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

For the Fiscal Reporting Period

January 18, 1997 – February 14, 1997

PMPR No. 97-5

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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
AI	Administrative Item
AECL	Atomic Energy of Canada Limited
AES	Atomic Emission Spectrometry
AGU	American Geophysical Union
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
ARDES	Activities Related to Development of the U.S. Environmental Protection Agency Yucca Mountain Standard
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
BTP	Branch Technical Position
CAI	Color Alteration Index
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
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
CRWMS	Civilian Radioactive Waste Management System
CSCS	Constrained Stochastic Climate Simulator
CSH	Calcium Sulfate Hydrate
DAS	Data Acquisition System
DBE	Design Basis Event
DC	Division of Contracts
DCAA	Defense Contract Audit Agency
DCF	Dose Conversion Factor
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
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
DRA	Division of Regulatory Applications
DTED	Digital Terrain Elevation Data
DWM	Division of Waste Management
EBS	Engineered Barrier System
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

ABBREVIATIONS (cont'd)

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
ESP	Environmental Simulation Program
ESF	Exploratory Studies Facility
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 Transport
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
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	HLW 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
IDLH	Immediately Dangerous to Life and Health
IHLRWM	International High-Level Radioactive Waste Management Conference and Exposition
IM	Intermediate Milestone
IME	Industrial Mobilization Exemption
IMS	Information Management Systems
INEL	Idaho National Engineering 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
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
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
LHS	Latin Hypercube Sampling
LITC	Lockheed Information Technology Company
LLNL	Lawrence Livermore National Laboratory
LLW	Low-Level Waste
LSS	Licensing Support System
LSSPP	Licensing Support System Pilot Project
LSSTB	Licensing Support System Test Bed
LWR	Light Water Reactor
Ma	Million Years Ago
METRA	Mass and Energy TRAnsport
MGDS	Mined Geologic Disposal System
MH	Mechanical-Hydrological
MIC	Microbially Influenced Corrosion
MIT	Massachusetts Institute of Technology
MM	Major Milestone
MO	Management and Operations

ABBREVIATIONS (cont'd)

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 Reports
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
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
PDR	Public Document Room
PEL	Permissible Exposure Limit
PEM	Program Element Manager
PER	Prelicensing Evaluation Report
PFD	Probabilistic Fault Displacement
PFDHA	Probalistic Fault Displacement Hazard
PI	Principal Investigator
PMDA	Program Management Decision Analysis
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
PVM	Parallel Virtual Machine
PWR	Pressurized Water Reactor
QA	Quality Assurance
QAP	Quality Assurance Procedure
QRAM	Quality Requirements Application Matrix
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
RRT	Regulatory Requirement Topic
RSRG	Real Space Renormalization Group
RT	Radionuclide Transport
RTS	Radwaste Treatment System
SAR	Safety Analysis Report
SCA	Site Characterization Analysis
SCC	Substantially Complete Containment
SCCEX	Substantially Complete Containment Example
SCM	Surface Complexation Models
SCP	Site Characterization 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
SDMP	Site Decommissioning Management Plan
SF	Spent Fuel
SFPO	Spent Fuel Project Office

ABBREVIATIONS (cont'd)

SFVF	San Francisco Volcanic Field
SGML	Standard Generalized Markup Language
SHE	Standard Hydrogen Electrodes
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
SRA	Systematic Regulatory Analysis
SRB	Sulfate-Reducing Bacteria
SRBS	Shafts, Ramps, Boreholes, and their Seals
SRD	Software Requirements Description
SRESNR	Support Revision of the EPA Standard and NRC Rule
SS	Stainless Steel
STEM	Scanning Transmission Electron Microscopy
STP	Staff Technical Position
SUFLAT	Stochastic Analyses of Unsaturated Flow and Transport
SVF	Springerville Volcanic Field, Arizona
SwRI	Southwest Research Institute
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
THMC	Thermal-Hydrologic-Mechanical-Chemical
TLM	Triple-Layer Model
TM	Thermal-Mechanical
TMH	Thermal-Mechanical-Hydrologic
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
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
VA	Viability Assessment
VCS	Version Control System
VF	Vitrification Facility
VIEW_PVH	View Probability of Volcanic Hazards
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
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 5

In the Division of Waste Management (DWM) Job Code (JC), the following items highlight the Center for Nuclear Waste Regulatory Analyses (CNWRA) key activities and accomplishments:

- Summary Results from Peña Blanca and Santorini—Journal Paper was submitted.
- The Software Requirements Document for TPA was transmitted.
- The User's Guide for FAULTING Module —Letter Report was delivered.
- Review of ^{36}Cl Data Collected in the ESF —Letter Report was submitted.

