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**APPLIED TECHNOLOGY SECTION MONTHLY REPORT
DECEMBER 1993 (U)**

by

M.R. Buckner

Westinghouse Savannah River Company
Savannah River Site
Aiken, South Carolina 29808

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**Westinghouse Savannah River Company
Inter-Office Memorandum**

January 28, 1994

TO: FRED BERANEK, 773-A

FROM: M. R. BUCKNER, 773-42A
(5-3149)

Applied Technology Section

Monthly Report

December 1993

Table of Contents

Table of Contents	i
Abstracts	1
Administrative	5
ENGINEERING MODELING AND SIMULATION	
(J. R. Pelfrey, Manager)	
Engineering Modeling.....	6
Finite Element Modeling to Simulate Crushing of Celotex - N. K. Gupta, Chung Gong	6
Thermal Evaluation of the 9965, 9968 and 9972-9975 Shipping Packages - J. W. Jerrell	6
Process Simulation	7
Integrated High Level Waste System Flowsheet Model (HLWSF) Support - Kirk L. Shanahan	7
High Level Waste Simulation Package - M.V. Gregory	7
APPLIED PHYSICS	
(C. E. Apperson, Manager)	
Computer Code Certification	9
J80 Criticality Codes Certification - D. Biswas, S. L. Lee, C. E. Boman, R. E. Grove, J. H. Hightower (Engineering & Scientific Computing Section), and R. L. Reed	9
Criticality Methods and Analysis	9
High-Level Waste Engineering (HLWE) Technical Task Request (TTR) for Criticality Safety Calculations - K. A. Niemer	9
In-Field Criticality Safety Training - T. G. Williamson	10
PNL Technical Review Panel - T. G. Williamson	10
100 Area Fuel Consolidation Support Activities - R. L. Reed and S. Y. Lee	10
300 and 100 Area CRC Meetings - R. L. Reed	11
DWPF Criticality Safety Reassessment - T. G. Williamson	11
Westinghouse Nuclear Fuels Facility - J. F. Mincey	11
Work In Support Of The E-Vault SAR - T. G. Williamson and J. F. Mincey	11
Plutonium Disposition Study	12
Plutonium Burner Support - R. W. Rathbun, D. Biswas, and S. Y. Lee	12
Technical Review Summaries	12
Technical Review: USF SAR - J. F. Mincey	12
Technical Review: Disassembly Basin Sludge Cleanup in K Area - R. L. Reed	12
Technical Review: Criticality Aspects of Sand Filter and Associated Settler Tank - R. L. Reed	13
Technical Review: NCSE for 320-M Laboratory Enriched Uranium Operations - R. L. Reed	13

Table of Contents

EXPERIMENTAL THERMAL HYDRAULICS

(D. R. Muhlbaier, Manager)

ITP Mixing Study - D. A. Eghbali.....	14
FRR Spent Fuel Dry Storage Development - H. N. Guerrero	14
Pilot-Scale Demonstration of HEME Dissolution Process - Z. H. Qureshi	15
Investigating Level Indicating Devices - T. L. Spatz	15
Cross-Flow Filter Test - J. L. Steimke, C. M. Hart	16

PACKAGING AND TRANSPORTATION

(E. K. Opperman, Manager)

Packaging - Tritium Spent Melt Crucible - P. S. Blanton	17
SED Facility D&D - Trap Shipments - T. K. Houghtaling	17
Americium-Curium Packaging for F-Canyon General - R. S. Maurer	18
Manuals Path Team Activities - M. N. Van Alstine.....	19

L1100, Applied Technology	20
---------------------------------	----

Distribution	22
--------------------	----

Abstracts

ENGINEERING MODELING AND SIMULATION (J. R. Pelfrey, Manager)

Engineering Modeling

- Finite Element Modeling to Simulate Crushing of Celotex - N. K. Gupta and Chung Gong6**
Structural analyses using ABAQUS finite element program were performed to simulate the slow rate crushing of Celotex. Various enhancements in the finite element model are being tried to match the test results.
- Thermal Evaluation of the 9965, 9968 and 9972-9975 Shipping Packages - J. W. Jerrell6**
Thermal analyses for the 9965, 9968, and 9972 through 9975 shipping packages with one source have been completed. The maximum allowable wattage for each of the packages has been determined.

Process Simulation

- Integrated High Level Waste System Flowsheet Model (HLWSF) Support - Kirk L. Shanahan7**
A two-day technical session was held with Dr. Ian Willetts of Aspen Technology relating to HLW modeling projects.
- High Level Waste Simulation Package - M.V. Gregory7**
The SPEEDUP High Level Waste Flowsheet Model continues to grow towards the vision described in the customer's Software Requirement Specification. Over the past month, the basic model has been expanded from 8 to 27 chemical components. Other team members are generating new subsystem models in parallel in preparation for a general integration of all models in the next month or so.

APPLIED PHYSICS (C. E. Apperson, Manager)

Computer Code Certification

- J80 Criticality Codes Certification - D. Biswas, S. L. Lee, C. E. Boman, R. E. Grove, J. H. Hightower (Engineering & Scientific Computing Section), and R. L. Reed9**
Work is continuing on the J80 Criticality Code User's Manual and J80 TWOTRAN, KENO and KOKO testing work.

Criticality Methods and Analysis

- High-Level Waste Engineering (HLWE) Technical Task Request (TTR) for Criticality Safety Calculations - K. A. Niemer9**
A Technical Task Request (TTR) was issued from High Level Waste Engineering (HLWE) for APG to perform criticality safety calculations. Work on this TTR has begun.
- In-Field Criticality Safety Training - T. G. Williamson10**
In-Field criticality safety training continues in the use of the Joshua GLASS module.
- PNL Technical Review Panel - T. G. Williamson10**
The Defense Nuclear Facility Safety Board (DNFSB) raised questions at Pacific Northwest Laboratory about the adequacy of the assay technology for analyzing radioactive waste boxes for transuranic elements. Dr. Williamson visited PNL on December 14-15 as chair of an external independent review panel.

