task plans were included in the budget request representing a total budget request of \$16.4 million. No official action was taken on the budget request; however, preliminary comments appear to be favorable. Programmatic updates of the ID will be pro-

vided to ER staff after issuance of the Program Execution Guidance.

Remediation

A licensing meeting was held in Augusta, Georgia to publicize the large number of SRTC biotechnology related patents. More than 100 participants from 50 companies attended the meeting. Additionally, local newspapers and television stations attended and reported on the meeting. Based on the level of interest, several licenses should result from the meeting. Thus, the meeting represents a success for the technology developers in SRTC and the Technology Transfer Office who arranged the meeting.

Operations at the in-situ Bioremediation Demonstration are continuing smoothly. This test, designed to demonstrate in-situ remediation of VOCs in soils and groundwater through microbial degradation by methanotrophic bacteria, spans for seven of the twelve months scheduled. Injection of air and methane into a horizontal well below the water table encourages the microbial activity, while a vacuum draws on a second horizontal well above the water table in the unsaturated zone. Injection of methane resulted in increases in the densities of the methanotrophic bacteria known to degrade VOCs by four to five orders of magnitude. In addition, most of the injected methane was utilized by indigenous bacteria and appeared only in trace quantities in the extraction well. This behavior is quite different from that of the inert tracer gas, (helium) injected to monitor vapor flow in the subsurface during the demonstration. Another indication of the microbial degradation process is the measurable increase of carbon dioxide, a degradation product, in the subsurface.

Plans for the dipole radio frequency (RF) demonstration at the ID site are progressing. This demonstration, designed to be a thermal enhancement of the vapor extraction process, will be conducted jointly with industry (KAI, Inc.) and Westinghouse Electric Company. Characterization data show that large concentrations of VOCs are held within the clayey layers of the unsaturated zone. Removal of these contaminants from the low permeability zones is difficult; thus, thermal enhancement should greatly improve the remediation efficiency of vapor extraction in these zones. Installation of a well to conduct this demonstration is discussed in the drilling section. Treatability work and

PROGRESS AND ACCOMPLISHMENTS

electrical measurements on core samples are complete. WSTC is revising the final test plan.

Investigation of natural barometric pumping as a passive remediation technology at small sites continues. Natural flow of air in and out of monitoring wells were monitored over the last several months. The data indicates a strong correlation in barometric pressure changes with a slight phase difference. This technology has potential for remediation of small sites by passive venting/enhanced bioremediation.

Characterization and Monitoring

The Ion Trap Mass Spectrometer, modified by the ORNL for field applications, was delivered to SRS for use at the ID Site and the Environmental Resources Department (ERD). This technology can be used for rapid field screening of environmental contaminants in water, air, or soil samples. A meeting describing the availability of the equipment was held with EPD-Groundwater, Environmental Protection Department-Environmental Monitoring Section (EPD-EMS), ADS, DOE, and ERD. The possibility of reducing the need for offsite analysis of some of the M-Area quarterly ground water samples was discussed.

Directional Drilling

Demonstration of a utility industry horizontal drilling technology was successfully completed with installation of a well designed for the thermally enhanced vapor extraction demonstration scheduled for early 1993. The innovative drilling system, developed by Charles Machine Works (Ditch Witch) and SNLL, utilized no drilling fluids to drill the hole. The technology represents a potential for a relatively inexpensive system for installing horizontal wells to improve access to the subsurface. The new well, installed at a horizontal depth of 37 feet, is screened for approximately 300 feet with fiberglass casing to withstand the high temperatures of the heating demonstration. The cooperative research and development agreement demonstrates industry's involvement and joint laboratory interactions.

Two additional horizontal wells are planned for installation under the M-Area Settling Basin. This demonstration will target the river crossing horizontal drilling technology. Two blind hole wells will be drilled at a depth of 115 feet and will extend for a length of 500

feet in the horizontal. These wells will be turned over to the ERD for incorporation into the Vadose Zone Remediation Program. The Cherrington Environmental Company will drill the wells with revert drilling fluid.

Substrates for Metal Binding Algae Evaluated

E. W. Wilde

Scientists from WSRC and Lawrence Berkeley Laboratories (LBL) began evaluations of substrates for immobilizing heavy metal sorbing algae. Initial tests evaluated glass wool and foam substrates. Two kinds of algae, *Mastigocladus* and *Cyanidium*, grow well on both substrates, while two other types of algae, *Chlorella* and *Oedogonium*, would not satisfactorily attach to the test substrates. However, the algae readily rinsed off the glass wool substrates indicating that it is unacceptable as a potential medium for growing algae for use in developing metal removal columns. The algal growth penetrated throughout the foam substrates and were not readily removed by washing. Two kinds of *Spirulina* were also grown on foam substrates and tests were initiated to evaluate metal sorption properties in packed columns using several algal treatments.

Soil Washing Demonstration—Bruni, Texas L. Jordan

The Scientific Ecology group engineered and demonstrated a soil washing system that meets the Texas Department of Health regulations. Consequently, it was used to process 9651 tons of soil. The processing rate improved to a new daily record of 19.8 tons/hour; more than 99 percent of the feed was returned to the field. SRTC is obtaining technical data from the program through an inter-works release subcontract placed in March 1992.

WSRC Assists EG&G in Sensor Evaluation Mission

H.E. Mackey

WSRC provided logistical assistance in support of the EG&G (Las Vegas, Nevada) remote sensing mission at SRS during September 1992. The objective of the mission was to test differing sensor systems for use

PROGRESS AND ACCOMPLISHMENTS

in waste site evaluation. WSRC identified candidate waste sites for evaluation and provided EG&G scientists with background information on those areas.

SCUREF Task 11, "Predictive Geographic Information System Study"

H.E. Mackey

Wetlands play a key role in pollution assimilation, flood and sediment control, breeding, and nursery grounds for many species of fish and wildlife, and help maintain groundwater supplies and water quality. The purpose of the "Predictive Geographic Information System Study" is to develop methods to predict and monitor aquatic vegetational development around L Lake, test the accuracy and reliability of satellite, aircraft scanner and photographic data for aquatic vegetational mapping, and to monitor the seasonal changes in aquatic vegetational mapping. At this time, digitization of large scale topographic maps of Par Pond was completed using ARC-INFO digitizing software. This was a three-month effort. Additionally, a manuscript entitled, "Predictive Modeling of Cattail and Waterlily Distribution in a South Carolina Reservoir Using GIS Modeling", was accepted for publication in the November 1992 issue of *Photogrammetric Engineering & Remote Sensing*. Dr. J. R. Jensen, of the USC Department of Geography, gave an overview of this project at the September 10, 1992 EPS Work Review.

SCUREF Task 13 "Field Tests to Investigate Groundwater Flow and Transport in the TNX Area"

R. L. Nichol

A variety of research activities have been performed at the TNX facilities since the early 1950s, resulting in large quantities of waste water. The waste water disposal was in excavated earthen "seepage" basins until 1988, resulting in groundwater contamination throughout the area. The objective of this investigation is to evaluate the subsurface flow and transport parameters in the unconfined aquifer. As a result of work performed on this task, SCUREF and WSRC developed a computer controlled data acquisition system for single-well tracer tests for use at SRS. This system is flexible, simple to operate and program, relatively inexpensive to build, and allows for communication with

a portable PC for real-time monitoring, sampling operation changes, and data uploading and downloading. It was tested under laboratory conditions and is scheduled for implementation under field conditions. Dr. M. A. Widdowson, of the USC Civil Engineering Department, gave a presentation on this task at the September 10, 1992 EPS Work Review.

SCUREF Task 14, "Compilation of Regional Geology"

R. K. Aadland

The objective of this effort is to revise, update, and document the geologic and seismologic sections of text and figures common to SRS environmental activity support documents. Regulations considered for waste management facilities would require seismic qualification before allowing permits to be issued. The current version of the regional geology in several reports written to support environmental, safety, and health concerns of SRS is fairly thorough, but could be improved by updating. SCUREF sent final reports on specific aspects of regional geology to WSRC for review.

SCUREF Task 19, "An Evaluation of 'PER-ALS' and Liquid-Liquid Extraction (LLE)"

J. R. Cadieux

The objective of this task is to evaluate the technique of alpha liquid scintillation for the detection of specific alpha-emitting radionuclides in typical SRS waste stream and environmental samples. Should this method provide rapid, sensitive, and cost-effective alpha analyses, then standards and technical procedures will be developed according to required SRS quality assurance standards to allow routine use onsite. Testing on sample extraction procedures continues. A presentation of the work on the effect of aqueous volume on the extraction yield was made at the Health Physics Society Annual Meeting in Columbus, Ohio from June 21 to 25, 1992. Several suggestions for further research were offered.

SCUREF Task 22, "The Effects of Heterogeneity and Diffusion on the Performance of a Recovery Well"

J. S. Haselow

As part of a groundwater restoration program, SRS utilizes recovery well networks with surface treatments to remediate contaminated groundwater. Recovery wells are capable of retrieving large amounts of contaminants but their ability to remove contaminants below primary drinking water standards is questionable. The objective of this study is to complete numerical simulations of flow and transport in heterogeneous, saturated porous media to simulate the effectiveness of recovery wells. Clemson University faculty and graduate students are working on several aspects of a computer model, including a graphics program, to visualize the results of a program that will solve a two-dimensional flow equation. The SCUREF Principal Investigator is conducting an analytical investigation on the effects of heterogeneity on contaminant loading and unloading times in simple heterogeneous media.

SCUREF Task 23, "An Experimental Study of Water Flow and Contaminant Transport in the Unsaturated Zone"

N. S. Roddy

The purpose of this task is to assist WSRC in the design and conduct of tests that study the effects of rainwater infiltration of buried low level radioactive waste sites. WSRC and SCUREF personnel will assist SRS in efforts to develop a local database to quantify critical hydraulic and contaminant transport parameters, to characterize contaminant transport under simulated closure conditions, and to calibrate and verify computer simulation models. Additionally, WSRC and SCUREF personnel will evaluate data that was produced over a number of years in lysimeter experiments. SCUREF personnel completed the design of the interface for a computer automated hydrologic data acquisition system. SCUREF forwarded findings of a literature review on measuring soil water parameters and modeling water flow in the vadose zone to WSRC.

SCUREF Task 26, "Establishment of a Field Geohydrology Experimental Site"

V. Price

This task involved the preparation of an "outdoor laboratory" from a well field at a site formerly proposed for waste burial at SRS, but never used for that purpose. Students and professional geohydrologists use the well field to conduct experiments that will improve the methodology for groundwater sampling aiding in the cleanup or prevention of contamination. In conjunction with this task, Clemson developed a master's degree program in hydrogeology. They are also preparing short courses for registered geologists in South Carolina. On September 9, 1992, Clemson conducted a hydrogeology symposium. Eight hours of credit for registered professional hydrogeologists was allowed toward the continuing education requirement of the South Carolina State Board of Registration for Geologists.

