CNWRA PROGRAM MANAGER'S PERIODIC REPORT ON ACTIVITIES OF THE CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

For the Fiscal Reporting Period

March 14, 1998 – April 10, 1998

PMPR No. 98-7

April 23, 1998

TABLE OF CONTENTS

TABLES

ABBREVIATIONS

1D	One-Dimensional
2D	Two-Dimensional
3D	Three-Dimensional
AA	Atomic Absorption
AAI	Average Annual Infiltration
ACD	Advanced Conceptual Design
ACF	Alumina (in excess of alkali feldspar), Calcium Oxide, Ferromagnesian Oxide
ACNW	Advisory Committee on Nuclear Waste
ACRS	Advanced Computer Review System
ADAMS	Agencywide Documents Access and Management System
AECL	Atomic Energy of Canada Limited
AES	Atomic Emission Spectrometry
AGU	American Geophysical Union
AI	Administrative Item
ALTS	Apache Leap Test Site
AML	Areal Mass Loading
ANS	American Nuclear Society
ANSI	American National Standards Institute
AO	Annotated Outline
AP	Administrative Procedure
APB	Acid-Producing Bacteria
ARDR	Activities Related to Development of the NRC High-Level Waste Regulations
ASCE	American Society of Civil Engineers
ASCII	American Standard Code for Information Interchange
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ASU	Arizona State University
ATDTS	Automated Technical Data Tracking System
BEG	Bureau of Economic Geology
BFD	Basis for Design
BM	Bare Mountain
BMF	Bare Mountain Fault
BNFL	British Nuclear Fuels Limited
BTP	Branch Technical Position
CAI	Color Alteration Index
CAM	Corrosion Resist Material
CAR	Corrective Action Request
CCDF	Complementary Cumulative Distribution Function
CCL	Commitment Control Log
CCM	Constant Capacitance Model
CD-R	CDROM Recordable
CDF	Cumulative Distribution Function
CDM	Compliance Determination Method
CDOCS	Consolidated DOCument Management System
CDROM	Compact Disk Read Only Memory
CDS	Compliance Determination Strategy
CDTS	Commission Decision Tracking System
CEB	Center for Environmental Biotechnology
CEC	Commission of the European Communities
CFD	Computational Fluid Dynamics
CFR	Code of Federal Regulation
CIAC	Computer Incident Advisory Capability
CISF	Centralized Interim Storage Facility
CLST	Container Life and Source Term
CM	Configuration Management
CNWRA	Center for Nuclear Waste Regulatory Analyses
COI	Conflict of Interest
COPS	CNWRA Operations
CPP	Cyclic Potentiodynamic Polarization
CQAM	CNWRA Quality Assurance Manual
CRG	Center Review Group
CRM	Corrosion Allowance Material
CRWMS	Civilian Radioactive Waste Management System
CSCS	Constrained Stochastic Climate Simulator
CSH	Calcium Sulfate Hydrate
CSPE	Corrosion Science and Process Engineering
DAS	Data Acquisition System
DBE	Design Basis Event
DC	Division of Contracts
DCAA	Defense Contract Audit Agency
DCB	Double Cantilever Beam
DCF	Dose Conversion Factor
DCM	Dual Continuum Model
D&D	Decommissioning and Decontamination
DECOVALEX	DEvelopment of COupled Models and Their VALidation Against EXperiments in Nuclear Waste Isolation
DEIS	Draft Environmental Impact Statement
DEM	Digital Elevation Model
DF	Dilution Factor
DFCSS	Division of Fuel Cycle Safety and Safeguards
DIE	Determination of Importance Evaluation
DIMNS	Division of Industrial and Medical Nuclear Safety
DKM	Dual Permeability Model
DLG	Digital Line Graph
DLM	Diffuse Layer Model
DNAG	Decade of North American Geology
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy
DOE-DP	DOE Defense Program
DOE-RU	U.S. Department of Energy Regulatory Unit
DRA	Division of Regulatory Applications
DST	Drift Scale Test
DTED	Digital Terrain Elevation Data
DTS	Dry Transfer System
DWM	Division of Waste Management
EBS	Engineered Barrier System

ABBREVIATIONS (cont'd)

EBSER	Engineered Barrier System Experimental Research
EBSPAC	Engineered Barrier System Performance Assessment Code
ECM	Equivalent Continuum Model
EDO	Office of the Executive Director for Operations
EDX	Energy-Dispersive X-Ray Spectroscopy
EIS	Environmental Impact Statement
EM	Element Manager
EMPA	Electron MicroProbe Analysis
ENFE	Evolution of the Near-Field Environment
ENGB	ENgineering and Geosciences Branch
EnPA	Energy Policy Act of 1992
ENS	European Nuclear Society
EPA	U.S. Environmental Protection Agency
EPR	Electrochemical Potentiokinetic Reactivation
EPRI	Electric Power Research Institute
EQA	External Quality Assurance
EROS	Earth Resource Observation System
ESF	Exploratory Studies Facility
ESP	Environmental Simulation Program
EXAFS	Extended X-Ray Absorption Fine Structure
FAC	FAvorable Condition
FCRG	Format and Content Regulatory Guide
FDSHA	Fault Displacement and Seismic Hazard Analysis
FEHM	Finite Element Heat and Mass Transfer
FEM	Finite Element Method
FEP	Features, Events, and Processes
FFRDC	Federally Funded Research and Development Center
FFT	Fast Fourier Transform
FTE	Full-Time Equivalent
FTP	File Transfer Protocol
FY	Fiscal Year
FYTD	Fiscal Year-to-Date
GDF	Ghost Dance Fault
GEM	General Electrochemical Migration
GEOTRAP	GEOlogic Transport of RAdionuclides Predictions
GERT	General Employee Radiological Training
GET	General Employee Training
GFM	Geological Framework Model
GHGC	GeoHydrology and GeoChemistry
GIA	Generalized Importance Analysis
GIS	Geographic Information System
GLGP	GeoLogy and GeoPhysics
GPS	Global Positioning Satellite
GROA	Geologic Repository Operations Area
GS	Geologic Setting
GSA	Geologic Society of America
GTFE	Great Tolbachik Fissure Eruption
GUI	Graphics User Interface
GWSI	GroundWater System Integration
GWTT	GroundWater Travel Time
HLUR	High-Level Waste and Uranium Recovery Projects Branch
HLW	High-Level Waste
HRTEM	High-Resolution Transmission Electron Microscopy
IA	Igneous Activity
IBM	International Business Machines
ICP	Inductively Coupled Plasma
ICPP	Idaho Chemical Processing Plant
IDLH	Immediately Dangerous to Life and
IHLRWMC	nal High-Level Radioactive nagement Conference and n
IM	iate Milestone
IME	Industrial Mobilization Exemption
IMS	Information Management Systems
INEEL	Idaho National Engineering and Environmental Laboratory
INETER	Instituto Nicaraguense de Estudios TERritoriales
INTRAVAL	International Code Validation
I/O	Input/Output
IPA	Iterative Performance Assessment
IR&D	Internal Research & Development
IRIS	Interim Records Information System
IRM	Office of Information Resources Management
IRSR	Issue Resolution Status Report
ISA	Initial Safety Analysis
ISFSI	Independent Spent Fuel Storage Installation
ISM	Integrated Site Model
IVM	Interactive Volume Modeling
IWPE	Integrated Waste Package Experiments
JC	Job Code
JPL	Jet Propulsion Laboratory
JRC	Joint Roughness Coefficient
KTI	Key Technical Issue
KTU	Key Technical Uncertainty
LA	License Application
LAAO	License Application Annotated Outline
LAN	Local Area Network
LANL	Los Alamos National Laboratories
LARP	License Application Review Plan
LAW	Low-Activity Waste
LBL	Lawrence Berkeley Laboratory
LBT	Large Block Test
LHS	Latin Hypercube Sampling
LITC	Lockheed Information Technology Company
LLNL	Lawrence Livermore National Laboratory
LLW	Low-Level Waste
LMAES	Lockheed Martin Advanced Environmental Systems

ABBREVIATIONS (cont'd)

LSS	Licensing Support System
LSSPP	Licensing Support System Pilot Project
LSSTB	Licensing Support System Test Bed
LWR	Light Water Reactor
Ma	Million Years Ago
MC	Monte Carlo
METRA	Mass and Energy TRAnsport
MGDS	Mined Geologic Disposal System
MH	Mechanical-Hydrological
MIC	Microbially Influenced Corrosion
MINC	Multiple Interacting Continua
MIT	Massachusetts Institute of Technology
MM	Major Milestone
MO	Management and Operations
MOU	Memorandum of Understanding
MPC	Multi-Purpose Canister
MRS	Monitored Retrievable Storage
MSS	MultiSpectral Scanner
MTU	Metric Ton of Uranium
NAS	National Academy of Sciences
NAWG	Natural Analogue Working Group
NCR	NonConformance Report
NEA	Nuclear Energy Agency
NFS	Network File Server
NIOSH	National Institutes of Safety and Health
NIR	Near-InfraRed
NIST	National Institute of Standards and Technology
NMSS	Office of Nuclear Material Safety and Safeguards
NNE	North-Northeast
NNW	North-Northwest
NOAA	National Oceanographic and Atmospheric Administration
NRC	Nuclear Regulatory Commission
NS	North-South
NSRRC	Nuclear Safety Research Review Committee
NTS	Nevada Test Site
NUREG	NRC Technical Report Designation
NWPA	Nuclear Waste Policy Act, as amended
NWTRB	Nuclear Waste Technical Review Board
OBES	Office of Basic Energy Sciences
OCRWM	Office of Civilian Radioactive Waste Management
OGC	Office of General Counsel
OITS	Open-Item Tracking System
OMB	Office of Management and Budget
OPS	Operations Plans
ORR	Operations Readiness Review
ORS	Overall Review Strategy
OWFN	One White Flint North
PA	Performance Assessment
PAAG	Performance Assessment Advisory Group
PAC	Potentially Adverse Condition
PAHT	Performance Assessment and Hydrologic Transport
PASP	Performance Assessment Strategic Plan
PC	Personal Computer
PC/TCP	Personal Computer/Transmission Control Protocol
PDF	Probability Distribution Function
PDR	Public Document Room
PEL	Permissible Exposure Limit
PEM	Program Element Manager
PER	Prelicensing Evaluation Report
PFD	Probabilistic Fault Displacement
PFDHA	Probabilistic Fault Displacement HAzard
PFS	Private Fuel Storage
PFSF	Private Fuel Storage Facility
PHA	Preliminary Hazard Analysis
PI	Principal Investigator
PMDA	Program Management, Policy Development and Analysis Staff
PMPR	Program Manager's Periodic Report
PMT	Photo-Multiplier Tube
PNNL	Pacific Northwest National Laboratory
PO	Project Officer
PPA	Proposed Program Approach
PPE	Prepassivated Platinum Electrode
PRA	Probabilistic Risk Assessment
PRT	Peer Review Team
PSAG	Probabilistic System Assessment Group
PSHA	Probabilistic Seismic Hazard Analysis
PTFE	PolyTetraFluoroEthylene
PTn	Paintbrush Nonwelded Tuff
PVHA	Probabilistic Volcanic Hazards Assessment
PVHVIEW	Probability of Volcanic Hazards VIEW
PVM	Parallel Virtual Machine
PWR	Pressurized Water Reactor
QA	Quality Assurance
QAP	Quality Assurance Procedure
QRAM	Quality Requirements Application Matrix
RAI	Request for Additional Information
RASA	Regional Aquifer System Analysis
RDCO	Repository Design, Construction, and Operations
RDTME	Repository Design and Thermal-Mechanical Effects
REE	Rare Earth Element
REECO	Reynolds Electrical and Engineering Company, Inc.
RES	Office of Nuclear Regulatory Research
RFP	Request for Proposal
RH	Relative Humidity
RIP	Repository Integration Program
ROC	Repository Operations Criteria
RPD	Regulatory Program Database