Abstracts

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Calculations for increased storage in Horizontal Storage racks in Disassembly indicate that rack storage can be increased 50% with the addition of a grating over the racks.	
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APG provided SRTC representation at the 300 Area and 100 Area Criticality Review Committee meetings (First Quarter, 1994).	
DWPF Criticality Safety Reassessment - T. G. Williamson	11
Nuclear Criticality Safety Evaluations of the Chemical Process Cell and the Melter of the DWPF were completed, reviewed and issued.	
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Training was conducted to train three APG engineers to perform criticality safety analyses at the Columbia, S. C. Westinghouse Nuclear Fuel Fabrication Facility (their report to work date is 1/4/94). A draft double contingency analysis using the Columbia UNH Bulk Solution Storage Tanks was also prepared and submitted for comment 12/23/93.	
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A task plan was written and issued for evaluating equivalence relations in support of the E-Vault SAR. Work on demonstrating compliance with the double contingency principle was deferred.	
Plutonium Disposition Study	
Plutonium Burner Support - R. W. Rathbun, D. Biswas, and S. Y. Lee	12
WSRC is supporting WEC with PDR600 core physics predictions for the Phase Ic effort. Core physics efforts for Phase Ic were documented and sent to WEC by the mid-December report milestone date. The WSRC report input was accepted by WEC project leadership with only a few editorial changes. Planning has proceeded for Phase Id efforts that will continue to the end of May, 1994, after which all task participants will meet with DOE for formal presentations.	
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The second phase review (Chapter 9) of the USF SAR was completed with comments..	
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Review of the RED evaluation (WSRC-TR-93-613) of the criticality potential associated with sludge removal activities in the K Disassembly Basin has been initiated.	
Technical Review: Criticality Aspects of Sand Filter and Associated Settler Tank - R. L. Reed	13
Review of the RED evaluation (WSRC-TR-93-614) of the criticality potential associated with operation of the sand filter for the K Disassembly Basin has been initiated.	
Technical Review: NCSE for 320-M Laboratory Enriched Uranium Operations - R. L. Reed	13
Review comments for NCSE #251 (WSRC-RP-93-320-251) have been provided to 300 Area personnel.	

EXPERIMENTAL THERMAL HYDRAULICS

(D. R. Muhlbaier, Manager)

- ITP Mixing Study - D. A. Eghbali14**
 The purpose of this study is to investigate, using Computational Fluid Dynamic Code (FI-DAP), the fluid dynamics and physical processes that occur during forced mixing in radioactive waste storage tank 51. Investigations include simulation of jet mixing pump induced flows, which are intended to mix and maintain particulate material distributed uniformly throughout the liquid volume. Tank 51 is a waste storage tank that utilizes four submerged mixing pumps, located near the bottom of the tank, to sustain uniform mixing of the slurry. Initially, about twenty inches of a settled sludge layer exist at the bottom of the tank. Mobilization of this sludge layer with jet mixing pumps is the focus of this study.
- FRR Spent Fuel Dry Storage Development - H. N. Guerrero14**
 The Department of Energy has a program to develop dry storage as a means of storing Foreign Research Reactor (FRR) spent fuel in the interim period prior to acceptance of the fuel in a final repository. This is needed in view of the present plans to phase out Separations Area facilities and the continuing delivery of FRR spent fuel over a period of 10 to 15 years. The objective of the ETF portion of the program is to determine how one of the four commercial dry fuel storage canister designs can be adapted to meet thermal storage requirements of the FRR spent fuel.
- Pilot-Scale Demonstration of HEME Dissolution Process - Z. H. Qureshi15**
 The High Efficiency Mist Eliminators (HEME) used in the melter feed preparation processes will be dissolved in a caustic solution for their ultimate disposal. A pilot-scale demonstration of this dissolution process will be conducted in the Thermal-Fluids Lab. to resolve some technical issues regarding dissolution and breakup of the fiberglass material. This task is scheduled to be complete by June '94.
- Investigating Level Indicating Devices - T. L. Spatz15**
 The density and height of constituents in the mixing tanks are currently measured with a diaphragmed bubbler device known as a Holledge probe. During testing with simulant sludge traditional bubblers encountered plugging problems. The purpose of this task is to search the available literature for the state-of-the-art in level indicators. This literature search will incorporate Holledge probes, modifying traditional Bubblers, and others
- Cross-Flow Filter Test - J. L. Steimke, C. M. Hart16**
 In preparation for delivery to the Defense Waste Processing Facility, slurry from Tank 49 will be washed in a process that uses a cross-flow filter in a vertical orientation. Most of the flow passes through the porous tubes of the filter in the axial direction. A small part of the flow is driven through the porous membrane of the tubes by a pressure difference. Filtrate collects in the shell around the porous tubes and is collected.

PACKAGING AND TRANSPORTATION

(E. K. Opperman, Manager)

- Packaging - Tritium Spent Melt Crucible - P. S. Blanton17**
 Following Tritium's Line 3 Operational Readiness Review (ORR), hot lithium-aluminum targets presently held in various Reactor basins will be processed. Tentatively, it is believed that some forty four (44) spent melt crucibles will be moved over the next 5-6 years once processing begins. SRTC Packaging and Transportation is providing Tritium with necessary design criteria for a package to transport processed spent melts to the ILT vault and with documentation in the form of a safety assessment to support such a move.

Abstracts

- SED Facility D&D - Trap Shipments - T. K. Houghtaling17**
P&TG recommended the NRC certified TRUPACT-II packaging for shipping SED traps to the site burial grounds. P&TG and project operations personnel are working out details regarding handling and preparation of the SED traps for containment in the TRUPACT-II. Application to the NRC for an exception to the Certificate of Compliance will be necessary for shipment of any trap containing more fissile material than permitted by the certificate.
- Americium-Curium Packaging for F-Canyon General - R. S. Maurer18**
F-Canyon General requested the Packaging and Transportation Group (P&TG) to determine the packaging requirements for the Tank 17.1 radioactive contents. F-Canyon General has plans to ship the Americium and Curium (Am-Cm) isotopes to Oak Ridge National Labs (ORNL) between 1997-2002.
- Manuals Path Team Activities - M. N. Van Alstine19**
The Manuals Path Team was formed within the Safety Technology Department to recommend a uniform task planning process. Starting with multiple departmental quality assurance manuals and higher-tier manuals, the Team systematically developed a single effective set of procedures for interim use until SRTC procedures are completed.