SCUREF Task 29, "Sealing of Soil Pores Around Waste In Low Level Radioactive Lysimeters by In-Situ Development of Mineral Depositing Bacteria"

M. E. Hodges

The purpose of this task is to determine the feasibility of stimulating the growth of mineral depositing bacteria in buried waste emplacements so that the soil pores around the waste are blocked, preventing leaching of radioactive contaminants. At this time, experimental bacterial columns are being maintained and analyzed in SRS soil samples. A new column series that will rely on sulfate reducing bacteria to plug the soil pores and reduce groundwater flow rates through these soils will begin. The bacteria, which cause blockage problems in the oil and gas industry, may be applicable to this task.

SCUREF Task 35, "Enhancement of Removal of Radionuclides from Lysimeters Using Low Impact Complexing Agents"

K. Dykes

The objective of this task is to evaluate the effectiveness of low impact complexing agents in removing radionuclides from contaminated groundwater. Initial computer modeling with MINTEQ was completed.

Soil adsorption studies are 75 percent complete. Three Clemson graduate students earned master's degrees in Environmental Systems Engineering through work performed under this task.

SCUREF Task 38, "Implementation of a Mesoscale Atmospheric Model for Emergency Response at SRS"

Lance O'Steen

The purpose of this task is to assess and solve problems related to the implementation of atmospheric computer models that evaluate the environmental impact of airborne contaminant releases. This can be done through analysis of the wind field and turbulence by which the contaminants are advected and dispersed. Among other accomplishments to date, SCUREF personnel modified the RAMS isentropic package to run on an IBM RISC 6000. SCUREF completed an updated version 2c of RAMS and transferred it to WSRC. Major improvements in the update include a new RAMS FORTRAN preprocessor, a modified soil model and vegetation scheme, a more flexible scheme for running variable initialization simulations, and a new analysis file structure that will make access to model output easier. Also, USC conducted tests on optimum interpolation schemes with promising results.

SCUREF Task 39, "Determine Rate of Release of Carbon-14 Bacteria from Ion-Exchange Resins in Lysimeters"

J. R. Cook

The purpose of this task is to determine the rate at which natural bacteria in the subsurface of the SRS burial ground destroy the ion exchange capacity of ion exchange resin, thereby releasing ¹⁴C into the soil water. Currently, bacterial communities present in the experimental lysimeters are characterized. Bacterial strains capable of growth on ion exchange resins were observed. The types and distribution of bacteria in soil around the SRS lysimeters was determined and modeling studies were initiated. A database of bacterial strains found in SRS soils was initiated.

SCUREF Task 45, "Sensors for Waste Glass Monitoring and Control"

D. F. Bickford

Clemson University personnel will fabricate sensors for measurement of alkali activity and oxygen fugacity in glasses under physical and chemical conditions similar to those of waste-glass production. Out of the twelve sensors that were sent to SRS, one sensor is complete. A preliminary composition glass was also melted. The design and assembly of two more sensors is underway.

SCUREF Task 53, "Sedimentology and Stratigraphy of the Upland Unit"

R. K. Aadland

A number of SRS waste disposal sites are located in "Upland" deposits, areas that contain poorly sorted, commonly conglomerated clayey-to-silty and pebbly sands and clays that occur at the surface at most higher elevations in the SRS vicinity. The purpose of this task is to characterize the geology of these areas so that the risk of contaminant migration can be more easily estimated. This includes determination of the areal distribution, geometry, age, and environments of deposition of exposures of the Upland unit on or near the Site. At this time, University of South Carolina faculty and students are collecting and analyzing samples and field mappings from several areas near the Site. X-ray diffraction and scanning electron microscopy were conducted on the clay fraction of numerous samples.

SCUREF Task 65, "Improved Computational Methods for Groundwater Modeling"

J. S. Haselow

The objective of this work is to develop a computer code for simulating two-phase (water and gas) groundwater contaminant flow and transport them in variable saturated porous media. This code will also be capable of simulating the flow of thermal energy. This is intended to be the first phase in the development of a code that handles three-dimensional four-phase flow. At this time, development of an equation model for infiltration of unsaturated soils began. The research team joined two other groups to leverage their efforts and maximize results.

SCUREF Task 69, "Development of a Biotreatment System for Destruction of Multi-Component Waste"

J. C. Corey

The objective of this task is to provide information for the design and fabrication of a bench-scale integrated system to detoxify or degrade selected halogenated solvents. Industry participation is being sought. At this time, a final design for a gas blending module for the bioreactor was delivered.

SCUREF Task 70, "Telerobot Control Software"

D. McMullin

The objective of this task is to develop software control algorithms for the SRS Telerobot, a prototype robot being developed to support Transuranic Waste Facility (TWF) operations. A robust control motion algorithm was developed for the Clemson Direct Drive Arm. SCUREF is currently troubleshooting requirements for a Robot Arm Upgrade.

SCUREF Task 72, "Test of Electron Beam Technology on Savannah River Laboratory Low-Activity Aqueous Waste for Destruction of Benzene, Benzene Derivatives and Bacteria"

J. P. Bibler

The objective of this task is to determine whether electron beam technology can effectively decontaminate SRTC low-activity aqueous waste, and possibly other dilute waste streams at SRS that contain organic or microbial pollutants. Subcontracts with Florida International University (FIU) and the University of Miami were negotiated. Experimental work was initiated at those facilities and the University of South Carolina (USC).

SCUREF Task 74, "Assist WSRC Technical Personnel on the Experimental Project to Remove Chlorocarbon Contaminants from Groundwater"

B. B. Looney

The purpose of this task is to provide decision support and performance evaluation information for an experimental project to demonstrate new in-situ remediation technologies that have the potential to reduce clean-up costs and time. During the summer, two student interns from Clemson University worked on this project at SRS. Brian Riha obtained six undisturbed soil samples from a monitoring well at the ID Site and he is preparing them for testing on hydraulic conductivity, porosity, and grain-size distribution. Anthony Ferrelli is developing a computer model to observe the effects of flow through the well on drawdown in a homogeneous isotropic aquifer.

SCUREF Task 75, "Parallel and Distributed Processing for Environmental Application at SRS"

K. A. Mansour

The objective of this task is to evaluate the effectiveness of parallel processing techniques for environmental transport problems at SRS. This includes development and implementation of state-of-the-art computing technology components and numerical algorithms. Task personnel held a week-long work session that focused on code development with the Parallel Virtual Machine (PVM). Representatives from James Madison University, the University of Wyoming, and several USC undergraduate and graduate students attended. Further refinements of the one-dimensional advection diffusion model were developed under PVM, including implicit solvers. Collaborative work is continuing with Partners in Computational Sciences (PICS).

SCUREF Task 76, "Assist WSRC Technical Personnel on a Scoping Study of Pretreatment of Transuranic Waste for Disposal by Vitrification"

D. F. Bickford

The objective of this task is for SCUREF faculty and graduate students to assist WSRC in testing a new

technology for waste treatment at the semi-works facilities at SRTC. Testing will begin this summer. Conversations continue with two companies concerning the formation of a Cooperative Research and Development Agreement (CRADA). Task personnel identified equipment and components needed to begin the vitrification research.

SCUREF Task 77, "Development of Procedures for the Identification of Organisms Capable of Degrading Trichloroethylene in the Environment"

T. C. Hazen

The purpose of this project is to develop nucleic acid probe methods for determining the presence and/or quantity of TOL-1 plasmid sequences capable of destroying trichloroethylene (TCE) from environmental samples (soil and groundwater). At this time, bacterial communities were characterized and DNA from cells trapped on filters can be analyzed.

SCUREF Task 78, "Experimental Bioreactor for Treatment of TCE and Tetrachloroethylene (PCE) Contaminated Groundwater"

T. C. Hazen

The objective of this investigation is to evaluate the use of a bench-scale fluidized expanded-bed bioreactor for the degradation of TCE and PCE in SRS groundwater. USC is assisting SRS in the design and construction of a bioreactor and the performance of hydraulic testing and specific bacteria tests. Testing on the bioreactors is underway. Hydraulic testing is complete. Work is underway to establish biofilm and to acclimatize the bacteria to the bioreactor.

SCUREF Task 79, "Development of Functional Group Probes: Acetogens, Nitrogen Fixers, and Aromatic Degradors"

T. C. Hazen

The objective of this work is to develop DNA probes for quantitative measurement of acetogen, nitrogen-fixing and aromatic degrader bacterial populations and genes involved in destroying organic chemicals via metabolic degradation to carbon dioxide, water, and simple inorganic acids, bases, and salts. At

this time, Protocatechuate 4,5-dioxygenase purification is complete. USC continues its characterization of the enzyme, which will allow development of oligonucleotide probes for cloning the structural genes. The suite of probes for aromatic degraders includes: the structural genes encoding catechol 1,2-dioxygenase, which are to be cloned from the *R. leguminosarum* library catechol 2,3-dioxygenase, which USC possesses, and protocatechuate 3,4-dioxygenase and protocatechuate 4,5-dioxygenase, which will be cloned.

SCUREF Task 82, "Savannah River Swamp Restoration and Mitigation Mapping Using Remote Sensing and Geographic Information System (GIS) Technologies"

H. E. Mackey

This task will begin in April 1992. Its purpose is to develop and implement a plan to mitigate past impacts to the cypress/tupelo and bottomland hardwood wetlands of the Savannah River Swamp. It involves gathering baseline information on the history of these wetlands and the current vegetation patterns and trends. The final product will be a report detailing the historical forestry trends of SRS from 1938 to 1991 and wetland community changes from 1981 to 1991. SCUREF received historical aerial photography and topographic maps of the swamp and initiated an interpretation of the historical aerial photography for 1938, 1943 and 1951 to locate timbering trails, railroads, and lay down areas within the Savannah River Swamp system. The 1981 aerial photography and airborne scanner data for vegetation mapping were provided.

SCUREF Task 89, "Subsurface Flow and Parameter Identification Via Inverse Simulation"

J. S. Haselow

This task began in May 1992. The purpose is to investigate the feasibility of a new mathematical modeling approach to reduce contaminant characterization and monitoring costs. Contaminant migration in the subsurface is a complex process, hence, any mathematical model for describing subsurface contaminant transport must be extremely detailed to adequately represent the physics of the transport process. Traditional inverse solutions focused on the flow equation, if the transport equation is also considered, uncertain-

PROGRESS AND ACCOMPLISHMENTS

ty in required parameters may be reduced. SCUREF and WSRC will investigate the possibility of using simultaneous solutions of the inverse flow and contaminant transport equations. At this time, SCUREF is accumulating publications on inverse modeling and parameter identification in aquifers.