The DWM JC year-to-date (YTD) cost variance was 14.9 percent. This variance reflects spending estimates from the approved CNWRA Operations Plans Revision 9 Change 0.

In the Waste Solidification Systems JC, the CNWRA staff engaged in limited activities associated with prior tasking. The YTD cost variance to this JC was 68.5 percent.

In the Tank Waste Remediation System JC, the CNWRA staff delivered the Interim Report on the DOE Hanford Tank Waste Classification on February 14, 1997. The YTD cost variance was 44.5 percent.

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-02-93-005

JOB CODES: D1035, L1793, J5164

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ESTIMATED BUDGET: $89,898,141

PERIOD OF PERFORMANCE: 10/15/92-9/26/97

PERIOD OF THIS REPORT: 01/18/97-02/14/97

1 TECHNICAL

1.1 CNWRA Operations (COPS)

In addition to a wide range of day-to-day activities, COPS accomplishments included (i) participation in an NRC/CNWRA Management Meeting at TWFN; (ii) involvement in discussions between the NRC and the CNWRA management concerning development of the SDMP RFQ, cancellation of the proposed DFCSS Regulatory Guides Project, and allocation of the CNWRA resources to and associated spending in the NRC programs for FY97; (iii) participation in weekly HLW Management Board meetings; (iv) work on the two remaining CARs from the annual CNWRA QA audit, conduct of scheduled surveillance, and continuation of the Quality Requirements Application Matrix activities; and (v) participation in the monthly NRC/CNWRA Computer Coordination Meeting, preparation of a response to PMDA on the final report from LLNL Computer Security Technology Center (Computer Incident Advisory Capability) concerning the audit of the CNWRA Computer Security System, and support for maintaining LAN operations.

Status of the CNWRA staffing is indicated in table 1. Recruitment efforts and interviews continued for the open positions indicated in table 1. The current Staffing and Hiring Plans, previously submitted and approved, will be again revised and conveyed for NRC review and approval in mid-March of this year. As recruitment efforts intensify, the CNWRA recognizes the tension between hiring to a level where the CNWRA can execute all existing and

anticipated NRC work this fiscal year and hiring to a level where it has reasonable assurance of not requiring any layoffs the subsequent fiscal year.

In the next period, the CNWRA expects to (i) submit another revision to the DWM OPS (Rev 9 Chg 1); (ii) conclude one of the corrective and preventive actions associated with the two remaining CNWRA QA audit CARs and complete the Quality Requirements Application Matrix based on the approved OPS; and (iii) send PMDA the CNWRA response to the final report (which was conveyed directly to the NRC) from the LLNL Computer Security Technology Center (Computer Incident Advisory Capability) audit of the CNWRA Computer Security System as well as continue CNWRA LAN operation and maintenance support.

1.2 Igneous Activity (IA)

Preparations for the technical exchange with the DOE on volcanism remained the focus during this reporting period. The technical exchange is scheduled for February 25-26, 1997 in Rockville, Maryland. Dry runs of the joint NRC/CNWRA presentations were conducted for the NRC and CNWRA management as well as the KTI Board. Briefings will concentrate on the following four general areas: (i) geologic setting of the YMR, (ii) probability of future volcanism in the YMR, (iii) geologic basis for volcanism consequence models, and (iv) initial dose calculations for volcanic disruption of the proposed repository. The primary goals of this technical exchange are to achieve issue definition on the approach for considering volcanic processes in the DOE TSPA-VA and identify areas of agreement and disagreement regarding these processes.

Presentations made during the International Association of Volcanology and Chemistry of the Earth's Interior meeting resulted in useful responses to proposed models and conclusions. Of particular relevance is the general acceptance of using the Suzuki (1983) model for tephra dispersal from relatively small, basaltic blow-over eruption columns. Discussions with authors of two alternative models resulted in agreement that basaltic eruption columns do not stabilize large umbrella clouds at high altitudes as implicitly calculated in some possible alternative models. Thus, the approach used by Suzuki (1983) and implemented in TPA-3 ASHPLUME is reasonably correct for modeling tephra dispersal tens of kilometers from basaltic volcanoes. Staff continues to investigate the utility of applying thermodynamic models for eruption column behavior to model this dispersal more accurately.