Administrative

Travel

Dec. 13 T. G. Williamson participated in a Technical Review Panel at Pacific Northwest Laboratory in Richland, WA.

Publications

None

Presentations

None

ENGINEERING MODELING AND SIMULATION
(J. R. Pelfrey, Manager)

Engineering Modeling

Finite Element Modeling to Simulate Crushing of Celotex - N. K. Gupta and Chung Gong

Cusomer: Packaging and Transportation Group, A. G. Eggers

Abstract: *Structural analyses using ABAQUS finite element program were performed to simulate the slow rate crushing of Celotex. Various enhancements in the finite element model are being tried to match the test results.*

Celotex is an impact energy limiter and insulator and is extensively used in the design of radioactive material packages. The package designs have to meet NRC requirements given in 10 CFR 71. The regulations require that the packages be able to withstand certain drops without any damage to the material container. Finite element modeling of the complete packages will help in understanding their structural response under various normal and accident loading conditions.

Seven (7) Celotex crush tests on 2"x2"x2" samples were performed by the Materials Technology Section to obtain the force deflection curves for different orientations of the Celotex samples under different confinement conditions. These data were plotted and digitized for use on the finite element model. PATRAN3 finite element modeling program was used to create the analysis model for ABAQUS structural analysis program. Finite elements exhibiting the properties of the cane fiberboard were used to reproduce the response of the Celotex obtained in the tests. It is found that the elements behave as expected, however, some enhancements are necessary in the available elements in the ABAQUS code to match the crush test results. These enhancements are being discussed with the ABAQUS developer.

Thermal Evaluation of the 9965, 9968 and 9972-9975 Shipping Packages - J. W. Jerrell

Customer: Packaging and Transportation Group

Abstract: *Thermal analyses for the 9965, 9968, and 9972 through 9975 shipping packages with one source have been completed. The maximum allowable wattage for each of the packages has been determined.*

Previous analyses of the 9965, 9968 and 9972 through 9975 shipping packages have assumed that the heat source was equally divided into two separate sources located in both the upper and lower food cans. However, the source may be localized as a single mass located at the top of the primary containment vessel (PCV) close to the seal. Since the maximum permissible cane fiberboard temperature is 250° F, the single mass requires using a smaller heat loading than is currently accepted for equally divided sources.

Analyses have shown that a package in the inverted position with a single source maximizes the PCV seal and cane fiberboard temperatures. This arrangement has been analyzed for all packages and the maximum allowable heat loadings have been determined as follows:

Package	Maximum (Wattage)
9965	10
9968	19
9972	11
9973	16
9974	20
9975	21

The results presented above are being documented in the Safety Analysis Report for the packages. The customer is currently considering the need for further thermal analyses to complete the Safety Analysis Report.

Process Simulation

Integrated High Level Waste System Flowsheet Model (HLWSF) Support - Kirk L. Shanahan

Customer: High Level Waste Management Division

Abstract: A two-day technical session was held with Dr. Ian Willetts of Aspen Technology relating to HLW modeling projects.

In early December, Dr. Ian Willetts of Aspen Technology, Inc. arrived in Augusta for a two-day session of technical talks on SPEEDUP modeling. The agenda consisted of a general presentation on the morning of the first day, followed by two-hour private sessions with SPEEDUP modellers working on HLW projects (HLWE, DWPT, ATS, IWT organizations). Dr. Willetts used a SPARCbook computer with an additional VGA screen for the sessions. Particular models had been Internet-mailed to Aspen Tech prior to Dr. Willetts departure, and were loaded and available for use on the SPARCbook. The sessions were well-received and additional ones are planned on a regular basis

High Level Waste Simulation Package - M.V. Gregory

Customer: High Level Waste Management Division

Abstract: The SPEEDUP High Level Waste Flowsheet Model continues to grow towards the vision described in the customer's Software Requirement Specification. Over the past month, the basic model has been expanded from 8 to 27 chemical components. Other team members are generating new subsystem models in parallel in preparation for a general integration of all models in the next month or so.

The SPEEDUP High Level Waste Flowsheet Model continues to grow towards the vision described in the customer's Software Requirement Specification. The previously developed "skeleton" model was expanded from the 8 chemical components which were needed to simulate Extended Sludge Processing to the full vector of 27 chemical components necessary to minimally represent the entire high level waste complex.

To allow such a fundamental conversion of all models to be performed efficiently, two SPEEDUP architectural formulations were developed: the component vector was structured into logical "slices" which can be individually indexed; individual component indices were equivalenced to the actual component names. Such a formulation allowed each SPEEDUP model to be written in a structure-

independent form, analogous to variable indices passed into a FORTRAN subroutine. The result is that any future changes in component structure need be made only in one place (the UNITS section) and will be automatically and transparently transmitted to every SPEEDUP model. With this structure in place, the conversion from 8 to 27 components became almost a trivial task.

The converted "skeleton" model is now up to 2970 differential and algebraic equations, with 1626 input parameters to be specified by the user. A typical problem requires 10-15 CPU sec per simulated day on the VAXcluster. Other modeling team members are currently generating models for In-Tank Precipitation, Late Wash, F/H Area Tank Farms, and the Defense Waste Processing Facility. Model input/output facilities are also being developed. Due to the architectural conveniences of SPEEDUP, these models can be developed and tested in parallel, stand-alone versions. When they are ready, we will begin to incrementally integrate them into the overall model. The final model should be approximately twice the size of the present "skeleton" model.

APPLIED PHYSICS
(C. E. Apperson, Manager)

Computer Code Certification

J80 Criticality Codes Certification - D. Biswas, S. L. Lee, C. E. Boman, R. E. Grove, J. H. Hightower (Engineering & Scientific Computing Section), and R. L. Reed

Customer: C. E. Apperson, Jr., Applied Physics Group

Abstract: *Work is continuing on the J80 Criticality Code User's Manual and J80 TWOTRAN, KENO and KOKO testing work.*

a) J80 Criticality Code User's Manual

MGBS document was updated based on the independent technical reviewer's comments (technical reviewer — R. L. Reed). The updated document becomes a section of the finalized J80 User's Manual and is ready for issue (limited distribution to selected users). The J80 User's Manual will not be formally issued unless validation work is done.

b) KOKO

The testing of KOKO and its associated codes (KATISHA and POOHBAH) was not completed by Chuck Henkel before he was moved to a different group. Jo Hightower has, therefore, initiated the task of completing the test reports.

c) KENO Random Number Generator Routines

The technical review of the new random number generator routines used in KENO has been started. Steve Harris is expected to complete the review in January.

d) TWOTRAN

Jo Hightower has taken over the task of Christa Boman to complete the certification work of TWOTRAN. The software requirement specification and the test plan have been written. Work on the test report has been initiated.