SCUREF Task 94, "Determination of Hydraulic Properties of Aquifers"

Van Price

This task began in September 1992 to aid the United States Geological Survey (USGS), DOE, and other agencies in a program to test aquifers in the SRS region to determine their ability to transmit water. The purpose of the task is for SCUREF to assist WSRC in testing groundwater monitoring wells at SRS for water level and water chemistry data. Specifically, SCUREF will observe water level changes in one or more wells while a nearby well is pumped or allowed to recover from pumping.

WASTE MANAGEMENT

Westinghouse Thermal Desorption System

S. T. Wach

The Westinghouse Savannah Technology Center (WSTC) developed a thermal desorption system with significant advantages that make the system a strong candidate for the planned ER soil treatability study.

The Westinghouse system is a modified, Shirco, infrared furnace, in which radiative heat can raise soil temperatures as high as 1100°F as the soils are gently carried through the furnace on a metal belt. All organics, and some metals, can be volatilized. A small purge stream carries the vapors to a condenser. Advantages over alternative desorption systems are:

- Radiative heat transfer allows higher soil temperatures for better desorption. Construction materials limit soil temperatures for screw type thermal desorbers that rely on conductive heat transfer.
- Low gas flow rates and gentle waste handling minimize carryover and offgas treatment. Rotary kilns use convective heat transfer with high gas flow rates. Steam strippers produce a large volume of secondary water waste.
- Permitting is simplified over incineration units, since the hazardous constituents are separated and condensed for later destruction in a permitted destruction facility, such as the Consolidated Incineration Facility (CIF).
- WSTC developed a simple high confidence method for predicting performance of the thermal desorption system by bench scale testing and a mathematical model.

Modification of a Shirco infrared furnace at TNX is being considered. However, initial consideration indicates that the use of Westinghouse's mobile unit would be more economical. The mobile unit is currently in use at the Coffeyville, Kansas Aptus facility.

Prompt Gamma Neutron Activation Analysis

S. T. Wach

Prompt Gamma Neutron Activation Analysis (PGNAA) is being considered for waste characterization at SRS. It can measure part per million (ppm) level concentrations of elemental species up to two feet deep in soils.

The PGNAA directs neutrons into the waste, which interacts with the nuclei to produce gamma rays that are signatures for detection of particular elements. Molecular concentrations can be implied if the waste history is sufficiently known. FAA successfully used the technology for detection of explosives in luggage. It is also being considered for various other applications.

The PGNAA can be mounted on a moving vehicle to examine large surface areas (e.g. a closure site). Under the current design, the PGNAA examines a one-inch circular area at any moment. A matrix of results could be statistically applied to determine bulk concentrations. The PGNAA can also measure concentrations of elements that may be radioactive. However, assuming the maximum sensitivity of 1 ppm, the PGNAA is not sufficiently sensitive to clear materials as clean or to certify them for disposal in the E-Area vaults.

Consideration will continue for characterization of hazardous constituents in ER soils.

Failure Strain Criteria for the Type III ITP Waste Tanks

J. K. Thomas and G. E. Mertz

At the request of Waste Management, an evaluation of the effects of multiaxial loading on failure strain is being conducted. This evaluation will support development of strain-based failure criteria to be used with an evaluation of the Type IIIA waste tank response to a hypothetical deflagration accident. A draft technical memorandum documenting these results was written and is undergoing technical and customer review.

The triaxiality factor (TF) approach is employed in this evaluation. It is defined as three times the mean (hydrostatic) stress divided by the equivalent (mises) stress. Upon first approximation, it was empirically determined that the failure strain under a multiaxial load-

ing is the uniaxial failure strain divided by the TF. Thus, a TF of 2 indicates a failure strain that is one-half the value obtained from a uniaxial tensile test.

This approach was also used to estimate failure strains for the reactor tank and reactor components in the analysis of their response to the gamma heating accident (WSRC-RP-92-304). Furthermore, Westinghouse - Hanford employed a TF-based multiaxial loading ductility reduction approach in the analysis of the response of their waste tanks to deflagration loadings and the Electric Power Research Institute (EPRI) recommended it for the analysis of reactor containment structures to overpressure loadings. Similar results were also reported in the literature with theoretical multiaxial failure strain models for ductile materials. For a deflagration accident in a waste tank, the global failure mode would be tensile instability, therefore, the uniform strain is employed as the failure strain.

The Scientific Computation Section (SCS) Computational Modeling group performed a finite element analysis of a Type III waste tank for a deflagration loading, and provided the primary and secondary liner stresses required to compute the triaxiality factor with the corresponding strains. The results for a 90 pounds per square inch (psi) pressure loading are considered bounding for this accident and were employed to provide preliminary results. The resulting TFs range from one to two for the primary and secondary liners. The predicted failure strain for some liner locations is, therefore, reduced by a factor of almost two, relative to the failure strain from uniaxial tensile tests. Waste Management (WM) will provide lower pressure loadings considered more representative of the pressures anticipated for this accident for the final analysis.

High Level Waste (HLW) Tank Inspection Guidelines

D. M. Barnes

On August 3 and 4, 1992, a meeting was held in Boston, Massachusetts to discuss inspection guidelines for HLW tanks as part of the DOE HLW Tank Task Force. The meeting focused on the development of in-service inspection guidelines that each HLW tank site should use in the future. The goal of the panel is to establish guidelines with active participation and support of the various sites in areas subject to inspection, re-

sponsibilities, provisions for accessibility and inspectability, examination methods, frequency of inspections, repair requirements, etc. Each site presented their current HLW tank structural integrity program (i.e. design, fabrication, material characteristics, current inspections and limitations, chemistry, and future plans for improvements).

The sites are performing the following tasks to assist the panel:

- preparing a list of planned inspection programs at the respective tank farms and providing a brief description of each program
- identifying the difficulties and challenges encountered in maintaining the tanks structural integrity and performing inspections
- providing input to the panel by identifying what the sites perceive the guidelines should include

Waste Management, SRTC and SS-Q/Non-Destructive Examination (NDE) are completing these tasks at SRS.

The next task force meeting is scheduled for October 1992.

Corrosion Testing on A106 Carbon Steel Cooling Coil Material

B. J. Wiersma

Corrosion testing of A106 carbon steel was initiated in response to recent discoveries of cooling coil failures in the Type III waste tanks. Although pressure tests identified these leaks, the precise location and mechanism by which the leaks occur is unknown. Previous cooling coil failures occurred due to pitting corrosion caused by inhibitor depletion in the waste solution and liquid dripping from the roof of the tank. This observation suggests two possible areas where pitting corrosion may occur. The first area of concern is the 85 feet section of coil embedded in the concrete roof. Chlorides in the concrete mixture may promote pitting of the cooling coil pipe by the same mechanism that degrades rebar in concrete structures. Attacks may also occur in the vapor space area inside the tank. Previous corrosion testing of carbon steels show that pitting

beneath precipitate deposits in the vapor space area may occur if the tank contents are uninhibited.

Cyclic polarization tests are being performed to determine the threshold chloride limit above which the cooling coils begin to pit. Test samples of A106 were sectioned from actual cooling coil pipes from Tanks 38 and 48, which were blanked-off due to failure. The tests are being conducted in a pore water solution that simulates the electrolyte in the concrete. Chloride is added to the "pore water" and the cyclic polarization test is performed. If no pitting occurs, the chloride level in the pore water is increased and the test is repeated. Chloride is added to the pore water until pitting is observed. Tests were conducted at 0, 10, and 18,000 ppm chloride. No pitting was observed at the two lower concentrations, while severe attack was noted at the higher chloride concentration. Tests at concentration levels between 10 and 18,000 ppm chloride are being conducted.

Partial immersion coupon tests were also initiated to investigate pitting attacks in the vapor space area inside the tank. Coupons were fabricated from the same A106 cooling coil pipes as the pitting samples. The tests solutions simulate the waste present in Tanks 38, 40, and 48. The test duration will span four months. At the conclusion of the tests the coupons will be examined for pit size, density, and shape.

Materials Testing for Replacement High Level Waste Evaporator (RHLWE)

G. T. Chandler and B. J. Wiersma

High Level Waste Evaporators (HLWE) reduce the volume of caustic waste received from the Separations canyons. Successive evaporations of the waste are performed to reduce the volume by 20 to 25 percent. The current evaporators handle waste streams with hydroxide concentrations ranging from 15 to 35 wt.% and operate at temperatures ranging from 130°C to 150°C. A RHLWE, with a capacity twice that of the current evaporators, is being designed. It will operate at higher temperatures (130°–180°C) to achieve greater volume reductions that result in higher hydroxide concentrations (15 to 50 wt.%). The construction material for the evaporators is AISI Type 304L stainless steel (304L). Type 304L is susceptible to stress corrosion cracking (SCC) and exhibits high general corrosion rates (more than 30 mpy) when subjected to the

higher temperatures and higher hydroxide concentrations expected in the RHLWE. Consequently, Hastelloy G-3, a nickel-based alloy, was recommended as the construction material for the RHLWE because of its higher resistance to corrosion under these conditions.

Constant Extension Rate Tensile (CERT) tests will be performed in simulated waste solutions to evaluate the susceptibility of G-3 to SCC under RHLWE conditions. Baseline CERT tests with 304L in 45 wt.% NaOH at temperatures above and below the apparent stress corrosion cracking boundary are being performed to demonstrate the viability of the CERT method as an indicator of SCC. CERT tests were completed for 304L in 45 wt.% NaOH at 100°C (below the SCC boundary) and at boiling at 140°C (above the SCC boundary). The fracture surfaces of the test specimens are being examined for indications of SCC. Immersion tests of G-3 and 304L in simulated H-Modified wastes are also underway to determine general corrosion rates under RHLWE conditions.

Electrochemical Noise Measurement (ENM) Technique for Waste Tank Applications

J. I. Mickalonis

Scoping tests are being conducted with the WSTC to assess the capabilities of electrochemical noise measurement (ENM), a new corrosion monitoring technique. ENM monitors the fluctuations in the potential and current signals of an electrode. These fluctuations are characteristic of specific corrosion mechanisms, especially localized corrosion, and may be correlated to a corrosion rate for uniform corrosion. WSTC has a proprietary licensing agreement for development of ENM for the nuclear industry.