ABBREVIATIONS (cont'd)

RRT	Regulatory Requirement Topic
RSRG	Real Space Renormalization Group
RT	Radionuclide Transport
RTS	Radwaste Treatment System
SAP	Standards Approval Package
SAR	Safety Analysis Report
SCA	Site Characterization Analysis
SCC	Substantially Complete Containment
SCCEX	Substantially Complete Containment EXample
SCE	Standard Calomel Electrode
SCFF	Southern Crater Flat Fault
SCM	Surface Complexation Models
SCP	Site Characterization Plan
SDMP	Site Decommissioning Management Plan
SDS	Structural Deformation and Seismicity
SECY	Secretary of the Commission, Office of the (NRC)
SELM	Spectral ELement Method
SEM	Scanning Electron Microscopy
SER	Safety Evaluation Report
SF	Spent Fuel
SFPO	Spent Fuel Project Office
SFVF	San Francisco Volcanic Field
SGI	Silicone Graphics Inc.
SGML	Standard Generalized Markup Language
SHE	Standard Hydrogen Electrodes
SHT	Single Heater Test
SIP	Scientific Investigation Plan
SKI	Swedish Nuclear Power Inspectorate
SLAR	Side Looking Airborne Radar
SNL	Sandia National Laboratories
SOTEC	SOurce TErm Code
SOW	Statement of Work
SPCR	Software Problem Correction Report
SRA	Systematic Regulatory Analysis
SRB	Sulfate-Reducing Bacteria
SRBS	Shafts, Ramps, Boreholes, and Their Seals
SRD	Software Requirements Description
SRS	Savannah River Site
SRSASF	Savannah River Site Aluminum-Based Spent Fuel
SS	Stainless Steel
STEM	Scanning Transmission Electron Microscopy
STP	Staff Technical Position
SUFLAT	Stochastic Analyses of Unsaturated FLow And Transport
SVF	Springerville Volcanic Field
SwRI	Southwest Research Institute
SZ	Saturated Zone
TA	Technical Assistance
TBD	To Be Determined
TBM	Tunnel Boring Machine
TCP/IP	Transmission Control Protocol/Internet Protocol
TDI	Technical Document Index
TDOCS	Technical DOCument Reference Database System
TEF	Thermal Effects on Flow
TEM	Transmission Electron Microscopy
THC	Thermal-Hydrologic-Chemical
THMC	Thermal-Hydrologic-Mechanical-Chemical
TLM	Triple-Layer Model
TM	Thermal-Mechanical
TMH	Thermal-Mechanical-Hydrologic
TMI-2	Three Mile Island Unit 2
TMS	The Minerals, Metals, and Materials Society
TOP	Technical Operating Procedure
TP	Technical Position
TPA	Total Performance Assessment
TPI	Time Period of Regulatory Interest
TR2	DOE Seismic Topical Report No. 2
TRG	Technical Review Group
TSAR	Topical Safety Analysis Report
TSPA	Total System Performance Assessment
TSPAI	Total System Performance Assessment and Integration
TSw-Chnv	Topopah Spring Welded-Calico Hills Nonvitric
TVD	Total Variation Diminishing
TWFN	Two White Flint North
TWINS	Tank Waste Information Network System
TWRS	Tank Waste Remediation System
UA	University of Arizona
UACH	Universidad Autónoma de Chihuahua
UCLA	University of California–Los Angeles
UDEC	Universal Distinct Element Code
UK	United Kingdom
UNM	University of New Mexico
UR	Uranium Recovery
U.S.	United States
USDA	U.S. Department of Agriculture
USGS	U.S. Geologic Survey
UTM	Universal Transverse Mercator
USFIC	Unsaturated and Saturated Flow Under Isothermal Conditions
UZ	Unsaturated Zone
VA	Viability Assessment
VCS	Version Control System
VF	Vitrification Facility

ABBREVIATIONS (cont'd)

VSIP	Vertical Slice Implementation Plan
WAN	Wide Area Network
WAPDEG	WAste Package DEGradation
WBS	Work Breakdown Structure
WCIS	Waste Containment and Isolation Strategy
WFO	Work for Others
WGB	Western Great Basin
WIPP	Waste Isolation Pilot Plant
WMB	Waste Management Branch
WNYNSC	Western New York Nuclear Service Center
WOL	Wedge-Opening Loading
WP	Waste Package
WSEI	Waste Systems Engineering and Integration
WSRC	Westinghouse Savannah River Company
WSS	Waste Solidification Systems
WTSO	Washington Technical Support Office
WVDP	West Valley Demonstration Project
WVNS	West Valley Nuclear Services
WWW	World Wide Web
XPS	X-ray Photoelectron Spectroscopy
XRD	X-ray Diffractometry
YM	Yucca Mountain
YMP	Yucca Mountain Project
YMSCO	Yucca Mountain Site Characterization Office
YMR	Yucca Mountain Region
YTD	Year-to-Date

EXECUTIVE SUMMARY—PERIOD 7

In the Division of Waste Management (DWM) Job Code (JC), the Center for Nuclear Waste Regulatory Analyses (CNWRA) continued work on numerous analyses and revisions to Issue Resolution Status Reports. In addition, TPA version 3.1.4 was developed, tested, and submitted.

The DWM JC year-to-date (YTD) cost variance was 13.6 percent. Although the variance increased in dollar terms since the previous month, the cumulative variance fell by 11.7 percent as work was accelerated in several areas.

In the Tank Waste Remediation System (TWRS) JC, the Nuclear Regulatory Commission (NRC) and CNWRA staffs collaborated to develop several reports. The YTD cost variance for the TWRS was 9.0 percent. This variance fell from last period—resulting from accelerated spending to prepare these reports.

In the Three Mile Island Unit 2 (TMI-2) Independent Spent Fuel Storage Installation (ISFSI) JC, increased spending reflected review and evaluation of the U.S. Department of Energy (DOE) response to the NRC first round Request for Additional Information (RAI), development of second round RAI, and preparation of an outline of the safety evaluation report. The YTD cost variance for the TMI-2 ISFSI was 33.7 percent. This variance is the lowest for this fiscal year.

In the Dry Transfer System (DTS) JC, the safety review of the DTS Topical Safety Analysis Report (TSAR) that was reinitiated during the last reporting period continued during this period. The YTD cost variance for the DTS was 64.7 percent. The decrease in this variance corroborated increased activity on this report.

In the Centralized Interim Storage Facility (CISF) JC, the final version of CISF RAI was transmitted as First Round Request for Additional Information—Final Letter Report. The YTD cost variance for the CISF was 23.7 percent. This reflects increased funding under the revised CISF Operations Plan but no commensurate increase in work, pending response from the DOE.

In the Private Fuel Storage Facility (PFSF) JC, the CNWRA staff awaits the PFSF response to the NRC First Round Request for Additional Information—Final Letter Report. The YTD cost variance for the PFSF was -1.9 percent, substantially below last period. This variance indicates efforts associated with the safety review of the PFSF SAR.

In the West Valley Demonstration Project (WVDP) JC, limited activities focused on administrative matters. The YTD cost variance for the WVDP JC was 64.1 percent. This reflects a lack of tasking pending issuance of a request for proposal related to a new contract in this area.

In the Savannah River Site Aluminum-Based Spent Fuel (SRSASF) JC, the draft report, Review of the Technical Issues Related to Interim Storage and Permanent Disposal of Al-based SNF, was sent for review. The YTD cost variance for the SRSASF JC was 18.9 percent. This variance presents higher levels of activity associated with the production of this draft report and identification of technical issues.

It should be noted that the current spending estimates in all JCs are based on the assumption that staffing is at authorized levels. Current staffing remains below authorized levels and recruitment continues at an accelerated pace.

CNWRA PROGRAM MANAGER'S PERIODIC REPORT ON ACTIVITIES OF THE CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TITLE: Center for Nuclear Waste Regulatory Analyses (CNWRA)

CONTRACTOR: Southwest Research Institute (SwRI)
6220 Culebra Road, San Antonio, Texas 78238-5166

CONTRACT NO: NRC-02-97-009

JOB CODES: D1035, J5164, J5186, J5206, J5190, J5226, J5210

NRC CNWRA PROGRAM MANAGER: John J. Linehan, (301) 415–7780

NRC CNWRA DEPUTY PROGRAM MANAGER: Deborah A. DeMarco, (301) 415–7804

CNWRA PRESIDENT: Wesley C. Patrick, (210) 522–5158

ESTIMATED BUDGET: $87,611,477

PERIOD OF PERFORMANCE: 09/27/97–09/27/02

PERIOD OF THIS REPORT: 03/14/98–04/10/98

1 TECHNICAL

1.1 CNWRA Operations (COPS)

In addition to a wide range of day-to-day activities, accomplishments in the management and planning area included (i) submitting a revision to AP–001, Evaluation of Potential Conflict of Interest; (ii) participating in an NRC/CNWRA management meeting at TWFN; (iii) engaging in the DWM budget development deliberations with the HLW Management Board; (iv) conveying CNWRA Operations Plans Revision 10, Change 1; (v) transmitting an Analysis of Work for Others—West Valley Demonstration Project as well as an addendum thereto; (vi) addressing further COI-related issues among NRC, SwRI, and CNWRA management staffs; (vii) discussing issues with various NRC staff concerning the NRC licensing of the MULTIFLO code to SwRI; and (viii) participating in weekly HLW Management Board meetings.

Status of CNWRA staffing is indicated in table 1, consistent with the revised staffing plan submitted as part of the previously delivered revision to the CNWRA Management Plan. During period 7, recruitment efforts and interviews continued for the approved open positions. Dr. Christopher S. Brossia joined the staff as a materials engineer. Two offers for positions in hydrology have been accepted and new staff are expected to start work in the next two or three periods.

Computer system support activities encompassed (i) participating in meetings with DWM and IRM staffs relative to enabling the CNWRA to use the Banyan Vines software available to SwRI staff, (ii) discussing potential replacement for the CNWRA-developed CDOCS software, (iii) participating in the monthly NRC/CNWRA Computer Coordination meeting, and (iv) maintaining LAN operations.

QA activities focused on (i) responding to the NRC comments made on the draft TOP–018, Development and Control of Scientific and Engineering Software, prior to issuance of the final document; (ii) conducting surveillances, issuing nonconformance notices as required, and working with cognizant staff in response to these notices; (iii) leading the configuration control effort of CNWRA scientific and engineering software determined ready for release; (iv) controlling issued documents and maintaining QA records; (v) working to prevent organizational COIs by review of SwRI RFPs; (vi) performing QA verification checks on each CNWRA deliverable; and (vii) completing the Quality Requirements Application Matrix for CNWRA NRC projects.

In the next period, the CNWRA staff expects to (i) develop a table for the Award Fee Pool in preparation for the next NRC Center Review Group meeting; (ii) submit Revision 6, Change 3, to the CNWRA Management Plan; (iii) continue dialog with the NRC deputy program manager concerning COPS operations; (iv) pursue hiring for open core staff positions; (v) participate in further discussions concerning use of Banyan Vines and a replacement for CDOCS; (vi) provide CNWRA LAN operation and maintenance support; and (vii) proceed with scheduled QA surveillances and development of the Quality Requirements Application Matrix planning tool, distribute TOP–018, perform QA indoctrinations for new CNWRA staff, input internal and product deliverable documents into QA records, review RFPs for potential COI, perform QA verification checks on each CNWRA outgoing deliverable, and prepare for the CNWRA annual QA audit tentatively scheduled June 23–26, 1998.