Criticality Methods and Analysis

High-Level Waste Engineering (HLWE) Technical Task Request (TTR) for Criticality Safety Calculations - K. A. Niemer

Customer: High Level Waste Engineering (HLWE)

Abstract: *A Technical Task Request (TTR) was issued from High Level Waste Engineering (HLWE) for APG to perform criticality safety calculations. Work on this TTR has begun.*

HLWE performed criticality safety analyses using 16-group Hanson-Roach cross sections with a one-dimensional discrete ordinates code to determine neutron multiplication factors. APG has been requested to analyze a small set of selected cases using another cross section set. This request was in response to a Defense Board comment that HLWE did not independently address bias in calculations with the 16-group Hanson-Roach cross sections.

The AMPX-77 and SCALE codes will be used with the new ORNL LAW 238-group ENDF/B V-VI cross section library to perform the comparison calculations. The 238-group library has been transferred from ORNL and installed on SRS computing systems. Comparison calculations are expected to begin in February.

In-Field Criticality Safety Training - T. G. Williamson

Customer: Nuclear Materials Processing and Waste Management

Abstract: *In-Field criticality safety training continues in the use of the Joshua GLASS module.*

This training is an alternative to the on-loan training program. The training is attended on an as-desired basis by the participants to gain an understanding of the basic physics of criticality safety computer codes.

PNL Technical Review Panel - T. G. Williamson

Customer: Pacific Northwest Laboratory

Abstract: *The Defense Nuclear Facility Safety Board (DNFSB) raised questions at Pacific Northwest Laboratory about the adequacy of the assay technology for analyzing radioactive waste boxes for transuranic elements. Dr. Williamson visited PNL on December 14-15 as chair of an external independent review panel.*

On September 20-22, 1993 representatives for the Defense Nuclear Facility Safety Board (DNFSB) visited Pacific Northwest Laboratory and raised questions about the adequacy of the assay technology for analyzing radioactive waste boxes for transuranic elements. An external independent review panel consisting of Dr. T. G. Williamson, Senior Advisory Scientist, Westinghouse Savannah River Laboratory, Dr. S. E. Binney, Professor of Nuclear Engineering, Oregon State University, and Dr. J. F. Higginbotham, Associate Professor of Nuclear Engineering, Oregon State University, visited PNL on December 14-15, 1993. The panel confirms the findings of internal review panels that the neutron sensing part of the assay equipment is adequate to measure transuranic waste material at the specified limit.

100 Area Fuel Consolidation Support Activities - R. L. Reed and S. Y. Lee

Customer: M. A. Rosser, RED

Abstract: *Calculations for increased storage in Horizontal Storage racks in Disassembly indicate that rack storage can be increased 50% with the addition of a grating over the racks.*

Proposals have been made (and are being studied) to increase the fuel storage capability in both Assembly Area and Disassembly Area of 105-K. SRT-CMA-930062 examined aspects of criticality potential for Mark 22 assemblies following damage to borated concrete fuel storage racks in Assembly (See September Monthly).

Means of increasing the Disassembly capacity for fuel storage include increasing the number of bundles stored in a slot in the horizontal storage racks from 2 to 3. Under task plan TP 93-006-I-E-1, APG has examined the changes in subcriticality margin from current storage configurations and the means proposed to ensure maintenance of a minimum margin of safety. RED has proposed that a grating be placed above the horizontal storage racks to prevent a dropped fuel bundle from increasing the reactivity of the filled storage racks. Calculations (HRXN-KENO and MGBS-TGAL) indicate that a grating that will maintain a spacing of 6 inches or more between the storage array and a dropped fuel bundle is adequate to maintain subcriticality. A report documenting the calculations has been drafted and is in review within APG. Additional calculations are in progress to resolve comments.

300 and 100 Area CRC Meetings - R. L. Reed

Customer: M. A. Rosser, RED and R. H. Ross, NMP

Abstract: *APG provided SRTC representation at the 300 Area and 100 Area Criticality Review Committee meetings (First Quarter, 1994).*

APG provided SRTC representation at the 300 Area and 100 Area Criticality Review (Audit) Committee meetings for the First Quarter, 1994 in December. The 300 Area activities included a technical review of a JCO (DPSTA-300-3A, Addendum 1) for 300-M operations.

DWPF Criticality Safety Reassessment - T. G. Williamson

Customer: B. C. Ha, SRTC

Abstract: *Nuclear Criticality Safety Evaluations of the Chemical Process Cell and the Melter of the DWPF were completed, reviewed and issued.*

A review of the DWPF process was requested to determine whether recent process test results raise potential criticality safety issues. The review covers the entire process and provides the justification for whether or not there are any new criticality safety issues to be addressed.

Nuclear Criticality Safety Evaluations of the Chemical Process Cell and the Melter of the DWPF were completed, reviewed and issued.

Westinghouse Nuclear Fuels Facility - J. F. Mincey

Customer: Westinghouse Commercial Nuclear Fuels

Abstract: *Training was conducted to train three APG engineers to perform criticality safety analyses at the Columbia, S. C. Westinghouse Nuclear Fuel Fabrication Facility (their report to work date is 1/4/94). A draft double contingency analysis using the Columbia UNH Bulk Solution Storage Tanks was also prepared and submitted for comment 12/23/93.*

Training of three APG engineers to perform criticality safety work at the Westinghouse Nuclear Fuel Fabrication Facility near Columbia, S. C. was conducted to support a 1/4/94 report to work date.

An example double contingency analysis was completed and submitted to Columbia for comment on 12/23/93. This example was for UNH Bulk Solution Storage Tanks.