The test objective was to simulate possible conditions in the waste tank during ITP. Two test cells are operating; one cell is a control cell and the other cell alters the corrosivity of the conditions. Adding corrosive (sodium nitrate) or inhibitive (sodium nitrite) species to the cells changes the corrosivity. The probes for ENM and immersion coupons are made from A537 plain carbon steel, which is the construction material for the Type III waste tanks. The simulated waste solutions are under a nitrogen blanket and at 40°C. The nitrate concentration was increased in a stepwise manner from an original concentration of 0.022M to 0.33M. The fluctuations of the potential and

current signals did not indicate pitting until high nitrate concentrations were obtained. The initial conditions of the simulated waste were at the limit for inhibition. The probes and coupons were visually observed at the 0.22 M nitrate concentration. Many pits were observed on coupons from both test cells. The probe from the control cell showed no signs of pitting, while the other probe did. A coupon from each test was removed and sent to SRS for further examination and analysis. The nitrite concentration will be increased in attempts to make the solution inhibitive. Cyclic polarization tests are also being performed at SRS to confirm the corrosivity of the test solutions.

Waste Management Technology Probe Retrieval Tool

D. C. Patterson and G. D. Teese

During the removal of several conductivity probes in the F-Area Tank Farm, two conductivity probes became lodged in 1 1/2" of schedule 40 pipe, causing the cables and wires to loosen. These probes monitor fluid levels in the leak detection box (LDB) and the flush pit (FP). E&MT agreed to provide a tool to retrieve the probes from the pipe and install new probes.

The tool design consists of a throttle control cable and a modified concrete anchor bolt. When the throttle control cable is activated, the concrete anchor bolt mechanism expands and grasps the conductivity probe housing. On July 30, 1992, one retrieval process from the LDB was completed in less than 20 minutes. Since the tool worked so well, WMT requested a longer tool to aid in the removal of a probe in a longer portion of pipe. This low cost tool will cut down the exposure time and reduce the contamination risk.

Defense Waste Processing Facility (DWPF) Recycle Stream Organics Studies

M. J. Barnes

Initial radiolysis experiments of DWPF recycle waste stream organics were completed. This project is being performed to verify that no unexpected problems will occur in waste tanks due to radiolytic reactions involving the organics. DWPF provided organic simulants SRAT Condensate (during PHA addition). The majority of organics present were phenol and aniline. Four different solutions were subjected to radiolytic

doses spanning an exposure range of three months to 12 years (assuming a radioactive waste concentration of 2 Ci/gallon). The solutions simulate the range of environments that the DWPF recycle waste stream organics are likely to be subjected. They included undiluted SRAT Condensate (during PHA addition), a 1:1 dilution of SRAT Condensate (during PHA addition) with deionized water, a 1:1 dilution of SRAT Condensate (during PHA addition) with a low concentration salt solution (3.8 molar, principally NaOH, NaNO₃, and NaNO₂), and a 1:1 dilution of SRAT Condensate (during PHA addition) with a high concentration salt solution (9.5 molar, principally NaOH, NaNO₃, and NaNO₂).

Radiolytic experiments were aimed at determining the rate of decomposition of sodium phenoxide due to radiolysis. G-values (number of molecules decomposed/100 ev) were calculated from the experimental data for the 100 percent, 50 percent, and low salt 50 percent solutions. Experimental data from the high salt 50 percent solution was erratic and could not be used. The G-values for the solutions for phenol/phenoxide decomposition and aniline decomposition are listed in Figure 4. The data indicates that the presence of inorganic salts (i.e., nitrate, nitrite, and hydroxide) accelerates the rate of radiolytic decomposition of both compounds. No major products could be identified from the decomposition of the compounds; however, a small amount of nitrobenzene was produced and decomposed. Nitrobenzene is an explosive compound that was identified in the literature as a potential decomposition product of phenol/phenoxide in the tank farm environment. The quantity of nitrobenzene produced was determined safe, assuming that no way of concentrating the solution is possible. The observation that the nitrobenzene was ultimately decomposed by radiolysis is also significant.

Phenol Solution	Aniline G-Value	G-Value
100 %	0.28	0.13
50 %	0.30	0.08
Low Salt 50 %	0.81	0.28

Figure 4. G-Values of the Phenol Solution

An unusual substance, a brown precipitate from the SRAT Condensate (during PHA addition), was also identified during preparation of the low salt 50

percent and high salt 50 percent solution when NaOH was added to the organics-containing solution. The precipitate floated on the surface of the solution and appeared to be organic in nature, but it has not been identified. Further studies to gain a better understanding of this occurrence are planned.

Liquid chromatography analysis of the irradiated solutions was conducted at the DWPF Analytical Laboratory at TNX. A second set of experiments addressing the fate of sodium phenoxide and other organics from the DWPF Recycle Stream in the Tank Farm evaporators is in progress.

Analysis of Tanks 25, 26, 27, and 28

D. D. Walker, C. J. Coleman and S. Wyrick

At the request of Waste Management, supernate samples from four F-Area waste tanks are being analyzed for the list of chemical components required by the ITP process requirements. The following analyses was completed:

Tank	25	26	27	28
Density (g/mL)	1.48	1.55	1.45	1.47
Na ⁺ (molar)	13.8	16.7	12.1	13.2
Cs-137 (d/m/mL)	2.5E09	3.2E09	2.2E09	2.6E09
U-235 (ppm)	<0.1	<0.1	<0.1	<0.1
U-238 (ppm)	7.4	21.1	2.1	1.6

Table 5. Analysis of F-Area Supernate Samples

Electrolytic Denitration of Decontaminated Supernate

D. T. Hobbs

The objectives of this effort are to determine the optimum electrode materials and conditions for the destruction of more than 95 percent of the nitrate in decontaminated supernate. The Electrosynthesis Company (ESC) (Buffalo, New York) is conducting experiments. Recent work focused on demonstrating longer-term performance (1000 hour) of a divided cell. Two completed tests indicate that the anode must be resistant to fluoride, which appears to be migrating across the membrane into the anolyte compartment. Platinized niobium and DSA02 anodes were attacked, resulting in unacceptably high cell voltages after several hundred hours of operation. Before the anodes were attacked, the tests exhibited good current efficiencies

(ca. 70 to 80 percent). A third test, with a platinum-cladded niobium anode, operated for more than 600 hours with no observed decrease in cell performance. This anode will not be attacked because the platinum cladding is not porous, thus, preventing fluoride from attacking the niobium base metal.

Testing of the radiation stability of possible ion-exchange membranes for the cell continued this month. This study evaluates the effects of solution composition and the absorbed dose on the radiation stability of two membranes, Nafion® 417 and Nafion® 324. SRTC conducted irradiations to provide the absorbed dose equivalent to 0.5, 1.0, 1.5, two and four years of cell operation for the three solution compositions. The samples were shipped to ESC to be evaluated for electrical properties and electrochemical cell performance.

Extended Sludge Processing (ESP) Support

M. S. Hay and N. E. Bibler

Concern arose because the aluminum content of the sludge in Tank 42H is higher than the Draft DWPF Feed Acceptance Criteria. The concern is based on analytical data on the sludge after the aluminum dissolution in 1982 that showed the aluminum content to be ~20 wt% (the acceptance criteria is 11 wt%). Since the 1982 demonstration, sludge from Tanks 18F and 21H was added to Tank 42H. Unfortunately, a sludge sample of Tank 42H has not been analyzed since the addition of sludge from Tanks 18F and 21H. A new sludge sample of Tank 42H is scheduled for mid October 1992.

Using actual analytical data from sludge samples of Tank 18F and 21H with the estimated volumes transferred to Tank 42H, it was estimated that the sludge in Tank 42H contains ~24 wt% Fe and ~7 wt% Al. Analysis of sludge samples from Tank 51H shows that the sludge contains 30 wt% iron (Fe) and 9 wt% aluminum (Al) (the acceptance criteria for Fe is 26 wt%). The blended sludge for Batch 1, Tanks 42H and 51H, that will feed the DWPF for the first two years, will have an estimated composition of ~24 wt% Fe and ~7 wt% Al.

An effort is underway to estimate the composition of the Batch 1 feed to DWPF for components controlled by the Draft DWPF Feed Acceptance Criteria.

PROGRESS AND ACCOMPLISHMENTS

Several meetings to resolve the ESP analytical requirements have taken place. The requirements are being driven by the Draft DWPF Feed Acceptance Criteria and criticality concerns. The meetings were primarily concerned with bringing the requirements in line with the analytical capabilities of SRTC and F Area laboratories. The final ESP sampling plan should be issued next month.

Fissile Loading Tests

D. T. Hobbs

The objective of these tests is to determine the maximum loading of plutonium (Pu) and uranium (U) onto monosodium titanate (MST). This information is necessary to determine what nuclear safety controls, if any, are necessary for the ITP process.

Two batch tests to determine the effects of temperature and competition on the loading of Pu and U onto MST were completed. In these tests, the MST solids were isolated and analyzed to determine U, Pu, strontium (Sr) and titanium (Ti) content. The results of these, and earlier, batch tests are presented in Figure 6. They indicate that loading of uranium decreases with increasing temperature, which suggests that the removal of uranium is an adsorption process. In the competition experiment, the uranium loading is decreased by about 25 percent in the presence of Pu and Sr. The Pu and Sr loadings are consistent with those determined in batch competition tests where solution analyses indirectly determined the loading.

Continuous loading tests, at 30°C and 75°C, to determine the maximum Pu and U concentrations for solutions that will be processed in the ITP are underway. These tests differ from batch tests in that a quantity of MST is being contacted with a salt solution in a continuous flow arrangement. Thus, the MST contacts the solution that is saturated with plutonium and ura-

nium, therefore, the chemical potential for loading is at the maximum value. Tests are being conducted at 30°C and 75°C to bound the temperatures that will occur in ITP.

Initial results on the 30°C test indicate that the uranium loading was 1.73 ± 0.05 Wt.%. This value is higher than that determined from batch tests, but it is below the infinitely safe level of 2.0 Wt.%, indicating that the maximum fissile loading will be safe. The higher value is partly due to contamination of the solids sample from uranium oxide solids that passed through the prefilter into the filter assembly containing the MST. The continuous runs will be completed by the end of September 1992.

ITP Precipitate—Thermal Conductivity Testing Program

J. F. McGlynn with Greg Hovis

Experimental work to determine the thermal conductivity of the potassium tetraphenylborate (KTPB) solutions for the ITP process was completed. The purpose of this effort is to determine the heat transfer coefficient for films of KTPB that may deposit on the cooling coils and reduce the cooling capability in Tank 48. This work involved coating six heating elements (twelve inches long by 0.370 inches in diameter) with 12 Wt.% KTPB simulant. Thermocouples were placed at various distances from the heating element/simulant interface. Two methods for coating the simulated heaters were tested to achieve the most efficient and uniform coating technique:

- dipping the heating element twice a day and setting it in an enclosed carboy to dry
- dipping the heating element, drying it with a heat gun, and dipping it again after it is dry.