1.2 Igneous Activity (IA)

Staff conducted field investigations to evaluate subsurface areas of disruption associated with 3.8 Ma eroded basaltic volcanic centers in Crater Flat, Nevada. The area of disruption is an important parameter in TPA models and needs to be constrained with relevant data from the YMR. Although numerous features in the 3.8 Ma Crater Flat volcanoes previously have been mapped as intrusions, many of these features represent lava flows or small, discontinuous intrusions emplaced in the lower parts of cinder cones. Three major eruptive centers are preserved, each having 2–4 satellite vents within 1 km of the main vent. The major centers form a west-stepping alignment 2.5 km long, with satellite vents and dikes extending this zone to 3 km long and around 0.3 km wide. Previous paleomagnetic studies at the 3.8 Ma centers measured only reversed magnetic orientations, which occurred between 3.6 and 4.0 Ma. Several field samples collected during this investigation, however, have apparent normal magnetic orientations. Surficial weathering and lightning strikes can reset rock magnetism to apparent normal orientation. Further investigations are needed to determine if these and other lavas in the Crater Flat area were emplaced during a period of normal paleomagnetic orientation (i.e., <3.6 or >4.0 Ma). This information is necessary to evaluate cumulative displacements proposed for these basalts in Crater Flat and model ground and aeromagnetic data for this area. Normal magnetic orientations also would

indicate this eruptive system probably reactivated after a hiatus in activity of at least 1,000 yr.

IA and SDS staff prepared a technical comment on the Wernicke et al. article, on Anomalous Strain Rates in the Yucca Mountain Region. This comment focuses on relating Wernicke et al. strain rates to postulated increases in volcanic and seismic hazards at YM. Although Lathrop Wells volcano may have formed during a period of high crustal strain between 60–110 ka, it is highly unlikely this episode of high crustal strain has continued to the present. Wernicke et al. data appear permissive of relatively high extension rates during the last 10 yr. A deterministic understanding between crustal extension and basaltic volcano recurrence rates, however, currently does not exist. Without this understanding, staff cannot evaluate rigorously how possible short-term variations in crustal extension may effect relatively long-term variations in volcano or earthquake recurrence. Staff concludes that although the Wernicke et al. article provides important new insights on possible time scales that tectonic processes may operate, there is an insufficient technical basis to conclude that volcanic hazard rates are underestimated by an order of magnitude at YM.

Work continued on the technical basis for Input to Igneous Activity IRSR Rev. 1—Letter Report (IM 1402-461-830). This revision will focus on the consequences of igneous activity and provide technical support for key volcanological parameters used in current TPA models. Staff also pursued, at a low level of effort, preparation of two journal articles to be submitted for Probability Models for Yucca Mountain Region—Journal Article (IM 1402-461-850).

A software development plan was implemented for completion of the PVHVIEW code by September 1998. This plan continues under the Khoros environment. Software development during this period focused on implementing the vent formation analysis toolbox, which is the last remaining toolbox for Version 1.0 of PVHVIEW. Once completed, the PVHVIEW code can construct base maps using USGS DEM and thematic overlays, calculate probabilities of new volcano formation using four different probability models, and display, save, and print probability maps with DEM base maps.

In the next period, staff will prepare Input to Igneous Activity IRSR Rev. 1—Letter Report (IM 1402-461-830). They will develop software test procedures for the PVHVIEW code and begin testing the code.

1.3 Structural Deformation and Seismicity (SDS)

SDS staff attended the DOE meeting that summarized the Final Yucca Mountain PSHA and PFDHA results. The PSHA was derived from an expert elicitation of 25 geoscientists and earthquake engineers who considered seismic sources and ground motion attenuation of seismic energy at YM. The meeting also included a brief presentation by the Sandia group on the DOE plans to implement the PSHA results in TSPA-VA.

SDS staff began an investigation of fault widths at YM with a brief field trip to the site and surrounding region. Samples of fault zone rocks were collected from several fault sites in the ESF and at the surface along Solitario Canyon and on Yucca Ridge. The analyses of thin sections of these samples will be integrated into the technical justifications of review

and acceptance criteria currently being developed for Input to Structural Deformation and Seismicity IRSR, Rev. 1—Letter Report (IM 1402-471-820).

Work on three SDS deliverables included (i) revisions to Input to Structural Deformation and Seismicity IRSR, Rev. 1—Letter Report (IM 1402-471-820); (ii) creation of the 3D Structural Model of Amargosa for Input to USFIC—CNWRA Report (IM 1402-471-860), including some preliminary analyses of the geophysical data available for the region; and (iii) development of an updated GIS Archive—CNWRA Report (IM 1402-471-850). Progress was made on modification of the 3DStress code in preparation for the release of Version 1.3, 3DStress Modifications—CNWRA User's Guide (IM 1402-472-890). The staff also defined plans for subsequent revisions to the 3DStress code.

SDS staff continued review of the DOE EARTHVISION 3D model of the YM site (ISM, Version 2.0) and made modifications to CNWRA SGI hardware in preparation for release of the large ISM, Version 3.0 model.

In the next period, staff will concentrate on the SDS IRSR, Rev. 1. Progress will be made on the 3D model of the Amargosa Desert, the GIS Archive, and the revised version of 3DStress.

1.4 Evolution of the Near-Field Environment (ENFE)

NRC and CNWRA staffs collaborated to revise the Input to Evolution of the Near-Field Environment IRSR, Rev. 1—Letter Report (IM 1402-561-800) to make acceptance criteria more specific, relate such criteria to areas of concern for PA, and update technical information.

Also, in collaboration with the NRC staff, a new set of computations for the natural analog release rate sensitivity analysis was completed. This investigation is being considered for inclusion among the system level sensitivity studies and as a paper to be submitted to the Scientific Basis for Nuclear Waste Management Symposium to be held in the Fall 1998.

Staff attended the DOE/NRC Technical Exchange on TSPA-VA held in San Antonio, Texas, March 17–19, 1998.

Field work in the vicinity of Paiute Ridge examined an alteration associated with a basaltic intrusion in tuffs at the NTS. This site was recently reported in the literature as a near-field analog for the YM repository. Samples of the tuff were collected for future petrographic studies.

The volume fraction of minerals in matrix and in fractures was determined by staff from data in the literature to create a relatively realistic geochemical lithology for tuff units that compose the repository block at YM. This lithology will be used in the MULTIFLO modeling regime to examine effects of repository heating and fluid circulation on the near-field environment.

Testing and debugging progressed on Version 1.2 of the MULTIFLO code. The staff completed coding for the DCM, including coupling the METRA and GEM modules, and

it is now in the testing stage. The MINC implementation in METRA is currently also being tested. The staff is in the process of creating a pre and postprocessor to enable use of the unstructured grid in MULTIFLO for computation domains limited to connected 3D blocks.

Staff reviewed the DOE reports on the performance effects of manmade materials, including cements and concretes. The outcome of this review will be used to refine plans for the Input to Evolution of the Near-Field Environment IRSR, Rev. 1—Letter Report (IM 1402-561-800) and support future TPA code exercises.

In the next period, the staff plans to attend a DOE natural analog strategy meeting. Samples from the Paiute Ridge area will be prepared for petrographic examination. Efforts will continue to revise the ENFE IRSR. A study will begin to develop an array of plausible near-field environmental conditions to be used to compute thermodynamically based solubility limits. Future MULTIFLO code development will include enabling regions of complete dryout to be incorporated into the GEM module. The MULTIFLO User's Manual is to be updated and completed for the DCM and MINC options. In addition, to enable full use of the unstructured grid capability in MULTIFLO, a postprocessor will be developed for creating plot files containing output data. The DOE reports on manmade materials will be reviewed.

1.5 Container Life and Source Term (CLST)

Discussions were held with the NRC staff on Input to Container Life and Source Term IRSR, Rev. 1—Letter Report (IM 1402-571-820). Various sections of the IRSR are being prepared.

Electrochemical corrosion testing continued to confirm the applicability of repassivation and corrosion potentials as predictive parameters for the long-term, localized corrosion of Alloy 825 in chloride-containing solutions. Open circuit potential of the specimen has varied from +190 to +255 mV vs. SCE. This specimen is now at +240 mV vs. SCE. These results are consistent with the "sawtooth" pattern of the corrosion potential where the potential increases to a value above the repassivation potential and localized corrosion initiates. When the potential of the specimen decreases below E_{rp}, repassivation occurs. After repassivation, the corrosion potential starts increasing again.

The staff initiated confirmatory testing of Alloy C-22 stress corrosion cracking and reviewed the design of the stress corrosion cracking test specimens used at LLNL. The heat of Alloy C-22 used by LLNL is no longer available from Metal Samples. Staff will explore obtaining the same heat from the original manufacturer Haynes International, Inc. A plate of type 316L SS was sent to Metal Samples to machine DCB SCC specimens from this material. The type 316L specimen will be tested prior to the Alloy C-22 specimens to benchmark the test procedure since the conditions under which type 316L SS would undergo stress corrosion cracking have been reasonably well established in prior programs. A new data acquisition system has been installed for stress corrosion cracking tests. The acquisition program is presently being debugged. The system will be rigorously tested prior to being used for actual tests.

The staff is assembling a requisite apparatus for localized corrosion testing of Alloys 625 and C-22 at temperatures above 95 °C, since tests at lower temperatures did not produce localized corrosion of Alloy C-22. Most of the necessary supplies including test specimens have been obtained. One set of zirconia plugs for the high temperature reference electrodes was evaluated using an electrochemical impedance technique. An additional set of zirconia plugs, machined at SwRI, is scheduled to be evaluated on April 17, 1998. After evaluation of the zirconia plugs, high temperature reference electrodes will be assembled.

A new staff member joined the CSPE element to initiate experimental activities on corrosion of carbon steel.

In the next period, preparation of the draft Input to Container Life and Source Term IRSR, Rev. 1—Letter Report (IM 1402-571-820) will progress. Long-term corrosion tests of Alloy 825 will continue and localized corrosion testing of Alloys 625 and C-22 will begin. Also, testing of the pit growth on carbon steel will be initiated.

1.6 Thermal Effects on Flow (TEF)

Revision 1 of the TEF IRSR is in preparation. This revision will be submitted during period 9 as Input to Thermal Effects on Flow IRSR, Rev. 1—Letter Report (IM 1402-661-810).

Development continued on implementing an analytical model to describe heat conduction, two-phase flow, and gravity-driven fracture film flow. This analytical model will assess the refluxing phenomenon for nonisothermal conditions.

Assessment of the MINC conceptual model to simulate fracture/matrix flow for nonhydraulic equilibrium conditions remains suspended pending incorporation of DKM capabilities into the MULTIFLC code. The dual continuum capability in MULTIFLO (referred to as the DCM) is undergoing preliminary testing. Both 1D and 2D models are evaluating the DCM capability.

A refined refluxing module with a greater degree of realism (referred to as REFLUX3) was formulated and is available for incorporation in TPA code Version 3.2. The substance of the REFLUX3 module was presented and discussed at the DOE/NRC Technical Exchange on Performance Assessment in San Antonio, Texas, March 17–19, 1998.

A report documenting the ventilation test results and analyses is under preparation for submission as Laboratory Experiment on Ventilation Effects on Repository—Journal Paper or Presentation (IM 1402-661-820). In the laboratory-scale boiling isotherm depression heater experiment that will assess the depression of the boiling isotherm by infiltration or refluxing water, water has been introduced at a rate of 1 L per day for over 120 days, after allowing temperatures to stabilize for 5 days. The correlation between depression of the boiling isotherm and an increase in RH in the drift exhibited a new behavior. In particular, the position of the boiling isotherm stalled after about 80–90 days, although the drift RH continued to increase to about 110 days.