Work In Support Of The E-Vault SAR - T. G. Williamson and J. F. Mincey

Customer: Solid Waste Division

Abstract: *A task plan was written and issued for evaluating equivalence relations in support of the E-Vault SAR. Work on demonstrating compliance with the double contingency principle was deferred.*

The E-Vault SAR review indicated work was needed before that facility was operated to address double contingency in a credible manner and to develop critical mass equivalence relations with U-235 for isotopes other than Pu-239. A task plan to develop these equivalence relations was started and a memo issued that stated what the equivalence relations were that the task would attempt to demonstrate valid.

It was decided by Solid Waste to defer addressing double contingency until mid-1994.

Plutonium Disposition Study

Plutonium Burner Support - R. W. Rathbun, D. Biswas, and S. Y. Lee

Customer: Westinghouse Electric Corporation, NATD

Abstract: *WSRC is supporting WEC with PDR600 core physics predictions for the Phase Ic effort. Core physics efforts for Phase Ic were documented and sent to WEC by the mid-December report milestone date. The WSRC report input was accepted by WEC project leadership with only a few editorial changes. Planning has proceeded for Phase Id efforts that will continue to the end of May, 1994, after which all task participants will meet with DOE for formal presentations.*

Phase Ic core physics efforts for the Pu Disposition Study were formally documented for the PDR600 (AP600 with weapons grade MOX fuel) optimization studies. Topics included studies for optimized fuel cycles, optimization on the number of reactor units required, extended burn cycles and tritium production capability. A section was also included that spelled out details of the probable test assembly configuration and reactor core positioning. Additionally, at the request of DOE, a section was included that listed the Westinghouse developmental needs for the Plutonium Burner Project. These documented core physics efforts for Phase Ic were sent to WEC by the mid-December report milestone date. The report input was accepted by WEC project leadership with only a few editorial changes.

By mid-January 1994, Phase Id is set to commence. WSRC core physics personnel are committed to studying the effects of burning the fuel to the licensable limit (48,000 MWD/MT), investigating the effect of increased integral burnable absorber along with zirconium cladding and studying the large 1420 MWe plant (non-passive) with full MOX fuel.

Phase Id is projected to end by the last week of May, 1994. DOE is requesting that all participants meet at that time for formal presentations at the Piney Point, Maryland facility.

Technical Review Summaries

Technical Review: USF SAR - J. F. Mincey

Customer: Regulatory Programs, Nuclear Materials Processing Division

Abstract: *The second phase review (Chapter 9) of the USF SAR was completed with comments..*

The second phase review (Chapter 9) of the USF SAR was completed with comments. The major comment is again the failure to address double contingency in a credible manner.

Technical Review: Disassembly Basin Sludge Cleanup in K Area - R. L. Reed

Customer: M. A. Rosser (RED)

Abstract: *Review of the RED evaluation (WSRC-TR-93-613) of the criticality potential associated with sludge removal activities in the K Disassembly Basin has been initiated.*

The sludge sample results for K Disassembly Basin were evaluated by RED with the same methodology previously employed in RRD-RED-930306 to show that sludge removal in K Disassembly is critically safe. Sufficient fissionable mass is in K Disassembly Basin sludge to support a critical situation, but the evaluation shows that probable concentrations of fissionable material are insufficient to support criticality and that the neutron absorptive characteristics of other materials in the sludge provide further margins of safety. Comments have been provided to RED and are being resolved.

Technical Review: Criticality Aspects of Sand Filter and Associated Settler Tank - R. L. Reed

Customer: M. A. Rosser (RED)

Abstract: *Review of the RED evaluation (WSRC-TR-93-614) of the criticality potential associated with operation of the sand filter for the K Disassembly Basin has been initiated.*

Questions were recently raised about the criticality safety of the sand filter and settler tank system used to clean up particulates from the Disassembly basin water, especially in consideration of the sludge sample analyses that indicate total fissionable masses in the sludge exceed critical mass limits. APG has consulted with RED personnel about conditions to consider in the evaluation. APG has supplied comments on a draft of the RED evaluation, WSRC-TR-93-614, to RED. The comments are being resolved.

Technical Review: NCSE for 320-M Laboratory Enriched Uranium Operations - R. L. Reed

Customer: R. H. Ross (NMP)

Abstract: *Review comments for NCSE #251 (WSRC-RP-93-320-251) have been provided to 300 Area personnel.*

During 300 CAC reviews of 320-M Laboratory operations, questions about conflicts and inconsistency between Technical Standards, procedural requirements, and practices were raised. The NCSE was written to provide a basis for the limits that are to be employed. At the beginning of the month, preliminary comments were forwarded to the author for resolution. No further activity during December.

EXPERIMENTAL THERMAL HYDRAULICS
(D. R. Muhlbaier, Manager)

ITP Mixing Study - D. A. Eghball

Customer: In-Tank Precipitation Technology Development

Abstract: *The purpose of this study is to investigate, using Computational Fluid Dynamic Code (FIDAP), the fluid dynamics and physical processes that occur during forced mixing in radioactive waste storage tank 51. Investigations include simulation of jet mixing pump induced flows, which are intended to mix and maintain particulate material distributed uniformly throughout the liquid volume. Tank 51 is a waste storage tank that utilizes four submerged mixing pumps, located near the bottom of the tank, to sustain uniform mixing of the slurry. Initially, about twenty inches of a settled sludge layer exist at the bottom of the tank. Mobilization of this sludge layer with jet mixing pumps is the focus of this study.*

A simple mixing model has been developed with one submerged mixing pump to investigate FIDAP's ability to model jet mixing phenomena. The effort at running FIDAP with the tank model has not been successful yet, due to the occurrence of a code internal error; this is currently under investigation by the FIDAP vendor. A more complex mixing model is under development to account for turbulence and particulate material modeling.