Wt.% Loading Solution	[MST] (g/L)	Temp.(°C)	Uranium	Plutonium	Strontium
U-doped	0.137	ambient	1.27	—	—
U-doped	0.492	ambient	0.86	—	—
U-doped	0.100	75 + 1	0.71	—	—
U, Pu & Sr	0.100	75 + 1	0.53	0.16	0.0048

Figure 6. Summary of Batch MST Loading Tests

This process was repeated until the required coating thickness was achieved (up to 1/2 inch on a side). Temperature differentials were then measured between the heater and the exterior of the coating and along the length of the heater element. The results are being analyzed to determine the heat transfer coefficient for films of KTPB.

In-Tank Precipitation (ITP) Filter Test Facility at TNX L. L. Kilpatrick

The facility will attempt to prove the mechanical integrity of the spare ITP Mott Filters by demonstrating KTPB solids decontamination factors (DF) above 10,000. The feed at TNX will be 2200 mg/l KTPB solids. KTPB solids will be collected from the Mott filter permeate on Millipore 0.2 micron filter paper and analyzed for potassium (K) and boron (B).

Dummy filter tests with feed containing KTPB solids are in progress. The Turbidity Meter and Millipore Filter are expected to be tested during the week of October 5, 1992. Failure of the main feed pump motor required that the cleaning tank be used as the feed tank until the motor is repaired. A Cuno Filter in the main feed line will remove solids from feed until the turbidity is less than 1500 ntu, which will leave enough solids in the feed to test the Millipore filter.

Piping drawings for an "Industrial Wastewater Permit" for state approval should be prepared by the end of October 1992. This permit would allow TNX to install a waste disposal line to the Organic Removal Facility for disposal of the test solutions containing low levels of benzene. After submission to the state, we expect that six months will be required for approval and two months for installation. Use of the facility before the issuance of the permit could be accomplished, but it would require that the waste be drummed up.

ITP Process Requirements (PR) D. D. Walker

The draft DWPF feed specifications from the proposed memorandum of agreement between DWPF and Interim Waste Management (IWM) were included in the approval copy of the ITP PRs circulated in August 1992. DWPF approved PRs, but WM disapproved because of disagreements over the proposed DWPF

feed specifications and the potential inability of IWM to meet the specifications without the capability to blend feed from different salt tanks. After approval, the ITP PRs will be adjusted accordingly and routed for further approval.

Late Washing

M. F. Morrissey, D. J. McCabe, M. L. Meyer, L. O. Dworjanyn, and D. D. Walker

On August 31, 1992, the Liquid Waste Processing group fulfilled its commitments to the DOE and the Late Wash Design Team by issuing documents describing:

- the Late Wash filter cleaning cycle demonstration and source terms for the cleaning solutions
- the washing efficiencies achieved on previous experimental tests
- the filtration performance with reprecipitated slurry
- the precipitation kinetics in Late Washing and the impact of spent Late Wash water on ITP DFs

ITP Waste Tank Inspection

D. K. Appel, L. R. Park, G. W. Lewis, and J. W. DeWent

Three double walled ITP waste tanks, Tanks 48, 49, and 50, are scheduled to be interfaced into the process during the summer of 1993 and a background Ultrasonic Testing (UT) exam is expected before these activities begin. The inspection will be performed remotely because the tanks are underground and access into the annular space is limited to 14 equally spaced eight inch holes. The UT examination will be limited to thickness maps of the inner tank to determine corrosion and pitting influences on the tank wall. Four vertical strips, the length of the tank and six inches wide, will be mapped on each tank.

The decision to use the P-scan AWS-5 crawler was made and development of the custom crawler was put on hold. The P-scan crawler will be procured as a complete system and will not need modifications when received. Therefore, the Equipment Engineering Section's (EES) level of effort will be reduced to providing

the deployment and camera tools. The design for the crawler deployment tool is completed and the drawings are being submitted for offsite fabrication. The camera tool design, which is almost complete, is based on the design of the ITP camera tool that was modified to make it more universal for WM. The redesign provides a universal pan unit (UPU) on which custom camera modules can be attached. This design allows the UPU to be a standard device that can be used for the ITP Inspection Program, Waste Tank Inspection Program, and several other tank camera needs. When the drawings are completed for the camera tool with the UPU, they will be submitted for offsite fabrication. The tool will be completed by December 1992, delivered to the tank farm by January 1993, and inspection will be completed by March 1993.

F-and H-Area Effluent Tritium Facility (ETF) Processing of DWPF Cold Chemical Runs (CCR) Wastewater

M. R. Poirier and J. L. Siler

Lab-scale tests, with simulated wastewater from the Integrated DWPF Melter System (IDMS) Offgas Condensate Tank (OGCT), show that wastewater will not adversely affect the F and H ETF if prefiltered.

Wastewater generated from the DWPF CCR must be treated and disposed of in compliance with regulations and permits. Several facilities are being examined to treat the waste, including the F and H ETF. A test program to examine the impact of the wastewater on the Norton ceramic microfilters, the activated carbon beds, and the reverse osmosis membranes began. Determining the effect of the wastewater on the DWPF cartridge filters is also planned.

The test feed is simulated OGCT wastewater from the IDMS. Since the organic concentration is low, no effect on the carbon beds is expected. After effectively prefiltering the water, the Norton filters and the reverse osmosis membrane performed well with no significant loss of flux or removal efficiency. However, some concerns with the cartridge filters arose. After four or five hours, the cartridge filter began to plug and suspended solids broke through, causing a second filtration to be required.

The next step is to evaluate the effect of wastewater from the Slurry Mix Evaporator Condensate Tank

(SMECT). SMECT water from IDMS will be available in late September 1992 and ETF testing will be complete by mid-October 1992.

Consolidated Incineration Facility (CIF) Particulate Carry-Over (PC) Test

D. B. Burns

The subcontract for the CIF PC test was placed with Accurex. The test will be performed at the Environmental Protection Agency (EPA) Incineration Research Facility (IRF), which consists of a 3 MMBtu/hr rotary kiln incinerator and secondary combustion chamber. The kiln has a 3'3" ID and a length of 8'2".

The primary objective for this test is to characterize kiln offgas particulates and bottom ash as a function of waste type, feed rate, and residence time. Simulated CIF feed material will be incinerated in the IRF while offgas particulate concentration and size distribution are measured at varying operating conditions. The waste feed for some runs will be spiked with hazardous metals and organics to tie the tests to the recently completed metals partitioning test.

SRTC and Waste Management Engineering (WME) personnel attended a contract kick-off meeting at the IRF to inspect the test facility, discuss the objectives of the test program, and review the required deliverables for the contract. Accurex will prepare a detailed test plan for SRTC approval. The plan is expected to be approved by December 1, 1992. The tests are scheduled to begin in early 1993.

CIF Kiln Air Inleakage Calculations

Thong Hang

WME requested an estimate of air inleakage to the CIF rotary kiln during a power loss event. During the event, combustion air fans stopped functioning, consequently, one ID fan is available. Information on the kiln air inleakage is required to verify the CIF explosion risk assessment study prepared by Science Applications International Corporation (SAIC).

Different scenarios were evaluated to account for various effects on the kiln air inleakage, such as steam injection into the scrubber, rotation of the combustion air fan impellers, and solid waste burning. Rotation of impellers is considered because impeller wheeling

causes larger pressure drops across the fan, hence, less flow through the B/D dampers at a given kiln pressure. The combustion product gas released by the burning solids is known to raise the kiln pressure, possibly lowering the amount of air leakage.

Results show that during the power loss, air leaks into the kiln through the idle combustion air fans at a total rate of about 11,000 lb/hr (no scrubber steam injection) or 12,000 lb/hr (with 10,000 lb/hr scrubber steam injection). Stoichiometric air required to burn a 72-lb solids batch in 20 minutes was previously estimated about 6,000 lb/hr. The study also shows the kiln air leakage rate can be increased by increasing the opening set pressures of the SCC B/D dampers.

The calculational procedures are being peer reviewed. A final report will be issued upon completion of the review.

Z-Area Performance Assessment

J. R. Cook, R. A. Hiergesell, C. A. Langton, E. L. Wilhite, and A. D. Yu

DOE Order 5820.2A requires that waste disposal facilities be the subject of a Radiological Performance Assessment to demonstrate that they will provide the degree of environmental protection specified in the order. The performance assessment is a complex modeling exercise requiring input from and analysis by many scientific disciplines. SRS will complete these studies for Z Area (Saltstone), E Area (low-level radioactive waste), and the Hazardous Waste/Mixed Waste Facility.

One of the major steps in the Z-Area performance assessment process was successfully completed. The DOE Performance Assessment Peer Review Panel carried out a preliminary review of the effort on August 17 and 18, 1992. SRS, ORNL/Grand Junction, ORNL/Tennessee, and Idaho National Engineering Laboratory (INEL) personnel made presentations and the panel praised the overall quality of the report and the presentations. Specifically, the panel noted the long-term research effort of C.A. Langton. Panel members commented that it was the best preliminary review in the DOE Complex to date. They also verbally offered thirteen comments that are not considered significant. The responses will be incorporated into the final report due in December 1992.

Vitrification of Weapons Electronic Components

D. F. Bickford

WSRC treated several actual weapons components as part of the Weapons Dismantlement and Immobilization Integrated Demonstration (WeDID). The overall objective of the program is to declassify and demilitarize weapons electronics components to recover valuable metals and to destroy or immobilize the hazardous components, such as lead and barium. Samples of the MC 3731 Fireset, the MC 3812 Radar Set, and the MC 1873 Filter Pack were treated. A DCA Ring Interface Module and a MC 2894 Preflight controller were also received.

Samples from the unoptimized treatment of the MC 3731 Fireset and the MC 3812 Radar Set were sent to SNLL. A more optimized process was developed. The preferred process includes the mechanical separation of large aluminum based objects, such as casings and mechanical support, and the magnetic removal of ferrous metals. This will improve the recovery of reclaimable metals and reduce the overall waste volume. The Fire Set samples were not treated by the optimized process, therefore, the waste volume is not as low as possible or the partitioning ratio for valuable vs. base metal components is not as desirable as it can be. However, these materials are low enough in hazardous materials to be sold for their valuable metal content. Based upon the treatment of one unit, we expect to obtain over 130 grams of recoverable metals per MC 3731 Fireset, over 430 grams per MC 1873 Filter Pack, and over 872 grams of recoverable metals per MC 3812 Radar Set.

Semiquantitative X-Ray Fluorescence indicates that the lead and iron content of the recovered metal can be reduced and the high palladium, gold, and silver contents make recovery a desirable feature of the process. Tests with commercial circuit boards were also successful, but they contained a lower precious metal content.

Waste Glass Collaboration at Clemson University

D. F. Bickford

The Glass Technology Group is developing a cooperative research and development program with Clem-

son University's Environmental Engineering Department to apply the expertise developed in the high level waste program to immobilize hazardous wastes. Clemson is being used because of their relatively low overhead, flexible manpower assignments, streamlined purchasing capabilities, and ability to attract commercial organizations for cost sharing.