Numerical modeling of the LBT progressed. Staff continue to pursue obtaining results from the DOE for the LBT to be used in analysis of THC coupled processes using the METRA

(and possibly the GEM) module of the MULTIFLO code. The DST currently underway in the ESF is being modeled with the MULTIFLO code. Results of these activities will be documented in a report for submission as Evaluation of DOE Thermal Test Data—Progress Report (IM 1402-661-830). The geochemical component of this analysis, if elected, will be conducted in conjunction with the ENFE KTI.

In the next period, TEF KTI staff plans to (i) continue the boiling isotherm penetration laboratory-scale experiment, (ii) prepare the final report for the ventilation and heating experiment, (iii) proceed with refinement of the LBT numerical model and initiate modeling of the DST, (iv) maintain testing of the MULTIFLO-DCM numerical code, (v) evaluate conceptual models of refluxing, and (vi) continue preparation of the revised IRSR.

1.7 Repository Design and Thermal-Mechanical Effects (RDTME)

The TM auxiliary analysis continued during this reporting period using computer codes UDEC and ABAQUS. Staff pursued the simulation of rock fall under seismic load in the repository thermal environment using the UDEC computer code. Results of this simulation work are expected to provide a technical basis for determining the magnitude of dynamic impact loads on the WPs due to rock falls and will be used as input to the SEISMO module in the TSPA code for disruptive scenario assessment. Establishment of a function relating the sizes of rock falls and magnitude of seismic ground acceleration is expected at the conclusion of the UDEC modeling. The results may also provide insight on rock falls and their possible effect on the near-field geohydrological environment during the postclosure period.

An investigation on repository-scale rock mass behavior under elevated temperature using ABAQUS progressed. The preliminary result indicates that long-term degradation of rock strength properties may have significant effect on near-field rock behavior. Emplacement drifts may become unstable at the later stage of the waste emplacement operation.

The staff initiated simulation of drift-scale rock mass behavior and its effect on concrete lining stability under high temperature using ABAQUS and completed development of numerical models for this activity during this reporting period.

Collection of literature and review on concrete performance under high temperature continued. A considerable amount of valuable information has been collected and will be documented in Rev. 1 of the RDTME IRSR. Preparation of this revision of the RDTME IRSR was initiated during this reporting period for submission as Input to Repository Design and Thermal-Mechanical Effects IRSR, Rev. 1—Letter Report (IM 1402-671-810).

A staff member attended the DOE PSHA meeting in Las Vegas, Nevada, April 6, 1998. Two NRC staff visited the CNWRA on April 7–8, 1998, to discuss the RDTME KTI activities, the preparation of Rev. 1 of the RDTME IRSR, and the revision of the SEISMO module of the TSPA code.

RDTME activities for the remainder of FY98 will be (i) development of the RDTME IRSR, (ii) literature search on the behavior of unreinforced and reinforced concrete (liners) under

long duration high temperature conditions, (iii) study of drift-scale rock mass behavior and its effect on liner performance under high temperature, (iv) analysis of repository-scale rock mass behavior under elevated temperature, (v) revision of conceptual model for the SEISMO module, (vi) simulation of rock falls under seismic load to provide input to SEISMO, and (vii) review of Seismic Topical Report No. 3.

In the next period, RDTME KTI staff plans to (i) search the literature on concrete performance under high temperature, (ii) investigate rock mass behavior under heated conditions on both repository and drift scales with an emphasis on long-term degradation of rock mass strengths, (iii) conduct rock fall simulations and prepare the IRSR, and (iv) conduct reactive activities including review of design documents.

1.8 Total System Performance Assessment and Integration (TSPAI)

Significant effort was devoted to coordinating the DOE/NRC Technical Exchange on TSPA-VA. During the three-day meeting held in San Antonio, Texas, March 17–19, 1998, detailed presentations were made by technical staff on the conceptual models that underlie the TPA Version 3.1.3 code and on preliminary results from the code.

Progress continued on revising chapters of the TPA Version 3.1.4 User's Guide. Particular emphasis was placed on chapter 4, which describes the flow of information, the intermediate results, the conceptual model(s), and the assumptions and conservatisms for each module. The updated report is expected to be completed in period 9 to fulfill User's Guide for TPA Version 3.1.4—Letter Report (IM 1402-762-800).

TPA Version 3.1.4 was developed, tested, and submitted. TPA Version 3.1.4 contains revisions to the SEISMO model agreed to during the SDS KTI meeting March 6, 1998. These changes to SEISMO correct the excessive seismic-related WP failures by sampling the fraction of the repository area that experiences rockfall and WP failures during a seismic event. In addition, the DCAGW and DCAGS modules were modified to make the onset of the pluvial period consistent with the infiltration state defined in UZFLOW.

TPA Version 3.1.4 has been used to produce 400 vector runs for various conceptual model configurations as part of the system-level sensitivity analysis. In addition, computing normalized sensitivity coefficients using the differential method has begun. These results will be reported in Input to TPA Version 3.1 Sensitivity Studies Report—Letter Report (IM 1402-761-810).

Development continued on the generalized importance analysis approach. Modifications to a test version of the TPA code were incorporated to allow the user to specify which subsystems of the engineered and geologic barriers are intact and functioning. These changes allow the user to quantitatively measure the relative importance of individual components such as the inner overpack CRM and outer overpack CAM.

In the next period, the PA staff will focus on (i) completing the updated User's Guide for TPA Version 3.1.4, (ii) assisting the NRC with conducting the system-level sensitivity studies, (iii) revising the TSPA IRSR, (iv) documenting the GIA technique, and

(v) initiating development of post processor for the TPA Version 3.1.4 code. In addition, recruiting efforts will continue for the open PA modeler and risk assessment positions.

1.9 Activities Related to Development of the NRC High-Level Waste Regulations (ARDR)

Incorporation of revisions to the previously issued report, Information and Analyses to Support Selection of Critical Groups and Reference Biospheres for Yucca Mountain Exposure Scenarios (CNWRA 97-009), resumed this period. The report, which is being revised to comply with NRC comments, is expected to be issued as a NUREG/CR. It will be a key reference document for the rulemaking effort and TSPAI activities. Document production staff completed incorporating technical and editorial revisions to address the NRC comments and the author is conducting a final review. The report will be delivered during period 8.

The CNWRA staff participated in meetings and reviewed draft language of the revised NRC HLW rule. Emphasis this period was on further refinement of draft requirements and definitions. To assist the HLW rule development effort, results of a review of a working draft of the standard conducted by a diverse team of CNWRA staff and management were developed during this period and informally delivered to the NRC PEM following the close of the period. The EPA Standard for YM has not been publicly issued, therefore, the review was put on hold pending public release of the standard.

A draft report delivered last period on the sensitivity of peak dose with respect to several intermediate outputs using the TPA code is awaiting the NRC PEM review and comment. Calculations contained in this report are expected to provide technical insight useful in developing the revised NRC HLW rule. After review by the NRC PEM, a final letter report for this deliverable will be prepared.

In the next period, the staff will continue to assist the NRC staff in refining sections of the draft NRC HLW rule. CNWRA management and technical staff who provided comments on the working draft HLW rule are expected to participate, as needed, in follow-up discussions and meetings arising from the recent review. Additional emphasis next period will be placed on providing support to the NRC staff in developing statements of consideration for the new HLW rule. If EPA issues the draft standard, staff will assist the NRC with reviewing the draft standard and preparing comments. The revision of CNWRA 97-009 to NUREG/CR format will be completed. In addition, following receipt of the NRC comments on the draft report on the sensitivity analysis of peak dose with intermediate calculations using the TPA code, development will commence on the final report.

1.10 Unsaturated and Saturated Flow Under Isothermal Conditions (USFIC)

Development continued, with close NRC staff collaboration, on the author-final draft of Input to Unsaturated and Saturated Flow Under Isothermal Conditions IRSR, Rev. 1—Saturated Zone Topics—Letter Report (IM 1402-861-830). Technical and editorial reviews were completed for Input to Unsaturated and Saturated Flow Under Isothermal Conditions IRSR, Rev. 1— Unsaturated Zone Topics—Letter Report (IM 1402-861-820).

The staff progressed on development of the site-scale 3D Flow and Transport model for YM. The model is being refined with new data obtained from the Nevada Environmental Restoration Project. The site-scale model can now be vertically refined for up to 20 layers. It is oriented along major fault trends and will be compared with a model aligned NS to study the effect of preferential flowpaths along major faults. USFIC staff completed preliminary planning for field investigations to be conducted in collaboration with the SDS KTI staff. These field investigations will provide insight to bound uncertainties in SZ flow and transport issues.

USFIC staff participated in the DOE/NRC Technical Exchange held March 17–19, 1998, in San Antonio, Texas, and assisted the NRC in identifying concerns regarding the DOE approach to abstracting matrix diffusion for TSPA-VA. These concerns formed part of the discussion at an appendix 7 meeting at Los Alamos and Sandia National Laboratories, April 8–9, 1998, in which USFIC staff participated. This appendix 7 exchange was useful in helping USFIC staff gain a more complete understanding of laboratory and field evidence for matrix diffusion and for modeling conducted to support inclusion of matrix diffusion in PA models.

During this period, a limited field experiment was undertaken in collaboration with the IA KTI staff to assess the utility of electromagnetic surveys for identifying and mapping variations in moisture content and related properties across fault zones in the YM region. The SCFF was chosen for this initial experiment because the fault crops out in the southern part of the map area, the fault has been trenched in two locations, and the fault juxtaposes basalt against alluvium, providing a good magnetic contrast. Distinctive magnetic and electrical conductivity anomalies were found to occur along the SCFF. These anomalies can be interpreted by increased transmissivity along the fault zone. USFIC staff began planning for possible extensions of this work to other areas.

Assumptions and implications of the infiltration model used in the TPA code were presented at the DOE/NRC Technical Exchange on TSPA. Model predictions are similar to the DOE model for current climatic conditions, but uncertainty increases under future climatic conditions. Ongoing work identified and ranked several sites in southern Nevada for their utility in providing analogs to YM under cooler and moister conditions. These sites will be used to assess and bound infiltration model predictions. The ranking included topographic maps, geologic maps, aerial photography, and field confirmation to match bedrock and soil characteristics, slope, and elevation with YM. The cooler and more moist conditions arising from higher elevations provide the analog to future climate.

In the next period, USFIC staff will devote time to (i) completing the author-final draft of Input to Unsaturated and Saturated Flow Under Isothermal Conditions IRSR, Rev. 1—Saturated Zone Topics—Letter Report (IM 1402-861-830); (ii) completing reviews of Input to Unsaturated and Saturated Flow Under Isothermal Conditions IRSR, Rev. 1—Unsaturated Zone Topics—Letter Report (IM 1402-861-820); (iii) developing a 3D, subregional site-scale flow and transport model; and (iv) planning and conducting field investigations.

1.11 Radionuclide Transport (RT)

CNWRA technical, programmatic, and editorial reviews of Input to Radionuclide Transport IRSR, Rev. 0—Letter Report (IM 1402-871-820) were completed during this period.

The author-final draft of Preliminary Fracture Sorption Module for TPA 3.2—Letter Report (IM 1402-871-810) was completed and placed in internal CNWRA review. This report includes a summary of fracture mineralogy and water chemistry and estimates of sorption parameter distributions based on surface complexation models. The statistics describing these distributions can be used either to support expert judgment or as direct input into existing sorption coefficient PDFs for PA. Part of the results of this work was presented at the DOE/NRC TSPA Technical Exchange in San Antonio, Texas, March 17–19, 1998.