FRR Spent Fuel Dry Storage Development - H. N. Guerrero

Customer: Technology Programs, T&RPI

Abstract: *The Department of Energy has a program to develop dry storage as a means of storing Foreign Research Reactor (FRR) spent fuel in the interim period prior to acceptance of the fuel in a final repository. This is needed in view of the present plans to phase out Separations Area facilities and the continuing delivery of FRR spent fuel over a period of 10 to 15 years. The objective of the ETF portion of the program is to determine how one of the four commercial dry fuel storage canister designs can be adapted to meet thermal storage requirements of the FRR spent fuel.*

The plan for the Design Alternatives Study is to analyze three generic commercial dry storage systems: a horizontal canister, a vertical canister, and a dry vault concept. A FIDAP model of the NUHOMS 24P canister has already been generated and used to evaluate a typical horizontal canister design, as reported in the previous monthly report. Currently, work is in progress to develop a FIDAP model of a vertical canister design based on the same NUHOMS 24P basic dimensions for the purpose of evaluating a horizontal versus a vertical design. In the future, the dry vault concept will be similarly analyzed.

Procurement schedules and cost present some difficulties in meeting our goal of starting the single fuel element mockup tests by the beginning of March. Consequently, the design of the heater mockup is being reevaluated to determine ways to be able to fabricate the mockup in-house and still achieve the required thermal prototypicality of the mockup. The original design utilizes swaging to bond the fuel plates to the side plates, as in the actual fuel, in order to simulate the thermal resistances that could affect the heat flow from the four sides. For insulation purposes, the grooves in the side plates and parts of the mockup fuel plates are designed to be anodized - thus, the need for vendor work. Epoxy bonding is now being investigated as an alternative method which can be readily performed in the Thermal Fluids Laboratory. This however requires further work to characterize the thermal bond resistances. The plan is to begin work on an epoxy bonded mockup, continue working on a swaged mockup, and to utilize the first available mockup for the single fuel element mockup test.

The design of the heat transfer loop for the single fuel element mockup testing is nearing completion. It was determined that the fuel element mockup will be installed inside a can of nominally similar dimensions as those of the can planned to be used in the canister, which however is yet to be actually

designed. A can outside temperature boundary condition is planned for the tests on the electrically heated fuel element mockup. This will be achieved by passing hot air, whose temperature will be controlled, over the can. Thus, a flow loop consisting of air blower, air preheater, ducting and the test section will be fabricated. An air blower has been purchased, while an air preheater is being designed.

FIDAP modeling of a single fuel element is also being performed to obtain pretest predictions and to provide thermal parameters for the global modeling of the canisters.

Pilot-Scale Demonstration of HEME Dissolution Process - Z. H. Qureshi

Customer: Defense Waste Processing Technology

Abstract: *The High Efficiency Mist Eliminators (HEME) used in the melter feed preparation processes will be dissolved in a caustic solution for their ultimate disposal. A pilot-scale demonstration of this dissolution process will be conducted in the Thermal-Fluids Lab. to resolve some technical issues regarding dissolution and breakup of the fiberglass material. This task is scheduled to be complete by June '94.*

The document on scaling issues for the HEME dissolution process was completed and issued. The proposed tests will preserve all the pertinent scaling parameters on full scale basis. The key parameters are the mass of fiberglass/mass of solution ratio; the solution pH value, temperature, the surface area of glass exposed to the solution; and physical conditions such as the solution agitation levels and the solution velocity that provide replenishment of the solution.

The 1/5th scale tank and a secondary containment tray have been fabricated and delivered to the Thermal-Fluids Lab. The design of three filter mockups is complete, and their fabrication is underway.

A fouled HEME from IDMS is available at TNX. Since it is contaminated with mercury, some waste disposal issues are being resolved before the fouled filter is brought to the Thermal-Fluids Lab. Monsanto, the fabricator of the plant HEME's, will supply 20 pounds of fiberglass material free of cost. The material is expected to be in by next week.

All the needed instrumentation has been collected in the lab. This includes air flow meter, solution flow meter and thermocouples. The loop assembly is in progress.

It is planned that the first phase of dissolution tests will be done under air sparging conditions since this option is available on the plant. In case this agitation method is not completely successful, alternate methods of agitation and solution replenishment will be tested.

Investigating Level Indicating Devices - T. L. Spatz

Customer: L.F. Landon

Abstract: *The density and height of constituents in the mixing tanks are currently measured with a diaphragmed bubbler device known as a Holledge probe. During testing with simulant sludge traditional bubblers encountered plugging problems. The purpose of this task is to search the available literature for the state-of-the-art in level indicators. This literature search will incorporate Holledge probes, modifying traditional Bubblers, and others*

A literature search has been ongoing to determine the state of the art in level indicators. The final report, in the form of an Inter-Office Memorandum, will be distributed by 1/11/94 with the unique document number SRT-ETF-940002. Two vendors have been found who manufacture diaphragm level indicators, similar to the Holledge diaphragm level indicator currently in use. The constraints of the application have eliminated most commercially available level indicating devices on the market today. The report cites the recent technological advances in liquid level indicators and discusses their possible utilization for the DWPF tank application.

Cross-Flow Filter Test - J. L. Steimke, C. M. Hart

Customer: DWPF

Abstract: *In preparation for delivery to the Defense Waste Processing Facility, slurry from Tank 49 will be washed in a process that uses a cross-flow filter in a vertical orientation. Most of the flow passes through the porous tubes of the filter in the axial direction. A small part of the flow is driven through the porous membrane of the tubes by a pressure difference. Filtrate collects in the shell around the porous tubes and is collected.*

To provide technical support the Thermal-Fluids Laboratory (TFL) is testing a cross-flow filter in a flow loop that allows flow in either the forward direction (tube side to shell side) or reverse direction. Brief flow in the reverse direction (back-pulsing) is useful for dislodging filter cake, which increases production of filtrate. The ten foot long DuPont filter at the TFL has been tested with clean water. Flow resistance was measured, defined as the trans-membrane pressure drop divided by the trans-membrane flux. For most of the TFL tests of the ten foot long filter the reverse resistance was half of the forward resistance. This difference was not expected because the flow through the porous membrane should be a Darcy flow. For a Darcy flow, the pressure drop is directly proportional to flowrate and inversely proportional to liquid viscosity. There was concern that the dependence of resistance on flow direction indicated a flaw in the TFL flow loop, the instrumentation or the filter. It was decided to resolve the unexpected measurement before proceeding with testing with simulated slurry.