The overall objective is to obtain a center where short term exploratory work can be conducted, using a variety of melter systems, within driving distance. This is necessary to conduct the pilot scale testing for the SNLL WeDID because adequate funding is not available to SRTC, or other credible laboratories, to conduct testing for LLMW or Transuranium (TRU) wastes. It is vitally needed because SRS is "storing" 510,000 curies of respirable plutonium wastes, most of which can never be shipped to the Waste Isolation Pilot Plant (WIPP) without pretreatment.

Two commercial melter manufacturers, Glasstech, Inc. (Stirred Melter) and Toledo Engineering Co. (TECO and Envitco, producers of high temperature waste glass melters based on commercial melter designs) agreed to supply pilot scale melters at a reduced cost in exchange for publicity and information developed during the testing. Chem Waste and the Digital Equipment Company are prepared to sign on in the initial effort to immobilize circuit board wastes with precious metal recovery. Subsequent tests are likely to be of common interest to SRS and Chem Waste, (e.g., incinerator ashes, vitrification of LLMW from reactor decontamination or ion exchange resins). The Westinghouse Scientific Ecology Group (SEG) was notified of the effort, but has not decided to participate.

Exact funding levels are being negotiated, however, approximately \$100,000 is expected from WeDID, and \$50,000 each is expected from Chem Waste and Digital. With cost sharing by Clemson, enough money is expected to lease a TECO melter and perform several pilot scale tests. The melter should be set up and operating this fall.

Glass Fabrication for Temperature Sensors

W. G. Ramsey and C. M. Jantzen

Glass Technology fabricated neodymium (Nd), europium (Eu), and terbium (Tb)-doped temperature sensors in support of an Analytical Development Sec-

tion (ADS) program. These sensors provided significant cost savings to the site.

Sensors were needed for monitoring temperatures for groundwater colloid transfer studies. Glass frit was doped with oxides, melted, and drawn into rods, which were made into sensors. The sensors performed well in dynamic tests and are being considered for other temperature measurement applications in the DOE complex. Commercial Westinghouse fabrication on-site resulted in a savings of \$2000 per sensor, which will result in an ultimate savings in excess of \$100,000 for this application alone.

Chemical Compatibility of the Contents of the DWPF Canister

J. R. Harbour

SRTC completed a comprehensive review of the compatibility of the contents of the DWPF canister and the canister itself. The study concluded that DWPF canistered waste forms produced under normal conditions will not experience significant internal corrosion before placement in a repository.

The study identified the canister materials and the species likely to be present (glass and semi-volatiles). It then examined the compatibility of these materials, considering service temperatures, radiation doses, and environmental conditions. It also considered potential atypical operating conditions and concluded that they would not result in significant corrosion of the canister.

Preparation of Waste Form Qualification Report (Volume 2)

M. J. Plodinec

SRTC prepared Volume 2 of the DWPF Waste Form Qualification Report. This document describes the method that will be used to determine and report the chemical composition of DWPF glass.

The DWPF is required to establish its ability to comply with DOE's specifications for acceptance of DWPF glass. One specification requires that the DWPF report the chemical composition of the canistered waste form for each waste type.

The chemical composition reported for each waste type will be an average calculated from the chemical

composition of each process batch in the macro-batch. Samples will be taken from each process batch (the Slurry Mix Evaporator and the Melter Feed Tank) and analyzed in the DWPF laboratory. The analytical values will be accumulated and averaged after the processing is completed.

Periodically, glass samples, using a specially designed glass sampler, will be taken from the glass stream as it enters a canister. SRTC will independently analyze the glass samples and use them to confirm the reported composition.

In the document, the basis for reporting, the methods for slurry glass sampling and analysis, and the methods for calculating the average chemical composition of the waste type are described. It also contains estimates of the errors associated with these activities, based on extensive SRTC testing. It appears that the largest source of variation in the reported composition will be the variations in the process batch compositions, reflecting the variability of the material in the waste tanks.

Defense Waster Processing Facility (DWPF) Analytical Laboratory Assessed for Readiness to Support Cold Chemical Runs C. T. Randall

Two assessments indicate that the Defense Waste Processing Facility (DWPT) Analytical Laboratory at TNX is well positioned to analyze samples from Startup Test WP-19 and to provide analytical backup to DWPF for CCR. A self-assessment, which was required by the Startup Plan, assesses specific requirements for the laboratory to support WP-19, as documented in the DWPF Startup Requirements Matrix. Four actions were identified and will be complete before the beginning of the CCR.

Site Quality, DWPF Quality, and SRTC Glass Technology (for Waste Compliance) made a separate surveillance assessment, which concludes that the "DWPT Analytical Laboratory was generally in compliance with the applicable QA Program requirements". Some areas of concern were identified and are being addressed.

SRTCs Analytical Development Laboratory made a similar assessment that includes similar conclusions and concerns. Areas of concern for SRTC analytical

support of DWPF CCR will be addressed before the beginning of the CCR.

DWPF Melter Inspection Device

C. E. Sweeney, T. J. Miller, F. M. Heckendorn, and B. S. Bushart

DWPF requested that EES develop and fabricate a remotely operable inspection device to visually inspect the interior of the DWPF glass melter. Assessments of the high anticipated corrosion rates within the melter will provide an improved prediction of remaining melter life. The device will be similar to a bore-scope, with the camera above the melter and an optical tube with a 45° mirror at the end for visual inspection.

Accuracy and repeatability tests were successfully performed on the DWPF melter inspection device. A stainless steel optical end was fabricated. We are working with the customer to develop operating procedures for baseline inspection in the first week of November 1992.

DWPF Impact Wrench Test

J. M. DeWent and K. M. Rehberger

The DWPF impact wrench characterization test utilized an Allen-Bradley variable frequency drive (VFD) to limit the ACME stud tensile force produced by the impact wrench within a specified test period.

Vickers Welco and EES reviewed the test data and concluded that motor revolutions per minute (rpm) would be the limiting factor in the motor's redesign. A reduction in rpm would reduce the linear travel of the impacted ACME nut, thereby reducing the tensile load delivered to the ACME stud. EES and Vickers Welco are discussing the effect of modifying the motor stator pole structure from 12 to 20 poles. Assuming constant torque, conversion to 20 poles would provide a motor RPM capable of delivering the maximum allowed load to the ACME stud in the specified time while being driven with conventional 60 Hz power.

PROGRESS AND ACCOMPLISHMENTS

Effectiveness of Decanter Modifications on Organic Removal

D. P. Lambert

The effectiveness of equipment and process modifications on organic removal in the Precipitate Hydrolysis Experimental Facility (PHEF) were documented in a report (WSRC-92-996) issued August 20, 1992. The report was the last item necessary for completing the task for demonstrating Salt Processing Cell Modifications, a DWPF deliverable. The report also summarized PHEF runs 54 through 59 that were completed to test various strategies for improving organic removal through decanter modifications and processing changes.

The report concluded that the new decanter is more efficient in organic removal than the original decanter because of the self-cleaning design. The high boiling organics are forced out of the decanter during the benzene production phase and replaced by relatively pure benzene. This allows for higher extraction efficiency during the organic stripping phase of the cycle. The new decanter is more efficient than the original decanter in the hydroxylamine nitrate (HAN) and Late Wash flowsheets. Because of the low production of diphenylamine in the Late Wash flowsheet and the high organic removal efficiency of the decanter during stripping, the product in the Late Wash process is extremely low in high boiling organics compared to the HAN product.

Synthetica Detoxifier Vendor Demonstrations

S. R. Young

The Synthetica Detoxifier is being investigated as an alternative to the CIF to destroy the organic product during initial DWPF radioactive operation. The Synthetica Detoxifier uses steam gasification to convert organic material to CO₂ and H₂O, rather than traditional incineration. Since the Detoxifier is not an incinerator, permitting is expected to be relatively expedient compared to the CIF.

A one year contract was arranged in April 1991 with Synthetica Technologies to demonstrate a destruction and removal efficiency (DRE) of 99.99 percent, an instantaneous throughput of no less than 75 gallons per day, and to demonstrate reliability. The

demonstrations simulated DWPF organic product from the PHEF. Figure 7 summarizes the tests completed through September of 1992.

Test Date	Core Temp. (°F)	Capacity (gal/day)	DRE ¹ %	Comments
12/91	1800	80-110	98.639	MBE conveyor problems
	2000	26-32	2	MBE conveyor problems
6/92	2100	3	99.997	Feed rate problems
9/92	2100	4	4	Ceramic core failure

1. DRE data for benzene.
2. Broken sample trap.
3. Steady-state not maintained because of feed rate control problems.
4. Steady-state not achieved because of carbon formation.

Figure 7. Detoxifier Tests Summary

Initial testing in December 1991 indicated that a capacity of 75 gallons per day and a DRE 99.99 percent was not feasible with the current heating capacity. The reactor heating elements operated at maximum output, which indicates that the heating capacity limited the unit. The contract was extended to allow Synthetica Technologies to increase power input and to continue development of the Moving Bed Evaporator (MBE), a high capacity feed unit.

In June 1992, a test was performed with a reactor core temperature of 2100°F and greater heating capacity. Installing longer reactor heating elements and using superheated steam, rather than turbine cooling water, increased the heating capacity. While the DRE exceeded 99.99 percent, the capacity was indeterminate. Although the steady-state was questionable, feed rates as high as 65 gallons/day were achieved.

Testing with a ceramic reactor core continued in September of 1992. The ceramic core was installed to allow temperatures greater than 2100°F, which was the maximum operating temperature of its metal predecessor. This test was started by repeating the test performed in June 1992 to obtain the DRE and capacity at 2100°F. Shortly after introducing the PHEF organic product, excessive carbon formation caused prohibitive pressure drops and the test was aborted. No useful

DRE or capacity data was collected. Upon disassembly of the reactor, the ceramic core was seriously fractured. Catastrophic failure of the core resulted in low residence times and low reaction temperatures. These conditions are believed to kinetically favor the carbon formation.

Because the Detoxifier was not able to meet the required processing rate and destruction efficiency, other technologies will be reviewed for their potential application. These will include the Westinghouse Pyroplasma Unit, chemical oxidation, and supercritical water oxidation. Development efforts on the Detoxifier will also continue.