A literature review continued to more fully identify and characterize key geochemical parameters controlling RT. Focus of the literature review is on Tc, I, Np, Pu, and Se. These radioelements are of concern in PA. Work began on the report, Preliminary Alluvium Sorption Module for TPA 3.2—Letter Report (IM 1402-871-830). This report will present an approach using geochemical sorption models to develop response surfaces that define sorption behavior as a function of system geochemistry. Additional work was undertaken to constrain alluvium mineralogy to the extent possible through available well logs, reports, and geologic maps.

In the next period, the report Input to Radionuclide Transport IRSR, Rev. 0—Letter Report (IM 1402-871-820) will be submitted. Technical, editorial, and programmatic reviews will be completed for Preliminary Fracture Sorption Module for TPA 3.2—Letter Report (IM 1402-871-810) and the final report submitted. Work will continue on the literature reviews of key geochemical parameters controlling sorption and alluvium mineralogy. Progress will be made on the report, Preliminary Alluvium Sorption Module for TPA 3.2—Letter Report (IM 1402-871-830).

1.12 Tank Waste Remediation System (TWRS)

In subtask 1.2, technical review of the Survey of Solidification Process Technologies Final Report (IM 1403-102-810) has been completed and will be delivered in period 8. In addition, comments on the annotated outline for Low-Activity Waste Feed Makeup, Solidification, and Offgas Technology and Process System Hazard and Safety Issues Report for TWRS—Letter Report (IM 1403-102-832) were received from the NRC and were incorporated in the outline. A request has been made to the NRC staff regarding the use of an outside consultant to review parts of the proprietary documentation on pretreatment submitted by TWRS privatization contractors as part of this report. An annotated outline for the Low-Activity Waste Auxiliary Support Equipment and Process Control Technology System Hazard and Safety Issues Report for TWRS—Letter Report (IM 1403-102-833) is being prepared.

A draft report of the Comparison of Risk Assessment Techniques (IM 1403-103-810) was received from the subcontractor and reviewed by the CNWRA staff under subtask 1.3. Comments were provided to the author for finalization of the report. This deliverable will enter the CNWRA review process during the next period. In subtask 1.4, work continued

on the Consequence Criteria Report for the TWRS (IM 1403-104- 820). The gaps in the categorization scheme described in draft revisions to 10 CFR Part 70 for intakes of soluble uranium and hazardous chemical exposures were identified. Appropriate methods for filling these gaps are being explored based on information found in NUREG-1391, other CFRs (e.g., 10 CFR Part 40), and additional sources as appropriate. The findings will be documented in chapter 4 of the final report. Recommendations for appropriate definitions of graded levels of protection based on the analysis of postulated exposure events at operating vitirification facilities are also being developed and will be documented in chapter 5.

An annotated outline for the Final Report on Chemistry of DOE Contractor Pretreatment Activities (IM 1403-106-815), with revisions based on the NRC staff input, was conveyed. Acquisition of literature pertinent to topics to be covered in the report continued. Revisions progressed on the Final High-Level Waste Chemistry Manual (IM 1403-106-805), with the NRC staff comments on the draft report incorporated and other chapters and appendixes added. In addition, a list was conveyed of demonstration examples developed by staff using the Environmental Simulation Program (a commercially available code from OLI Systems, Inc.) to simulate the effects of chemical reactions during retrieval and pretreatment of tank wastes.

In the next period, activities will continue in subtask 1.2. The Survey of Solidification Process Technologies Final Report (IM 1403-102-810) will be provided. In addition, an annotated outline will be prepared for the Low-Activity Waste Auxiliary Support Equipment and Process Control Technology System Hazard and Safety Issues Report for TWRS—Letter Report (IM 1403-102-833). Work will continue on the Consequence Criteria Report for the TWRS (IM-1403-104-820). In subtask 1.6, the report, Final High-Level Waste Chemistry Manual (IM 1403-106-805), will continue revision. Also, literature review will progress concerning topics covered in the Final Report on Chemistry of DOE Contractor Pretreatment Activities (IM 1403-106-815).

1.13 Three Mile Island Unit 2 Independent Spent Fuel Storage Installation (TMI-2 ISFSI)

Review and evaluation of the DOE response to the NRC first round RAI, development of second round RAI, and preparation of an outline of SER continued during this reporting period. These will be documented in a report for delivery as Second Round RAI/Outline of SER—Draft Letter Report (IM 1405-014-820).

In the next period, TMI-2 ISFSI staff plans to continue to review and evaluate the DOE response to the NRC first round RAI, develop the second round RAI, and prepare an outline of SER.

1.14 Dry Transfer System (DTS)

The safety review of the DTS TSAR, reinitiated during the last reporting period, continued during this period. This review will be used to develop First Round Request for Additional Information—Draft Letter Report (IM 1405-021-810).

In the next period, DTS staff plans to continue the safety review of the DTS TSAR.

1.15 Centralized Interim Storage Facility (CISF)

The final version of CISF RAI report was completed during this reporting period and transmitted March 18, 1998, as First Round Request for Additional Information—Final Letter Report (IM 1405-031-820). This RAI report was accepted on April 6, 1998.

In the next period, CISF staff will focus on identification of cask-specific issues that may need to be investigated by the NRC and participation in a DOE/NRC video conference meeting on the first round RAI.

1.16 Private Fuel Storage Facility (PFSF)

The final RAI delivered March 14, 1998, as First Round Request for Additional Information—Final Letter Report (IM 1405-041-810) has been accepted.

In the next period, PFSF staff plans to participate in a PFS Limited Liability Company/NRC teleconference meeting on the first round RAI.

1.17 West Valley Demonstration Project (WVDP)

Expenditures incurred during this period were limited to contract administration and reporting while continued WVDP work under the IME is being considered by the NRC and CNWRA management.

In the next period, activity will be limited to contract administration and reporting. The WVDP work under the HLW program will be terminated as directed by the NRC.

1.18 Savannah River Site Aluminum-Based Spent Fuel (SRSASF)

The draft report, Review of the Technical Issues Related to Interim Storage and Permanent Disposal of Al-based SNF (IM 1407-001-810), was sent for review. The title of the report is different from that in the Operations Plan (Review of U.S. DOE Approaches to the Co-disposal Options for Al-based SNF) to be more consistent with the scope of the report. Technical issues identified in the report include the effect of temperature on vapor corrosion and mechanical properties of the cladding and fuel that could affect waste transfer operations prior to repository closure, assumptions made in the criticality calculations to satisfy in-container and outside the container criticality safety considerations, the approach to corrosion testing as outlined in the test protocol for waste form arising from the two treatment alternatives, and the partitioning of radionuclides between the melt, slag, and off gas.

In the next period, a teleconference with the DOE is planned to discuss the ongoing review and obtain clarification as necessary. The final report, Review of the Technical Issues Related to Interim Storage and Permanent Disposal of Al-based SNF (IM 1407-001-810) will be prepared after receiving comments from the NRC staff.

2 MANAGEMENT ISSUES

None to report.

3 MAJOR PROBLEMS

None to report.

4 SUMMARY OF SCHEDULE CHANGES

Schedule changes for IMs are included in table 2. Completed deliverables are noted on table 3 and in the Executive Summary.

5 SUMMARY OF FINANCIAL STATUS

Table 4 summarizes the CNWRA financial status in the context of authorized funds provided by the NRC. Total commitments of the CNWRA are $238,421. The appendix lists planned and actual costs to date, as well as variances between these, without allowance for fee, on both a per-period and a cumulative basis. These data do not include commitments. Pertinent financial information is provided for the DWM JC, including COPS and 10 KTIs, TWRS JC, TMI-2 ISFSI JC, DTS JC, CISF JC, PFSF JC, WVDP JC, and SRSASF JC. The planned costs per period are based on the spending plans contained in the CNWRA OPS, Revision 10, Change 1, for the DWM JC; TWRS Operations Plan, Revision 1, Change 1, for TWRS JC; SFPO Operations Plan, Revision 1, Change 5, for the TMI-2 ISFSI, DTS, CISF, and PFSF JCs; WVDP Operations Plan, Revision 8, Change 0, for the WVDP JC; and SRSASF Operations Plan, Revision 0, Change 2, for the SRSASF JC.

It should be noted the current spending estimates in all JCs are based on the assumption that staffing is at authorized levels. Staffing remains below authorized levels and accelerated recruitment is in progress. An updated Staffing Plan will be submitted next period as part of Revision 6, Change 3, to the CNWRA Management Plan.

Period 7 FY98 CNWRA composite expenditures increased 18.8 percent from last period but this aggregate of all JCs was underspent by $901,783 or 15.8 percent. The DWM, TWRS, TMI-2 ISFSI, and DTS JCs evidenced higher spending levels, while the CISF, PFSF, WVDP and SRSASF JCs showed lower levels. In percentage terms, the TWRS and DTS JCs registered sharp rises in expenses in contrast with a pronounced decline in expenditures for the CISF, PFSF, and WVDP JCs. Specific explanations for these swings are provided in the individual sections corresponding to each JC.

The DWM JC was underspent by $641,041 or 13.6 percent. Expenses increased 19.0 percent from the previous period as costs rose in COPS, and the IA, ENFE, CLST, RDTME, TSPAI, USFIC, and RT KTIs, but declined in SDS, TEF, and ARDR KTIs.

The TWRS JC was underspent by $37,515 or 9.0 percent. Expenditures increased 81.7 percent over last period as the result of report preparation.

The TMI-2 ISFSI JC was underspent by $33,945 or 33.7 percent. Costs rose 42.6 percent from last period—reflecting increased activity primarily related to review and evaluation of the DOE response to the NRC first round RAI.

The DTS JC was underspent by $91,144 or 64.7 percent. Spending accelerated following approval of the operations plan and resumption of work.

The CISF JC was underspent by $26,663 or 23.7 percent. Expenses fell by 76.4 percent from the previous period—related to increased funding for this project and minimal activities awaiting the DOE response to the NRC first round RAI.

The PFSF JC was overspent by $1,205 or -1.9 percent. Expenditures declined by 93.4 percent over last period because detailed safety review of the PFSF SAR was completed and the CNWRA awaited the DOE response to the NRC first round RAI.

The WVDP JC was underspent by $61,224 or 64.1 percent. Costs reflect only administrative expenses. This project will be closed and a new contract initiated in the near future.

The SRSASF JC was underspent by $11,456 or 18.9 percent. Spending decreased over last period although staff continued review of the DOE reports along with preparation of a draft report.

The CNWRA expenditures on SwRI labor, consultants, and subcontractors as a percentage of composite spending on all JCs was 23.8. The CNWRA expense on consultants and subcontractors as a fraction of composite spending on all JCs was 16.5 percent. These percentages increased from the previous period, indicating a CNWRA commitment to enhance, where appropriate, participation of consultants and subcontractors in the conduct of CNWRA work.

As shown in table 1, the CNWRA has 47 core and one limited-term staff members. The CNWRA has updated the Staffing Plan portion of the Management Plan, which is reflected in table 1. The available pool of approved consultants and subcontractors decreased to 43.

This FYTD no capital or sensitive equipment was purchased with NRC funds (other than overhead, general and administrative expenses, and fees).

DWM JC

The DWM JC cumulative cost variance through period 7 was 13.6 percent. Expenditures in this JC increased by 19.0 percent over the previous period. Specific explanations for over/underspending for COPS and each KTI follow.