The resistance to forward flow for the ten foot long filter at the TFL was somewhat higher than the forward flow resistance measured by the DuPont Company for the same model filter with clean water, and also somewhat higher than the forward and reverse (backpulse) resistances for a much smaller (one tube 18" long) DuPont filter tested at the TFL. Reverse resistance was not measured at Seneca. Bio-fouling was suspected to be a cause of increased flow resistance in the forward direction. Cleaning the ten foot long TFL filter with a 1% solution of oxalic acid, followed by a one percent solution of sodium hydroxide, decreased the resistance to forward flow such that all filters had about the same forward flow resistance; but the directional difference in resistance persisted for the ten foot long TFL filter. The TFL flow loop was rigorously checked and no flaw was found to explain the discrepancy. The TFL is now investigating the possibility of a crack inside the filter that would widen when the flow was in one direction, and close when the flow was in the other direction. Data support the hypothesis of a crack, but thus far no crack has been found.

PACKAGING AND TRANSPORTATION
(E. K. Opperman, Manager)

Packaging - Tritium Spent Melt Crucible - P. S. Blanton

Customer: Tritium

Abstract: *Following Tritium's Line 3 Operational Readiness Review (ORR), hot lithium-aluminum targets presently held in various Reactor basins will be processed. Tentatively, it is believed that some forty four (44) spent melt crucibles will be moved over the next 5-6 years once processing begins. SRTC Packaging and Transportation is providing Tritium with necessary design criteria for a package to transport processed spent melts to the ILT vault and with documentation in the form of a safety assessment to support such a move.*

The Tritium Extraction Facility (Line 3) can temporarily store 12 processed crucibles before having to move the spent melts from their facility to the Burial Grounds. Previous plans for movement of the spent melts involved designing and acquiring a certified DOT transportation cask that could transport the crucibles from the Tritium facility to the ILT vault. This design was put out for bids but the job was never awarded. Due to present funding constraints, Tritium is investigating alternatives to utilizing a certified transportation cask.

The previous conceptual design packaged each processed crucible in an overpack, a slightly larger diameter tube than the crucible, specifically designed to fit into the existing ILT vaults. The overpack would then have been placed into a certified DOT cask for transport. The cask primary function was containment and shielding. The present path forward involves modifying the existing overpack design to provide the primary containment function for the spent melt. An outer transport shielding vessel would be designed in parallel. Packaging and Transportation will act as the cognizant RAM packaging liaison to the selected design agency in providing necessary design criteria to transport the spent melt to the ILT vault.

SED Facility D&D - Trap Shipments - T. K. Houghtaling

Customer: Separations

Abstract: *P&TG recommended the NRC certified TRUPACT-II packaging for shipping SED traps to the site burial grounds. P&TG and project operations personnel are working out details regarding handling and preparation of the SED traps for containment in the TRUPACT-II. Application to the NRC for an exception to the Certificate of Compliance will be necessary for shipment of any trap containing more fissile material than permitted by the certificate.*

As part of Decomtamination and Decommissioning (D&D) of the SRS Separations Equipment Development (SED) facility, a number of transuranic (TRU) waste traps will be removed and shipped to the site burial grounds. The traps were integral parts of the facility and contain varying amounts of TRU-waste. For this on-site shipment from SRTC to the TRU pads, the Packaging and Transportation Group (P&TG) recommended TRUPACT-II from among five candidates. P&TG identified it as the safest, most straight forward to use packaging for the task. The TRUPACT-II is NRC certified and readily available from the Waste Isolation Pilot Plant (WIPP) in Carlsbad, NM. However, the Safety Analysis Report for Packaging (SARP) requires venting the traps and limits the amount of fissile material the TRUPACT-II can transport. The venting requirement is common to all DOE/NRC certified packagings to eliminate explosive concentrations of flammable gasses. Venting can be accomplished by fitting small HEPA filters to the glovebag(s) surrounding each trap and to one of the external closure plates that will be bolted over trap openings. If the project operations leadership agrees to implement the venting filters, and the assays of trap contents show fissile material quantities as expected, then four of the six traps can be shipped under the existing Certificate of Compliance. Shipment of any trap

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containing more than the certified amount of fissile material will require an exception to the existing certificate from NRC. The application for exception will require a criticality analysis of the trap(s) and arguments supporting administrative control of access to SRS roads.

Americium-Curium Packaging for F-Canyon General - R. S. Maurer

Customer: A. P. GOUGE

Abstract: *F-Canyon General requested the Packaging and Transportation Group (P&TG) to determine the packaging requirements for the Tank 17.1 radioactive contents. F-Canyon General has plans to ship the Americium and Curium (Am-Cm) isotopes to Oak Ridge National Labs (ORNL) between 1997-2002.*

F-Canyon General needs to ship the Am-Cm contents to ORNL. These contents are of great value to ORNL and can provide many applications. The Tank 17.1 contents include many Lanthanides and other invaluable isotopes that will have to be either shipped with the Am-Cm or separated by chemical separations processes.

P&TG evaluated packagings based on the following three options for transporting the tank 17.1 radioactive contents.

1. Transporting all the tank 17.1 radioactive contents in liquid form.
2. Transporting all the tank 17.1 radioactive contents in oxide form.
3. Transporting only the Am-Cm isotopes in oxide form.

The packaging category, shielding requirements, and heat loading were determined by analyses. These analyses have been completed for (1) and (2) based on initial content list supplied by the customer (this list contained only the actinides and was developed through decay calculations). The content is severe requiring a Type B, Category I packaging for transportation. The packaging also must provide good radiation shielding and heat generation rejection.

Due to the stringent packaging requirements, the P&TG has determined that certifying a packaging for transporting the liquid contents would be a major effort and require industry support. P&TG also reviewed a cask previously used to ship the liquid contents (in 1963), and has determined that this cask would not qualify under the current transportation requirements.

P&TG evaluated three packagings for (2). The SRS 5320, SRS 9968, and Mound 1KW packagings were analyzed based on their shielding and heat loadings. The following payloads were determined for these packagings:

- * SRS 5320 - 25 grams (limited by gamma shielding)
- * SRS 9968 - 95 grams (limited by 30 watt heat loading)
- * Mound 1KW - 285 grams (limited by gamma shielding)

P&TG will continue to optimize the packaging options for contents (2) and (3) as F-Canyon General supplies a more specific content isotopic listing.