DWPF Participation in DOE EM-343 Audit

Defense Waste Processing Technology's (DWPT) participation in the DOE EM-343 Audit, during the week of September 14, 1992, resulted in no conclusions. DOE auditors, observers from the Office of Civilian Radioactive Waste, and observers from the Nuclear Regulatory Commission reviewed the following activities:

- DOE audits of the DWPT-Glass Technology group
- technical aspects of the Product Consistency Test
- Internal Gas Pressure with the canisters
- CPES (computer model to prepare DWPF material balances)
- Product Composition Control System

IDMS Mercury Water Wash Tank (MWWT)/Process Vessel Vent System (PVVS) Inspection

N. D. Hutson

The MWWT and the vapor exit line of the SRAT/SME Condenser in the IDMS were inspected after the PX4 operation. PX4 represented the first IDMS operation using the "Late Wash" PHA produced in the PHEF. The SRTC recommended "Nitric Acid Flowsheet" was also used during the PX4 run. The reference Late Wash precipitate hydrolysis procedure produces

an aqueous product that is relatively free of the high boiling organics (e.g., diphenylamine, etc.) and that tends to accumulate in the MWWT piping of the PVVS of the IDMS and on the High Efficiency Mist Eliminator (HEME) in the Formic Acid Vent Condenser (FAVC).

Inspection of the SRAT/SME Condenser vapor exit line revealed no evidence of organic accumulation. Inspection of the MWWT revealed a clear condensate layer with settled material at the bottom of the tank. Samples of the supernate and the supernate and the settled solids were taken. Phenol was the only organic present in the clear supernate (~80 ppm). Phenol (~80 ppm), diphenylamine (~20 ppm), and m-terphenyl (~2 ppm) were found in the settled solids and supernate sample. Overall, the inspection revealed that Late Wash PHA reduces the accumulation of organics in the IDMS. A more detailed inspection will be conducted after completion of the second run using the Late Wash PHA (PX5).

Design Review Package for the Nitric Acid Flowsheet

L. F. Landon

The SRTC recommended that the DWPF substitute nitric acid for formic acid to neutralize the sludge batched to the SRAT. The principal technical basis for this change is to off-set the marked reduction in the oxidant (nitrate) content of the aqueous product produced in precipitate hydrolysis with the implementation of Late Washing and the corresponding elimination for the need to use HAN—the principal source of nitrate in the aqueous product. Without this process change, the melter feed that would be produced with the SRAT flowsheet (i.e. formic acid acidification of the sludge) requires trimming with an oxidant to prevent producing a melter feed that would be excessively reducing, resulting in the precipitation of metals during vitrification.

A Design Review Package that will contain the documentation to technically support the recommendation to change to a nitric acid flowsheet in the Chemical Process Cell (CPC) is being prepared. The schedule calls for this package to be completed by October 26, 1992, followed by an independent review scheduled to be completed in early November 1992. Specific

deliverables and responsible individuals are documented in WSRC-RP-92-1063. The Design Review Package will contain documentation that addresses the following technology issues:

- stoichiometric bases for determining the nitric acid requirement in the SRAT
- melter feed redox control
- melter feed rheology control
- hydrogen generation
- corrosion
- NOx emissions
- essential materials
- ruthenium volatility during vitrification
- mercury stripping efficiency and recovery
- glass quality

A revised DWPF material balance that incorporates Late Washing and the nitric acid flowsheet will be produced.

DWPF Product Composition Control System (PCCS) Version 2.0 Delivery and Acceptance K. G. Brown

DWPF technical personnel tested Version 2.0 of the PCCS (OPS-DTA-920057) on August 24, 1992. The PCCS will serve as the main instrument to ensure that the properties of the waste glass produced in DWPF will demonstrably satisfy the applicable processing and repository constraints. The processing constraints include those on melt viscosity, liquidus temperature, and waste component solubility while the repository constraint dictates that the glass produced must be resistant to leaching. In PCCS, the constraints imposed upon properties that cannot be measured in the process are translated into constraints on composition, which is measured in the process. Thus, the PCCS employs multivariate statistical process control (SPC) techniques to control melter feed composition within acceptable confidence intervals.

SPC in PCCS is segregated into three different, yet symbiotic, functions (blending, monitoring, and remediation). The PCCS initially defines the optimal SRAT and SME target blends that prescribe the manner in which the melter feed material is produced. After the SME material is blended, the PCCS tests the predicted properties of the resulting composition for acceptability. If the material is deemed acceptable, it is transferred to a hold tank, then to the melter; otherwise, the SME material is remediated using Frit and trim chemicals. Remediation uses the same algorithm as blending, thus only blending and monitoring were tested.

SRTC personnel developed a test case for the principal features of the PCCS SPC algorithms (WSRC-RP-92-897). The case proceeds from empty SRAT and SME vessels and completes two acceptable SME product batches for transfer to the MFT. Independent results were generated and verified using SAS®, IMSL® and a code written in FORTRAN® (WSRC-RP-92-992). The results were used to develop the test case procedure for PCCS Version 2.0 verification (OPS-DTB-920021).

PCCS Version 2.0 was delivered to DWPF Technical personnel on June 30, 1992. Acceptance testing on PCCS Version 2.0 was successfully completed on August 21, 1992. The few discrepancies that were discovered were resolved quickly and to the satisfaction of DWPF Technical personnel. The other "findings" posed little or no impact on the software acceptability and were resolved by SRTC and DWPF Technical and Engineering (T&E). The manual system and automatic interface between PCCS and PIMS were functional and future modifications will primarily revolve around expanding the automatic interface.

DWPF Process Requirements (PRs) L. F. Landon

Initial DWPF PRs for startup of DWPF CCRs were issued and approved. However, with the implementation of Late Washing, the corresponding change in DWPF precipitate hydrolysis process operating parameters and the recommendation to use nitric acid rather than formic acid to neutralize the sludge in the SRAT, require revision before the start of CCRs.

PROGRESS AND ACCOMPLISHMENTS

"Precipitate Hydrolysis" (DWPFPR-S03) must include a limit on the copper catalyst content of the aqueous product produced during precipitate hydrolysis. This is necessary to prevent the production of a melter feed that is excessively oxidizing. In addition, the PR is being modified for application in the Late Wash or HAN process.

"Melter Feed Preparation" (DWPFPR-S04) requires a revised redox limit for melter feed. The redox of the melter feed will be a function of the copper content of the aqueous product produced during precipitate hydrolysis (to prevent exceeding the copper solubility in the waste glass); therefore, a redox limit will be specified as a function of copper content of the waste glass over the expected range of copper content to be produced in DWPF during CCRs.

The revised PRs will be issued for approval by October 5, 1992.

Ion Exchange (IX) Technology Assessment

R. A. Jacobs

Four members of DWPT participated on the IX Technology Assessment team. The DWPT participants and their area expertise and contributions were:

- Erich Duhn - Chairman
- Dave Boersma - Operational requirements and technical issues and uncertainties
- John Fowler - Z Area requirements and IX feed characteristics
- Roy Jacobs - DWPF feed acceptance and process flowsheet/selection

The primary conclusions of the technology assessment team were:

- SRS IX of waste is technically feasible.
- The SRS resorcinol and formaldehyde resin is preferred.
- Research and development should further define the process and provide design information as needed.
- An engineering study should be performed to determine siting and an estimate cost for a second generation or contingency replacement for ITP, Late Wash, and Precipitate Hydrolysis.

PROGRESS AND ACCOMPLISHMENTS

DWPF Performance Indicators

R. A. Jacobs

Figure 8. SRTC Performance Indicators

Three activities have not been completed:

- approval of feed acceptance criteria for precipitate slurry
- approval of feed acceptance criteria for sludge
- minimum nitrite runs/reports

DWPT delivered the document covering the first two items for approval. Approval is pending resolution of differences between IWM and DWPF on implementation of feed acceptance. The third item is likely to be released from the schedule due to a change in scope resulting from the development of Late Wash.

Technical Bases for the Late Washing Facility

D. L. Fish and L. F. Landon

Design efforts are in progress to modify the Auxiliary Pump Pit such that the tetraphenylborate precipitate, produced during ITP operations and stored in Tank 49, will undergo a final wash to reduce the nitrite content of the slurry to 0.01M or less before transfer to DWPF. The reduction in nitrite negates the need for HAN during acid hydrolysis in the Salt Processing Cell

resulting in the elimination of the major source of ammonium flow into the Chemical Process Cell. In addition, the reduced nitrite content produces an aqueous product during hydrolysis that contains significantly less strippable organic high boilers than shown during process operations in IDMS to accumulate in the vessel vent system.

The initial technical bases that support the Late Wash facility was transmitted to DWPF on August 10, 1992. Revised technical bases were submitted on September 8, 1992. The major revision in the technical bases, based on additional cross-flow filter cleaning tests, is that the spent oxalic acid and caustic cleaning solutions will not contain Cs-137 projected concentrations that necessitate disposal in Tank 48. Rather, these spent cleaning solutions may be combined with a cross-flow filter permeate and transferred to Tank 22 (the ITP spent wash water hold tank). In addition, the shielding wall thickness of the cell accommodating the cleaning solution hold tanks will not be dictated by biological radiation shielding constraints.

Subsequent to the issue of the revised technical bases, pilot-scale demonstrations of the benzene removal concept were initiated. This concept, which includes nitrogen sparging of the cross-flow filter

permeate and spraying of the permeate into the vapor space of the permeate hold tanks, was deemed necessary to reduce the benzene content of the permeate within the available cycle period to Tank 22 limits (less than 5 ppm). Initial pilot-scale tests, with only sparging, indicate that the initial benzene content of the permeate can be reduced to less than 5 ppm in 10 hours or less. Evidently, the rapid depletion of benzene is attributed to the ability to produce a bubble size significantly smaller than assumed practical and it was used in the model to predict the period required to reduce the benzene concentration to less than 5 ppm. Tests directed at developing the final design bases for the nitrogen spargers to be installed in the permeate hold tanks in the Auxiliary Pump Pit continue.

Statistical Design for Melter Feed Tank (MFT) Homogeneity Study at TNX

T. B. Edwards

The MFT homogeneity study supports the DWPF objective to verify the homogeneity of the feed composition (Frit-Sludge-PHA) from the MFT to the melter while maximizing attainment by minimizing the heel level left in the MFT between batches. The study consists of two parts: the high weight percent solids and the low weight percent solids.

A statistical design to be used for each half of the study was developed. The design provides a plan for the collection of the samples from the MFT and for the sequencing of the analyses of these samples to obtain data for the homogeneity study. The details of the design were issued in report SCS-ASG-92058.

GENERAL

First Priority Update

P. C. Hopson and R. E. Osteen

The evaluation module for the First Priority software was designed and a preview function was added to the goals tree builder module to allow users to view how the evaluation interface will appear when a measurement statement is created.

Note taking and auditing capabilities are also being added. This will give the user the ability to attach notes to the project as a whole or to individual goals or measures. This capability provides an excellent mnemonic mechanism and the ability to assist with the creation of audit trails. A report generating facility will use these notes to produce status reports on the project.

Currently, the project consists of several stand-alone modules. Work is continuing to integrate all portions of the program into the goals tree building portion of First Priority. The modified Saaty scale editor used for weighting the goals tree, the notes and audit trail features of the software, and the evaluation module builder will be included. A release date for the alpha version of the program is set for early October 1992.