The cost variance for COPS was 7.5 percent: 4.6 percent for the Management, Planning, and Computer Support subtask (1402-158) and 21.3 percent for the QA subtask (1402-159). Spending in the 158 subtask rose and that for 159 declined from last period. Expenses in the Management, Planning, and Computer Support subtask are expected to remain near estimated levels for the next period and those associated with the QA subtask should increase slightly after planning for the annual QA audit begins. QA subtask costs will peak during conduct of the annual QA audit.

The cost variance for the IA KTI was 3.1 percent. Minor underspending is expected to continue until staff commences field investigations during period 8.

The cost variance for the SDS KTI was -5.9 percent. This overspending should continue throughout the year. Authorization of additional expenditure is anticipated to support several new tasks. Some staff members will assist other KTIs to reduce the total amount of this KTI overspending.

The cost variance for the ENFE KTI was 16.9 percent. This variance is slightly above the last period. Future variances may increase until costs for external reviews are posted.

The cost variance for the CLST KTI was 14.8 percent. The positive cost variance decreased from the last period in percentage terms and will further decline with the augmented level of activities in various tasks.

The cost variance for the TEF KTI was 14.3 percent. Although this cost variance is higher than that of the previous period, it is expected to diminish during the next few periods as the result of assigning additional non-CNWRA labor to activities.

The cost variance for the RDTME KTI was 22.9 percent. This cost underrun is significantly less than that of the previous period and indicates accelerated activity. This variance is anticipated to decrease as additional non-CNWRA staff are added to this KTI activities.

The cost variance for the TSPAI KTI was 16.3 percent. This spending rate is expected to remain roughly constant during period 8. Increased use of SwRI staff on tasks related to development of the post processor for the TPA code, and PVM and PC versions of TPA Version 3.1.4 will increase spending during the ensuing months.

The cost variance for the ARDR KTI was 47.2 percent. Although this variance is higher than last period, an increased rate of spending is anticipated—resulting from tasking a newly hired staff member and organizing a CNWRA team to assist the NRC with revising the HLW rule.

The cost variance for the USFIC KTI was 16.8 percent—a significant reduction in percentage terms from last period. This variance is expected to diminish further as field work is undertaken and additional USFIC staff are added.

The cost variance for the RT KTI was 32.6 percent. Although the variance continues to grow in dollar terms, the percentage variance has notably declined from earlier periods. Further reduction is anticipated as costs for literature reviews and detailed sorption modeling are posted to this account.

The cost variance for the TWRS project was 9.0 percent. The positive cost variance decreased substantially from the last period due to increased activities related to the preparation of intermediate milestone reports in subtasks 1.2 and 1.6. It is anticipated that the spending rate in the next period will lessen slightly once these milestones are completed and activities on other milestones continue.

The cost variance for the TMI-2 ISFSI project was 33.7 percent—significantly lower than that of the previous period. It will continue to decrease as resources are allocated for reviewing and evaluating the DOE response to the NRC first round RAI and preparing the SER. Moreover, the CNWRA plans to acquire core staff that will also be used on this project.

The cost variance for the DTS project was 64.7 percent. Spending increased from the previous period. As activities progress, consultants employed, and staff acquired, this cost variance will decrease.

The cost variance for the CISF project was 23.7 percent—primarily a result of augmented funding in the revised CISF Operations Plan. This cost underrun will continue until the CNWRA receives the DOE response to the NRC first round RAI and hires staff that will also support this project.

The cost variance for the PFSF project was - 1.9 percent—a substantive reduction from the previous period. This variance will be affected by the CNWRA awaiting the DOE response to the NRC first round RAI.

The cost variance for the WVDP was 64.1 percent. Costs during the next period are expected to be limited to contract administration and reporting.

The cost variance for the SRSASF project was 18.9 percent. Spending is related to the production of the draft review report and is expected to decrease in the following periods once the final report is completed.

Table 1. CNWRA Core Staff—Current Profile and Hiring Plan* (Period 7)

Expertise/Experience	Current No.	Professional Staff	Positions Open FY98
ADMINISTRATION	4	H.GARCIA, W.PATRICK, J.RUSSELL, B.SAGAR	
CHEMICAL PROCESSING ENGNG./PHYS. CHEM.	2	V.JAIN, D.DARUWALLA	
CODE ANALYSIS/DEVELOPMENT	3	R.JANETZKE, R.MARTIN, J.BANGS	
DATA MANAGEMENT/PROCESSING, INCLUDING FINANCIAL	1	P.MALDONADO	
DOSE/RISK/HAZARD ANALYSIS	0		1
ELECTROCHEMISTRY	1	G.CRAGNOLINO	
ENGINEERING GEOLOGY/GEOLOGICAL ENGNG.	2	R.CHEN, G.GYOEGBU	
ENVIRONMENTAL SCIENCES	1	P.LaPLANTE	
GEOCHEMISTRY	5	W.MURPHY, R.PABALAN, E.PEARCY, J.PRIKRYL, D.TURNER	
GEOHYDROLOGY/HYDROGEOLOGY	3	R.FEDORS, R.GREEN, J.WINTERLE	2
GEOLOGY	2(1)†	L.McKAGUE, M.MIKLAS, P.LAFEMINA†	
HYDROLOGIC TRANSPORT	1	A.ARMSTRONG	2
INFORMATION MANAGEMENT SYSTEMS	1	R. KOTARA	
MATERIAL SCIENCES	3	D.DUNN, N.SRIDHAR, S.BROSSIA	1
MECHANICAL, INCLUDING DESIGN & FABRICATION	0		1
MINING ENGINEERING	1	S-M.HSIUNG	
NUCLEAR ENGINEERING	1	M.JARZEMBA	
OPERATIONAL HEALTH PHYSICS	2	J.WELDY, L.DEERE	
PERFORMANCE ASSESSMENT	3	R.BACA, S.MOHANTY, G.WITTMEYER	2
QUALITY ASSURANCE	1	B.MABRITO	
RADIOISOTOPE GEOCHEMISTRY	1	D.PICKETT	
ROCK MECHANICS, INCLUDING CIVIL/STRUC. ENGNG.	2	A.CHOWDHURY, A.GHOSH	
SOURCE-TERM/SPENT FUEL DEGRAD.	1	P.LICHTNER	
STRUCTURAL GEOLOGY/ SEISMO-TECTONICS	3	D.FERRILL, J.STAMATAKOS, D.SIMS	
SYSTEMS ENGINEERING	1	P.MACKIN	
VOLCANOLOGY/IGNEOUS PROCESSES	2	C.CONNOR, B.HILL	
TOTAL	47(1)†		9

* See staffing plan for details

† Limited term

Table 2. Summary of Schedule Changes (Period 7)

MILESTONE NUMBER	TYPE	DESCRIPTION	ORIGINAL DATE	REVISED DATE	RATIONALE FOR CHANGE
1402-761-800	IM	Input to Total System Performance Assessment IRSR, Rev.1—Letter Report	05/22/98	06/30/98	Absence of key personnel during May 1998 and additional time needed to update model abstraction subissue.

Table 3. Deliverables (Period 7)

MILESTONE NO.	TYPE	DESCRIPTION	ORIGINAL COMPLETION DATE	REVISED DATE	# OF REVISIONS	ACTUAL COMPLETION DATE	REASON (IF DELAYED)
1405-031-820	IM	First Round Request for Additional Information—Final Letter Report (CISF)	03/18/98			03/17/98	

Table 4. Financial Status (Period 7)

Project Names	Funds Authorized	Funds Costed to Date	Funds Uncosted	Commitments
COPS	1,168,781	808,996	359,785	3,887
IA	430,766	302,976	127,790	7,428
SDS	593,490	491,941	101,549	9,675
ENFE	660,016	408,898	251,118	37,202
CLST	451,739	250,729	201,010	12,721
TEF	501,781	305,424	196,357	2,573
RDTME	310,849	147,177	163,672	958
TSPAI	1,128,934	682,891	446,043	6,707
ARDR	277,585	98,390	179,195	0
USFIC	762,351	449,762	312,589	6,394
RT	293,706	125,032	168,674	58,600
DWM Costs	6,580,000	4,072,216	2,507,784	
DWM Award Fee	420,000	0	420,000	
DWM Base Fee	0	158,194	(158,194)	
TOTAL DWM	7,000,000	4,230,410	2,769,590	146,143
TWRS Costs	820,596	378,160	442,436	92,250
TWRS Award Fee	47,643	0	47,643	
TWRS Base Fee	31,762	14,686	17,075	
TOTAL TWRS	900,000	392,846	507,154	92,250
TMI-2 ISFSI SAR Costs	155,545	66,846	88,698	28
TMI-2 ISFSI SAR Award Fee	9,080	0	9,080	
TMI-2 ISFSI Base Fee	6,053	2,579	3,474	
TOTAL TMI-2 ISFSI SAR	170,678	69,426	101,252	28
DTS Costs	180,000	49,742	130,258	0
DTS Award Fee	12,000	0	12,000	
DTS Base Fee	8,000	1,915	6,085	
TOTAL DTS	200,000	51,657	148,343	0
CISF Costs	99,000	85,615	13,385	0
CISF Award Fee	6,600	0	6,600	
CISF Base Fee	4,400	3,298	1,102	
TOTAL CISF	110,000	88,913	21,087	0
PFSF Costs	108,000	64,781	43,219	0
PFSF Award Fee	7,200	0	7,200	
PFSF Base Fee	4,800	2,495	2,305	
TOTAL PFSF	120,000	67,277	52,723	0
WVDP Costs	39,900	34,266	5,634	0
WVDP Award Fee	0	0	0	
WVDP Base Fee	0	1,331	(1,331)	
TOTAL WVDP	39,900	35,596	4,304	0
SRSASF Costs	103,826	49,021	54,805	0
SRSASF Award Fee	6,640	0	6,640	
SRSASF Base Fee	4,427	1,898	2,529	
TOTAL SRSASF	114,893	50,919	63,974	0
Grand Total	8,655,471	4,987,043	3,668,428	238,421
Note: All authorized funds have been allocated.				

Table 5. Private Fuel Storage Facility License Fee Cost Recovery Status (Period 7)

LICENSE FEE COST RECOVERY STATUS

JOB CODE: J5226

TITLE: Private Fuel Storage Facility

PERIOD: March 14–April 10, 1998

TASK NUMBER	FACILITY NAME	DOCKET NUMBER	TAC OR INSPECTION IDENTIFICATION NUMBER	PERIOD COSTS	CUMULATIVE COSTS THIS FISCAL YEAR
20-1405-041	Private Fuel Storage Facility	72-22	L22462	$1,733.97	$67,276.61

Note: Costs include 4 percent actual base fee but not award fee, which is determined annually.