Manuals Path Team Activities - M. N. Van Alstine

(Team Members: A. A. Zagrodnik (chairman), J. B. Kelly, T. J. Steeper, A. O. Smetana, M. N. Van Alstine)

Customer: Safety Technology Department (internal)

Abstract: *The Manuals Path Team was formed within the Safety Technology Department to recommend a uniform task planning process. Starting with multiple departmental quality assurance manuals and higher-tier manuals, the Team systematically developed a single effective set of procedures for interim use until SRTC procedures are completed.*

The Safety Technology Department Manager instituted the Manuals Path Team to recommend a single path through the then-existing inherited departmental procedure manuals, the new E7 and L1 manuals, and the 1Q Manual. Team members were selected from within STD. The Team was already active when STD received directives to implement E7.

Given Site directives to eliminate departmental procedure manuals, the Team recommended procedures from 1Q, E7 and L1 when prudent. Likewise, elimination of many 1Q34 and all 1Q35 procedures was recommended. The Team delivered recommendations to management on how to perform typical types of STD work using procedures from the various manuals, on training, and on procedure revisions.

STD management accepted the Team recommendations and prescribed them as the STD task planning process. Due to the presently volatile higher-tier procedure manuals, Team activity will continue to maintain STD procedure compliance.

Organizational Chart

L1100, Applied Technology

Melvin R. Buckner
Section Manager
773-42A 143 — 5-3149

Parent Organization:
L1000 - Safety Technology

Administrative Secretary: Susie McKinney
773-42A 183 — 5-1102

L1130	Applied Physics	Apperson, Courtney E	25
Biswas, Debdas	773-22A 10	5-3406	
Boman, Christa E	786-1A 8	5-5626	
Clark, Hugh	773-22A 7	5-2718	
Frost, Robert L	786-1A 6	5-8195	
Graves, William E	773-42A 173	5-4546	
Grove, Robert E	773-42A 122	5-5145	
Hammer, K. E	786-1A	5-8233	
Hightower, Josephine H	773-42A 113	5-8210	
Justice, J. B.	786-1A 11	5-1284	
Lee, S. Y.	773-11A 5	5-2328	
Mincey, James F	773-22A 7	5-2718	
Nierner, Keyes A	786-1A 1	5-2622	
Okafor, Kenneth C	786-1A 04	5-8194	
Pevey, Ronald E	773-42A 119	5-5133	
Rathbun, Roy W	786-1A 3	5-8232	
Reed, R. L.	773-42A 126	5-3468	
Skiles, Samuel K	786-1A 7	5-1977	
Summers, L. Kaye	773-42A 186	5-8211	
Trumble, Edward F	786-1A 10	5-4196	
Tidwell, Rocky W	786-1A 10	5-7714	
Vescovi, Peter J	773-22A 3	5-3335	
Webb, Roger L	786-1A 13	5-8459	
Williamson, T. G.	773-42A 123	5-5999	
Zino, John F	786-1A 9	5-5864	
L1180	Experimental Thermal Fluids	Muhlbaier, Dave R.	24
Anderson, A. H.	786-A	5-3562	
Armstrong, M. L.	786-A	5-3204	
Beard, B. W.	786-6A 9	5-8266	
Bruckner, L. P.	786-5A 6	5-3355	
Bush, V. L.	786-A 102	5-3204	
Corbett, J. W.	786-6A 5	5-8225	
Duignan, M. R.	786-5A 11	5-8256	
Edhballi, D. A.	786-6A 7	5-8253	
Fowley, M. D.	786-5A 17	5-1492	
Guerrero, H. N.	786-5A 13	54127	
Hart, C. M.	786-A 103	5-4195	

Organizational Chart

Hensley, W. W.	786-5A 7	5-2827
Kinsey, A. C.	786-A 1	5-3204
Mills, J. E.	786-A 102	5-3204
Qureshi, Z. H.	786-5A 10	5-3613
Rohleder, K. H.	786-6A 8	5-8254
Smith, Jr., A. C.	773-55A	5-8267
Spatz, T. L.	786-5A 14	5-2551
Sponseller, S. E.	786-6A 9	5-8224
Steeper, T. J.	786-5A 16	5-3826
Steimke, J. L.	786-5A 12	5-1500
Strege, D. K.	786-6A5	5-8225
Whitehouse, J. C.	786-6A 6	5-5275
L1190 Packaging and Transportation	Opperman, Erich K.	11
Blanton, P. S.	786-5A	5-5307
Cadelli, G.	305-2A	5-4764
Eggers, A. G.	305-2A	5-4756
Gromada, R. J.	305-2A	5-4760
Hoang, D. S.	305-2A	5-4728
Houghtaling, T. K.	305-2A	5-4765
Maurer, R. S.	305-2A	5-4763
Phipps, D. P.J.	305-2A	5-7084
Van Alstine, M. N.	305-2A	5-4758
Whitney, M. A.	305-2A	5-4766
L1170 Engineering Modeling & Simulation	Pelfrey, James R	14
Aleman, S. E.	773-42A 147	5-8205
Dimenna, R. A.	773-42A 141	5-5300
Gong, Chung	773-42A 154	5-3167
Gregory, Michael V	773-42A 142	5-3696
Gupta, N. G.	773-42A 150	5-8201
Hamm, L. L.	773-11A 7	5-8259
Hensel, Steve J.	773-42A 155	5-5094
Hutchens, G. J.	773-42A 178	5-9780
Jerrell, Jeffrey W	773-42A 153	5-1727
Lam, Poh-Sang	773-42A 178	5-5306
Miller, R. F.	773-42A 184	5-8462
Shadday, M. A.	773-11A 1	5-1147
Shanahan, K. L.	773-42A 140	5-5296
Wolf, Ralph J	773-42A 136	5-5158
L1150 Applied Statistics	Tuckfield, R. Cary	9
Anderson, Rachel A.	773-42A 162	5-3199
Edwards, Thomas B	773-42A 125	5-5148
Harris, Stephen P	992-W1 112	4-5032
Jenkins, E. W.	773-42A 158	5-1698
Reeve, Charles P	773-42A 130	5-8216
Shine, Eugene P	773-42A 112	5-5156
Weber, Jilene H	773-42A 160	5-5528
Wise, Morgan D	773-42A 145	5-252

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