FY93 Personal Computer Forecast Completed

S. E. Lance

SRTC Level 3 managers were surveyed to determine projected section needs for FY93. Two hundred and ninety two personal computers are needed for FY93. This total reflects new systems, upgrades, and replacements of obsolete equipment and computers requisitioned in FY92, but not ordered. Out of the 286 computers projected in FY92, SRTC was allowed to order 144 systems.

Statistical Analysis of DOE Survey Data

T. B. Edwards

The Performance Assurance Office of DOE-SR provided survey data that was analyzed to investigate

responses to the survey by various demographic categories, such as gender and age.

The survey data were imported from Filemaker Pro into JMP, a commercial software package for Apple computers from SAS Institute, Inc. The statistical results from JMP were entered into Microsoft Excel to summarize the information into more appropriate tabular formats that were provided to the customer.

Organizational Analysis

P. L. Ames and J. W. Krieger

SCS became formally involved in the organizational analysis task in May 1992. At that time, expectations concerning software focused primarily on calculations of recommended management spans. Over time the emphasis shifted to calculation of current spans, since the state of the organizational data made the latter a nontrivial calculation.

The primary purpose of the software is to produce tables that are read into a spreadsheet to generate various types of reports. One of the reports consists of "box and whisker" charts that show composite and individual spans and provides a comparison with span recommendations developed during interviews with senior management.

The Organization Analysis team is determining the final format of the reports. Since reports are generated independently of tables, changes to reports do not require modifications to the software. Current plans call for the generation and delivery of updated span information on a monthly basis.

Mobile Robot Development

R. F. Fogle, M. Collins, D. L. Daniels, and G. A. Henning

Several types of remote controlled vehicles are under development for use in Equipment and Materials Technology's (E&MT) Robotic Rapid Response Program. Six remote controlled vehicles will share a similar electronic control system design using the STD bus architecture. The development of a generic electronic design for teleoperated vehicles using off-the-shelf components is anticipated to reduce the variety of spare parts for the vehicles and electronic troubleshooting will be easier.

PROGRESS AND ACCOMPLISHMENTS

A new electronic control system was developed. It is nearly identical to earlier designs of the MERRV and ACEC teleoperated vehicles. The new design will be installed in two Hornet vehicles and two PEDSCO teleoperated vehicles. All are skid-steer, battery powered vehicles. The Hornet vehicles have tracks and the PEDSCOs have wheels.

The software for the Hornet vehicles permits radio or tether operation and automatically switches from a wire to a wireless mode of operation if the tether link between the operator and vehicle is severed or rendered unusable. The PEDSCO software will be similar to that of the Hornet.

Rapid Response Enhancements

R. L. Witherspoon and R. F. Fogle

- An exhaustive search for a teleoperated vehicle to carry the Schilling manipulator was completed
- A small, electric, radio controlled forklift was chosen as the most desirable candidate.
- The procurement requisition and specification were written.
- The possibility of installing a radio frequency (RF) link to control the manipulator was explored and appears feasible.
- Other issues associated with mobilizing the Schilling are being evaluated.
- The conceptual design was completed for a small LPG powered hydraulic power unit for the manipulator.
- The issue of integrating the Schilling control module with the vehicle's power supply is being addressed.
- A remote audio/video system is being developed.
- When completed, the forklift/Schilling combination will be added to the rapid response equipment.

E&MT Contributes to Cost Savings/Quality Improvement Suggestion System (QISS)

Award - #241-14H Pumphouse Radiographic Testing (RT)

B. D. Howard

B. D. Howard, R. S. Jasniecki, R. A. Leishear, and R. J. Moxley received a QISS award for successfully utilizing RT to diagnose the source of internal hammering in a check valve located in 241-14H Pumphouse. Under normal circumstances, lines where check valves appear to be malfunctioning are drained, disassembled, and visually inspected. The Non-Destructive Examination (NDE) Consultation group recommended that RT be used to solve this problem. E&MT coordinated field support with EBASCO Services, who produced excellent radiographs even though the lines were full of radioactive solution. Internal details of the check valve were clearly revealed and the cause of the hammering was diagnosed to everyone's satisfaction. Estimated savings were over \$15,000, with possible future savings.

As a follow up to this activity, the NDE Consultation group was requested to return to H Area and give a presentation on the value of non-destructive testing.

E&MT NDE Lab Project Progresses

I. D. Hill and A. Placr

To improve the quality of services of the E&MT NDE Consultation group, a project was initiated to design and install a NDE facility that supports the development of specialized NDE techniques, aid in failure analysis of materials and equipment, and provide state-of-the-art NDE capabilities. The lab project is in the design phase with construction scheduled for completion in the third quarter of FY93.

Lab capabilities will include a TEKTRONDTM Arius II UT Immersion System with X, Y, Z and Q to an accuracy of 0.0001". The UT instrument controller is multi-channel, fully programmable and provides constant scanning velocity along 3-D paths. The processor will be a 50MHz i486 Intel CPU with a built-in 487 math co-processor 32 MB high-speed RAM, and 525 MB 12 mx SCSI hard drive with 64K cache buffer. The system is projected to be delivered in the first quarter of FY93. In addition, the lab has a 150 Kev, EG&G radiography cabinet that is fully self contained and will

PROGRESS AND ACCOMPLISHMENTS

be available for service by November 1992. A Zetec MIZ40 eddy current instrument is also available. The E&MT lab will be able to meet the present and projected needs of SRTC customers.

ITEMS OF INTEREST

- The American Society of Microbiology requested that T. Hazen attend an organizational meeting for the Water Quality in the Western Hemisphere conference in San Juan, Puerto Rico in April 1993.
- A Liquid Effluent Monitoring Surveillance of SRTC facilities was conducted in June 1992. The final report contains no deficiencies for the SRTC program.
- A. Galbraith received a site Total Quality Award (submitted by ER and WM) for the Metlab Basin Seepage Basin Closure task team.
- J. L. Hansen is coordinating Decontamination and Decommissioning (D&D) safety documentation development, safety analysis and information exchange with Westinghouse Government Operations Contractor (WGOCO), and the Energy Facility Contractors Group (EFCOG) Safety Analysis Working Group ER/D&D subcommittee members. A status report will be issued at the October 28, 1992 WGOCO D&D subcommittee meeting.
- N. Roddy, D. Simmons, and E. Stevens assisted with the Waste Minimization and Recycling display at the Augusta Mall SRS Appreciation Days in July 1992.
- E. Orebaugh participated in the symposium on "Chemical Pre-treatment of Nuclear Wastes for Disposal" in August 1992 at the National Meeting of the American Chemical Society.
- External Affairs requested that E. Wilhite participate in an Environmental Forum in Allendale, South Carolina.
- E. Wilhite and J. Cook assisted Solid Waste Management in assessing the disposition of Naval Reactor core barrels versus the low-level waste disposal facility Technical Standard (TS).

PUBLICATIONS

- C. A. Eddy and B. B. Looney, "Three Dimensional Imaging of Environmental Data: Selection of Gridding Parameters". *International Journal of Geographic Information Systems*.

PRESENTATIONS

- T. C. Hazen presented, "DOE/SRS Integrated Demonstration: In Situ Bioremediation of Soil and Groundwater at a Chlorinated Solvent Contaminated Site Using Horizontal Wells to Inject Air and Methane", at the International Symposium on Bioremediation of Industrial Waste Water and Contaminated Environments, sponsored by the Gas Research Institute, Michigan Biotechnical Institute, and the International Symposium for In-Situ Bioremediation, sponsored by Environment Canada.
- D. S. Kaback presented, "Horizontal Well Drilling Technology", at a short course on Environmental Drilling at the University of Wisconsin at Milwaukee.

ITEMS OF INTEREST

- C. M. King presented, "Catalytic and Biochemical Concepts for Removal of Tritium from the SRS Process and Environment", at the American Chemical Society Symposium on, "Emerging Technologies for Hazardous Waste Management: Waste and Environmental Restoration at Savannah River" Special Symposium in Atlanta, Georgia. C. M. King (SRTC) and V. Van Brunt (University of South Carolina-Columbia) chaired the session. C. B. Fliermans, A. Schwirian, J. W. Schafer III also collaborated in this effort.
- B. B. Looney presented, "In-Situ Air Stripping of VOC's Using Horizontal Wells: Field Test Results", at the American Chemical Society Symposium on "Emerging Technologies for Hazardous Waste Management: Waste and Environmental Restoration at Savannah River". D. S. Kaback and T. C. Hazen also collaborated in this effort.
- R. C. Tuckfield presented, "To Block Or Not To Block: A Comparison of Analysis of Covariance (ANCOVA) and Randomized Block Designs", at the Statistical Ecology Section of the Ecological Society of America from August 9 to 13, 1992 in Honolulu, Hawaii. The presentation compared and contrasted the two statistical methods common to the experimental research in Ecology and Environmental Science.
- M. R. Buckner presented, "Statistical Process Management: An Essential Element of Quality Improvement", at the WEC Electronic Systems Group's, "Total Quality Management: Metrics of Success III Symposium", in Baltimore, Maryland on August 7, 1992.
- J. P. Church presented a review of the Strategic Plan for Scientific Computing to the SRS Computing Architecture and Standards Team on August 25, 1992.

OTHER

- The final version of a DOE guideline for preparing Criticality Safety Evaluations (CSE) was reviewed at an EG&G organized INEL workshop. This guideline supplements DOE Order 5480.24. It defines the scope and formats for the documents termed Nuclear Criticality Safety Analyses (NCSA) at SRS. Criticality safety analyses used in Safety Analysis Reports (SAR) are outside the scope of this guideline and governed by DOE Orders 5480.22, 5480.23, and 5480.24. In addition, EG&G Rocky Flats requested development of a white paper of the other DOE contractors as a potential future guideline on validation.

With the issuance of 5480.24, three principal DOE Orders exist that provide guidance for criticality safety analyses. Order 5480.23 covers SARs and Order 5480.22 covers Technical Safety Requirements (TSR). Orders 5480.24 and 5480.23 lead to questions regarding the amount of CSE details that need be placed in the SARs. DOE (DP-62) also appears to be questioning the provision for excluding criticality Safety Limits from TSRs (currently part of the 5480.22 Guidelines). Suggestions for resolving these issues should be made to DOE as soon as possible.

ITEMS OF INTEREST

EG&G Rocky Flats is seeking to rapidly expand the guidance of ANS 8.1, Section 4.3, on criticality code validation. Many of the other DOE contractors believe Rocky Flats resorted to this step to guard against DOE criticism. This effort could result in more detail than should be specified in a DOE guideline (or revision to the ANS 8.1 Standard).

END

**DATE
FILMED**
9 / 30 / 93