APPENDIX A
Planned and Actual Costs, and Cost Variances Period 7–FY98

CNWRA COMPOSITE
TOTAL ESTIMATE COST

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	792,693	896,745	564,255	715,293	891,897	916,053	925,522	973,389	942,768	971,203	962,048	999,164	960,811	5,702,458
Act Pd Cost	581,443	701,484	651,807	532,261	712,281	740,997	880,402	0	0	0	0	0	0	4,800,675
Variance, $	211,250	195,261	(87,552)	183,032	179,616	175,056	45,120	0	0	0	0	0	0	901,783
Variance, %	26.6%	21.8%	-15.5%	25.6%	20.1%	19.1%	4.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	15.8%
Est FY Cumul	792,693	1,689,438	2,253,693	2,968,986	3,860,883	4,776,935	5,702,458	6,675,847	7,618,616	8,589,819	9,551,867	10,551,031	11,511,843	
Act FY Cumul	581,443	1,282,927	1,934,733	2,466,994	3,179,276	3,920,272	4,800,675	0	0	0	0	0	0	
% Complete	5.1%	11.1%	16.8%	21.4%	27.6%	34.1%	41.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	211,250	406,511	318,960	501,992	681,607	856,663	901,783	0	0	0	0	0	0	
Cumul Var, %	26.6%	24.1%	14.2%	16.9%	17.7%	17.9%	15.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

DIVISION OF WASTE MANAGEMENT (DWM)
1402-000

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	594,821	697,393	356,542	760,809	750,668	768,644	784,380	824,192	809,185	826,244	829,016	851,975	828,168	4,713,256
Act Pd Cost	492,507	600,030	558,113	449,328	591,389	630,604	750,245	0	0	0	0	0	0	4,072,216
Variance, $	102,314	97,363	(201,571)	311,481	159,279	138,040	34,135	0	0	0	0	0	0	641,041
Variance, %	17.2%	14.0%	-56.5%	40.9%	21.2%	18.0%	4.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	13.6%
Est FY Cumul	594,821	1,292,214	1,648,756	2,409,565	3,160,233	3,928,877	4,713,256	5,537,448	6,346,634	7,172,878	8,001,894	8,853,869	9,682,038	
Act FY Cumul	492,507	1,092,537	1,650,650	2,099,978	2,691,367	3,321,970	4,072,216	0	0	0	0	0	0	
% Complete	5.1%	11.3%	17.0%	21.7%	27.8%	34.3%	42.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	102,314	199,677	(1,894)	309,587	468,866	606,906	641,041	0	0	0	0	0	0	
Cumul Var, %	17.2%	15.5%	-0.1%	12.8%	14.8%	15.4%	13.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

CNWRA OPERATIONS (COPS)
1402-150

ITEM	1	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	120,424	120,574	132,169	125,526	125,186	125,616	125,033	125,650	124,826	125,652	124,578	126,550	124,578	874,528
Act Pd Cost	106,290	129,997	136,680	97,262	111,411	102,585	124,571	0	0	0	0	0	0	808,996
Variance, $	14,134	(9,423)	(4,711)	28,264	13,775	23,031	462	0	0	0	0	0	0	65,532
Variance, %	11.7%	-7.8%	-3.6%	22.5%	11.0%	18.3%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.5%
Est FY Cumul	120,424	240,998	373,167	498,693	623,879	749,495	874,528	1,000,178	1,125,003	1,250,655	1,375,233	1,501,783	1,626,360	
Act FY Cumul	106,290	236,287	373,167	470,429	581,840	684,425	808,996	0	0	0	0	0	0	
% Complete	6.5%	14.5%	22.9%	28.9%	35.8%	42.1%	49.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	14,134	4,711	0	28,264	42,039	65,070	65,532	0	0	0	0	0	0	
Cumul Var, %	11.7%	2.0%	0.0%	5.7%	6.7%	8.7%	7.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

IGNEOUS ACTIVITY (IA)
1402-460

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	48,715	48,716	13,506	49,490	50,593	51,355	50,360	51,612	50,358	51,787	50,294	52,305	50,094	312,735
Act Pd Cost	39,614	34,754	36,569	39,730	45,968	49,808	56,534	0	0	0	0	0	0	302,976
Variance, $	9,101	13,962	(23,063)	9,760	4,625	1,547	(6,174)	0	0	0	0	0	0	9,759
Variance, %	18.7%	28.7%	-170.8%	19.7%	9.1%	3.0%	-12.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.1%
Est FY Cumul	48,715	97,431	110,937	160,427	211,020	262,375	312,735	364,347	414,705	466,492	516,787	569,092	619,186	
Act FY Cumul	39,614	74,368	110,937	150,667	196,634	246,442	302,976	0	0	0	0	0	0	
% Complete	6.4%	12.0%	17.9%	24.3%	31.8%	39.8%	48.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	9,101	23,063	0	9,760	14,386	15,933	9,759	0	0	0	0	0	0	
Cumul Var, %	18.7%	23.7%	0.0%	6.1%	6.8%	6.1%	3.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

STRUCTURAL DEFORMATION AND SEISMICITY (SDS)
1402-470

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	51,967	51,970	164,832	46,924	49,533	50,317	49,051	54,073	52,487	54,391	52,428	54,644	52,313	464,594
Act Pd Cost	99,973	104,899	63,346	58,408	47,715	63,352	54,248	0	0	0	0	0	0	491,941
Variance, $	(48,006)	(52,929)	101,486	(11,484)	1,818	(13,035)	(5,197)	0	0	0	0	0	0	(27,347)
Variance, %	-92.4%	-101.8%	61.6%	-24.5%	3.7%	-25.9%	-10.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-5.9%
Est FY Cumul	51,967	103,937	268,769	315,693	365,226	415,543	464,594	518,667	571,154	625,545	677,973	732,617	784,930	
Act FY Cumul	99,973	204,872	268,218	326,626	374,341	437,693	491,941	0	0	0	0	0	0	
% Complete	12.7%	26.1%	34.2%	41.6%	47.7%	55.8%	62.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	(48,006)	(100,935)	551	(10,933)	(9,115)	(22,150)	(27,347)	0	0	0	0	0	0	
Cumul Var, %	-92.4%	-97.1%	0.2%	-3.5%	-2.5%	-5.3%	-5.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

EVOLUTION OF THE NEAR-FIELD ENVIRONMENT (ENFE)
1402-560

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	67,378	67,719	69,339	72,374	71,411	72,375	71,267	72,613	70,871	72,670	70,672	73,456	70,637	491,862
Act Pd Cost	71,128	76,576	56,732	34,826	59,438	52,000	58,198	0	0	0	0	0	0	408,898
Variance, $	(3,750)	(8,857)	12,607	37,548	11,973	20,374	13,068	0	0	0	0	0	0	82,964
Variance, %	-5.6%	-13.1%	18.2%	51.9%	16.8%	28.2%	18.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	16.9%
Est FY Cumul	67,378	135,097	204,436	276,810	348,221	420,596	491,862	564,475	635,345	708,015	778,686	852,142	922,779	
Act FY Cumul	71,128	147,704	204,436	239,262	298,700	350,700	408,898	0	0	0	0	0	0	
% Complete	7.7%	16.0%	22.2%	25.9%	32.4%	38.0%	44.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	(3,750)	(12,607)	0	37,548	49,521	69,895	82,964	0	0	0	0	0	0	
Cumul Var, %	-5.6%	-9.3%	0.0%	13.6%	14.2%	16.6%	16.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

CONTAINER LIFE AND SOURCE TERM (CLST)
1402-570

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	0	37,055	15,783	52,904	59,077	59,727	69,899	70,665	69,814	70,669	69,615	70,725	69,615	294,445
Act Pd Cost	0	16,677	36,161	27,404	47,447	58,016	65,024	0	0	0	0	0	0	250,729
Variance, $	0	20,378	(20,378)	25,500	11,630	1,711	4,875	0	0	0	0	0	0	43,716
Variance, %	0.0%	55.0%	-129.1%	48.2%	19.7%	2.9%	7.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	14.8%
Est FY Cumul	0	37,055	52,838	105,742	164,819	224,546	294,445	365,110	434,924	505,593	575,208	645,933	715,548	
Act FY Cumul	0	16,677	52,838	80,242	127,689	185,705	250,729	0	0	0	0	0	0	
% Complete	0.0%	2.3%	7.4%	11.2%	17.8%	26.0%	35.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	0	20,378	0	25,500	37,130	38,841	43,716	0	0	0	0	0	0	
Cumul Var, %	0.0%	55.0%	0.0%	24.1%	22.5%	17.3%	14.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

THERMAL EFFECTS ON FLOW (TEF)
1402-660

ITEM	1	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	53,077	53,079	36,424	53,750	53,232	53,751	53,197	63,582	62,914	63,708	62,913	64,332	62,771	356,510
Act Pd Cost	33,343	54,058	55,179	35,140	49,982	40,049	37,672	0	0	0	0	0	0	305,424
Variance, $	19,734	(979)	(18,755)	18,610	3,250	13,702	15,525	0	0	0	0	0	0	51,086
Variance, %	37.2%	-1.8%	-51.5%	34.6%	6.1%	25.5%	29.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	14.3%
Est FY Cumul	53,077	106,156	142,580	196,330	249,562	303,313	356,510	420,092	483,006	546,714	609,627	673,959	736,729	
Act FY Cumul	33,343	87,401	142,581	177,721	227,703	267,752	305,424	0	0	0	0	0	0	
% Complete	4.5%	11.9%	19.4%	24.1%	30.9%	36.3%	41.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	19,734	18,755	(1)	18,609	21,859	35,561	51,086	0	0	0	0	0	0	
Cumul Var, %	37.2%	17.7%	0.0%	9.5%	8.8%	11.7%	14.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

REPOSITORY DESIGN AND THERMAL-MECHANICAL EFFECTS (RDTME)
1402-670

ITEM	1	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	0	34,896	(16,027)	42,936	42,933	43,568	42,685	49,251	48,364	49,421	48,148	49,507	48,148	190,991
Act Pd Cost	0	2,457	17,938	18,182	24,107	32,250	52,242	0	0	0	0	0	0	147,177
Variance, $	0	32,439	(33,965)	24,754	18,826	11,318	(9,557)	0	0	0	0	0	0	43,814
Variance, %	0.0%	93.0%	-2.2%	57.7%	43.8%	26.0%	-22.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	22.9%
Est FY Cumul	0	34,896	18,869	61,805	104,738	148,306	190,991	240,242	288,606	338,027	386,175	435,682	483,829	
Act FY Cumul	0	2,457	20,395	38,578	62,685	94,935	147,177	0	0	0	0	0	0	
% Complete	0.0%	0.5%	4.2%	8.0%	13.0%	19.6%	30.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	0	32,439	(1,526)	23,227	42,053	53,371	43,814	0	0	0	0	0	0	
Cumul Var, %	0.0%	93.0%	-8.1%	37.6%	40.2%	36.0%	22.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

TOTAL SYSTEM PERFORMANCE ASSESSMENT AND INTEGRATION (TSPAI)
1402-760

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	125,724	126,309	5,517	137,718	133,247	142,520	144,640	150,409	146,700	151,137	156,496	161,386	156,256	815,675
Act Pd Cost	79,059	94,441	84,050	65,303	106,318	116,391	137,329	0	0	0	0	0	0	682,891
Variance, $	46,665	31,868	(78,533)	72,415	26,929	26,129	7,311	0	0	0	0	0	0	132,784
Variance, %	37.1%	25.2%	-1423.5%	52.6%	20.2%	18.3%	5.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	16.3%
Est FY Cumul	125,724	252,033	257,550	395,268	528,515	671,035	815,675	966,084	1,112,783	1,263,920	1,420,416	1,581,802	1,738,058	
Act FY Cumul	79,059	173,500	257,550	322,853	429,171	545,562	682,891	0	0	0	0	0	0	
% Complete	4.5%	10.0%	14.8%	18.6%	24.7%	31.4%	39.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	46,665	78,533	0	72,415	99,344	125,473	132,784	0	0	0	0	0	0	
Cumul Var, %	37.1%	31.2%	0.0%	18.3%	18.8%	18.7%	16.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

ACTIVITIES RELATED TO DEVELOPMENT OF THE NRC HIGH-LEVEL WASTE REGULATIONS TECHNICAL ASSISTANCE (ARDR)
1402-770

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	31,214	31,300	(19,397)	36,061	35,465	36,117	35,465	40,872	40,106	41,111	51,351	52,799	51,293	186,225
Act Pd Cost	20,453	12,747	9,918	7,597	19,412	15,949	12,315	0	0	0	0	0	0	98,390
Variance, $	10,761	18,553	(29,315)	28,464	16,053	20,168	23,150	0	0	0	0	0	0	87,835
Variance, %	34.5%	59.3%	-1.5%	78.9%	45.3%	55.8%	65.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	47.2%
Est FY Cumul	31,214	62,514	43,117	79,178	114,643	150,760	186,225	227,097	267,203	308,314	359,665	412,464	463,756	
Act FY Cumul	20,453	33,199	43,117	50,714	70,126	86,076	98,390	0	0	0	0	0	0	
% Complete	4.4%	7.2%	9.3%	10.9%	15.1%	18.6%	21.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	10,761	29,315	0	28,464	44,517	64,684	87,835	0	0	0	0	0	0	
Cumul Var, %	34.5%	46.9%	0.0%	35.9%	38.8%	42.9%	47.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

UNSATURATED AND SATURATED FLOW UNDER ISOTHERMAL CONDITIONS (USHC)
1402-860

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	96,322	96,437	(35,952)	104,088	91,068	93,819	94,516	96,338	94,481	96,569	94,312	97,142	94,257	540,298
Act Pd Cost	42,647	67,346	47,731	51,525	56,150	74,615	109,747	0	0	0	0	0	0	449,762
Variance, $	53,675	29,091	(83,683)	52,563	34,918	19,204	(15,231)	0	0	0	0	0	0	90,537
Variance, %	55.7%	30.2%	-2.3%	50.5%	38.3%	20.5%	-16.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	16.8%
Est FY Cumul	96,322	192,759	156,807	260,895	351,963	445,782	540,298	636,636	731,116	827,685	921,997	1,019,139	1,113,396	
Act FY Cumul	42,647	109,994	157,724	209,249	265,400	340,015	449,762	0	0	0	0	0	0	
% Complete	3.8%	9.9%	14.2%	18.8%	23.8%	30.5%	40.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	53,675	82,765	(917)	51,646	86,563	105,767	90,537	0	0	0	0	0	0	
Cumul Var, %	55.7%	42.9%	-0.6%	19.8%	24.6%	23.7%	16.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

RADIONUCLIDE TRANSPORT
1402-870

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Bst Pd Cost	0	29,338	(9,652)	39,038	38,923	39,479	48,267	49,128	48,266	49,129	48,209	49,130	48,208	185,393
Act Pd Cost	0	6,077	13,610	13,950	23,441	25,588	42,366	0	0	0	0	0	0	125,032
Variance, $	0	23,261	(23,262)	25,088	15,482	13,891	5,902	0	0	0	0	0	0	60,362
Variance, %	0.0%	79.3%	-2.4%	64.3%	39.8%	35.2%	12.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	32.6%
Bst FY Cumul	0	29,338	19,686	58,724	97,647	137,126	185,393	234,522	282,788	331,918	380,127	429,258	477,466	
Act FY Cumul	0	6,077	19,687	33,637	57,078	82,666	125,032	0	0	0	0	0	0	
% Complete	0.0%	1.3%	4.1%	7.0%	12.0%	17.3%	26.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	0	23,261	(1)	25,087	40,569	54,460	60,362	0	0	0	0	0	0	
Cumul Var, %	0.0%	79.3%	0.0%	42.7%	41.5%	39.7%	32.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

TANK WASTE REMEDIATION SYSTEM (TWRS)
1403-000

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Bst Pd Cost	104,800	104,888	103,954	(116,898)	72,723	73,778	72,431	74,089	64,207	69,379	64,200	70,238	64,112	415,675
Act Pd Cost	58,211	34,643	37,343	41,773	68,873	48,751	88,565	0	0	0	0	0	0	378,160
Variance, $	46,589	70,244	66,611	(158,671)	3,850	25,027	(16,134)	0	0	0	0	0	0	37,515
Variance, %	44.5%	67.0%	64.1%	-1.36%	5.3%	33.9%	-22.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	9.0%
Bst FY Cumul	104,800	209,688	313,641	196,743	269,466	343,244	415,675	489,765	553,972	623,351	687,551	757,789	821,901	
Act FY Cumul	58,211	92,854	130,197	171,970	240,843	289,595	378,160	0	0	0	0	0	0	
% Complete	7.1%	11.3%	15.8%	20.9%	29.3%	35.2%	46.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	46,589	116,833	183,444	24,773	28,623	53,649	37,515	0	0	0	0	0	0	
Cumul Var, %	44.5%	55.7%	58.5%	12.6%	10.6%	15.6%	9.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

THREE MILE ISLAND UNIT 2 INDEPENDENT SPENT FUEL STORAGE INSTALLATION (TMI-2 ISFSI)
1405-010

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Bst Pd Cost	20,995	22,153	19,515	10,008	9,143	10,008	8,996	10,121	8,761	10,177	8,760	10,308	8,760	100,819
Act Pd Cost	11,023	3,270	11,411	4,257	799	14,887	21,226	0	0	0	0	9	0	66,874
Variance, $	9,972	18,884	8,104	5,751	8,344	(4,879)	(12,230)	0	0	0	0	0	0	33,945
Variance, %	47.5%	85.2%	41.5%	57.5%	91.3%	-48.8%	-135.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	33.7%
Bst FY Cumul	20,995	43,148	62,664	72,672	81,815	91,823	100,819	110,940	119,701	129,877	138,637	148,944	157,704	
Act FY Cumul	11,023	14,293	25,704	29,961	30,760	45,648	66,874	0	0	0	0	0	0	
% Complete	7.0%	9.1%	16.3%	19.0%	19.5%	28.9%	42.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	9,972	28,856	36,960	42,711	51,055	46,175	33,945	0	0	0	0	0	0	
Cumul Var, %	47.5%	66.9%	59.0%	58.8%	62.4%	50.3%	33.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

DRY TRANSFER SYSTEM (DTS)
1405-020

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	36,476	36,707	36,293	8,234	7,631	8,234	7,311	9,082	8,103	9,167	7,972	9,393	7,673	140,886
Act Pd Cost	12,889	28,222	585	93	102	1,268	6,582	0	0	0	0	0	0	49,742
Variance, $	23,587	8,485	35,708	8,141	7,529	6,966	729	0	0	0	0	0	0	91,144
Variance, %	64.7%	23.1%	98.4%	98.9%	98.7%	84.6%	10.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	64.7%
Est FY Cumul	36,476	73,183	109,476	117,710	125,341	133,575	140,886	149,968	158,071	167,238	175,211	184,604	192,277	
Act FY Cumul	12,889	41,111	41,697	41,790	41,892	43,160	49,742	0	0	0	0	0	0	
% Complete	6.7%	21.4%	21.7%	21.7%	21.8%	22.4%	25.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	23,587	32,072	67,779	75,920	83,449	90,415	91,144	0	0	0	0	0	0	
Cumul Var, %	64.7%	43.8%	61.9%	64.5%	66.6%	67.7%	64.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

CENTRALIZED INTERIM STORAGE FACILITY (CISF)
1405-030

ITEM	01	02	03	04	05	06	7	08	09	10	11	12	13	Total
Est Pd Cost	13,072	13,072	12,711	18,600	18,027	18,769	18,027	19,824	18,691	19,909	18,578	20,164	18,578	112,278
Act Pd Cost	0	13,753	27,523	18,695	20,791	3,927	926	0	0	0	0	0	0	85,615
Variance, $	13,072	(681)	(14,812)	(95)	(2,764)	14,842	17,101	0	0	0	0	0	0	26,663
Variance, %	100.0%	-5.2%	-116.5%	-0.5%	-15.3%	79.1%	94.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	23.7%
Est FY Cumul	13,072	26,144	38,855	57,455	75,482	94,251	112,278	132,102	150,793	170,702	189,280	209,444	228,022	
Act FY Cumul	0	13,753	41,275	59,971	80,762	84,689	85,615	0	0	0	0	0	0	
% Complete	0.0%	6.0%	18.1%	26.3%	35.4%	37.1%	37.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	13,072	12,392	(2,420)	(2,516)	(5,280)	9,562	26,663	0	0	0	0	0	0	
Cumul Var, %	100.0%	47.4%	-6.2%	-4.4%	-7.0%	10.1%	23.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

PRIVATE FUEL STORAGE FACILITY (PFSF)
1405-040

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	0	0	13,092	11,941	11,706	13,659	13,178	13,772	12,773	13,773	12,476	14,034	12,475	63,576
Act Pd Cost	0	0	7,300	6,733	23,751	25,329	1,669	0	0	0	0	0	0	64,781
Variance, $	0	0	5,792	5,208	(12,045)	(11,670)	11,509	0	0	0	0	0	0	(1,205)
Variance, %	0.0%	0.0%	44.2%	43.6%	-102.9%	-85.4%	87.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-1.9%
Est FY Cumul	0	0	13,092	25,033	36,739	50,398	63,576	77,348	90,121	103,894	116,370	130,404	142,880	
Act FY Cumul	0	0	7,300	14,032	37,784	63,113	64,781	0	0	0	0	0	0	
% Complete	0.0%	0.0%	5.1%	9.8%	26.4%	44.2%	45.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	0	0	5,792	11,001	(1,045)	(12,715)	(1,205)	0	0	0	0	0	0	
Cumul Var, %	0.0%	0.0%	44.2%	43.9%	-2.8%	-25.2%	-1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

WEST VALLEY DEMONSTRATION PROJECT (WVDP) 1406-000														
ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	13,579	13,582	13,579	13,615	13,579	13,577	13,579	13,978	13,429	14,222	13,428	14,222	13,428	95,490
Act Pd Cost	6,571	15,974	2,511	5,437	2,350	1,421	1	0	0	0	0	0	0	34,266
Variance, $	7,008	(2,392)	11,068	8,178	11,229	12,556	13,578	0	0	0	0	0	0	61,224
Variance, %	51.6%	-17.6%	81.5%	60.1%	82.7%	89.8%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	64.1%
Est FY Cumul	13,579	27,161	40,740	54,355	67,934	81,911	95,490	109,468	122,897	137,119	150,546	164,768	178,195	
Act FY Cumul	6,571	22,546	25,057	30,494	32,844	34,265	34,266	0	0	0	0	0	0	
% Complete	3.7%	12.7%	14.1%	17.1%	18.4%	19.2%	19.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	7,008	4,615	15,683	23,861	35,090	47,646	61,224	0	0	0	0	0	0	
Cumul Var, %	51.6%	17.0%	38.5%	43.9%	51.7%	58.2%	64.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
SAVANNAH RIVER SITE ALUMINUM-BASED SPENT FUEL (SRSASF) 1407-000														
ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	8,950	8,950	8,569	8,984	8,420	8,984	7,620	8,331	7,619	8,332	7,618	8,830	7,617	60,477
Act Pd Cost	242	5,592	7,020	5,945	4,226	14,809	11,188	0	0	0	0	0	0	49,021
Variance, $	8,708	3,358	1,549	3,039	4,194	(5,825)	(3,568)	0	0	0	0	0	0	11,456
Variance, %	97.3%	37.5%	18.1%	33.8%	49.8%	-64.8%	-46.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	18.9%
Est FY Cumul	8,950	17,900	26,469	35,453	43,873	52,857	60,477	68,808	76,427	84,759	92,378	101,208	108,826	
Act FY Cumul	242	5,833	12,853	18,799	23,024	37,833	49,021	0	0	0	0	0	0	
% Complete	0.2%	5.4%	11.8%	17.3%	21.2%	34.8%	45.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	8,708	12,067	13,616	16,654	20,849	15,024	11,456	0	0	0	0	0	0	
Cumul Var, %	97.3%	67.4%	51.4%	47.0%	47.5%	28.4%	18.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	