IA staff continued to support TPA activities related to VOLCANO module development and evaluation. These activities included evaluation of the VOLCANO code and associated parameters to support TPA-3 implementation and development of a detailed sensitivity study plan. Work also continued on the IA section of the Input to Detailed Review of DOE TSPA-95 (IM 5708-761-710).

A paper, Cooling of an Igneous Dike Twenty Years After Intrusion, was accepted by the journal *Geology*, pending revision. This paper documents the results of an integrated field geophysical and numerical modeling study conducted over a cooling basaltic intrusion emplaced as part of the 1975 eruption of Tolbachik volcano in Kamchatka, Russia. The results provide a test of numerical models used to simulate temperature gradients and redistribution of moisture around potential igneous intrusions in the repository. These models will be used to assess the indirect effects of igneous activity on repository performance.

In the next period, preparations for and participation in the DOE technical exchange on volcanism will be the focus of work in the IA KTI.

1.3 Structural Deformation and Seismicity (SDS)

Preparations began for two workshops to be held at TWFN. The fractures workshop, to be held on March 3, 1997, is intended as an informal meeting to (i) summarize analyses of natural fractures at YM, (ii) discuss geologically-based approaches for producing synthetic fracture populations in 2D and 3D, and (iii) investigate alternative approaches for incorporating fracture data into process models. The FAULTING module workshop, to be held on March 4, 1997, will focus on plans for future modifications of the module, including improvements in the manner in which faults are represented in the module. These modifications should enhance user confidence in upcoming sensitivity studies of faulting.

Development continued on a manuscript for Yucca Mountain Tectonics—Journal Article (IM 5708-471-730) to be submitted to a peer review journal. This manuscript will focus on the tectonic setting of the YMR in preparation for issue resolution.

The revised milestone on Type 1 Faults in the Yucca Mountain Region (MM 5708-471-650) was submitted in response to NRC comments.

Uncertainties in Earthquake Magnitudes from Surface Fault Displacement Based on Finite Element Analysis (IM 5708-471-750) underwent technical and programmatic review in preparation for submission to the NRC and the 36th U.S. Rock Mechanics Symposium. A manuscript, Modeling of Deformation and Porosity Changes from Normal Faulting, was prepared and reviewed internally.

The staff reviewed TOP-018 (Development and Control of Scientific and Engineering Software) as a vehicle to expedite implementation of procedures concerning placement of codes used by the SDS KTI under software control.

SDS staff participated in the revision of the FY97 OPS. This included upgrading IRSR input to IM status and deleting certain deliverables to maintain scope and cost.

In the next period, preparation for and participation in the workshops on fractures and the faulting module will be the focus of the SDS KTI. Work will continue on the YMR tectonics manuscript; the SEISM 1.1 Modifications—Letter Report (IM 5708-471-780) will be prepared and submitted for internal review.

1.4 Evolution of the Near-Field Environment (ENFE)

Work continued on placing the MULTIFLO code under the provisions of TOP-018 (Development and Control of Scientific and Engineering Software). In addition, Evaluating Portions of the DOE NF Interpretations—Letter Report was essentially completed. This report which is entitled Critique of DOE's Near-Field Environment Modeling for the Proposed High-Level Nuclear Waste Repository at Yucca Mountain, Nevada, is presently being finalized following CNWRA programmatic review.

Summary Results from Peña Blanca and Santorini—Journal Paper (IM 5708-561-720) was submitted.

Prolonged corrosion tests continued for 971 d to confirm the applicability of repassivation and corrosion potentials as predictive parameters of the long-term localized corrosion of Alloy 825 in chloride-containing solutions. No initiation of localized corrosion was observed on specimens continuously maintained below the repassivation potential. A long-term test with a creviced Alloy 825 specimen in an aerated 1,000 ppm Cl^- solution at 95 °C has been in progress for 559 d at the open-circuit potential. Limited localized corrosion of this specimen has been observed during a defined time interval when the corrosion potential exceeded the repassivation potential.

Collaboration continued with the NRC co-author on preparation of the Effects of Microbes on Near-Field Environment—Journal Paper (IM 5708-561-760).

Published chemical models for predicting the phase equilibrium assemblage of a cement blend were evaluated. The evaluation was necessary because of the possible use of cement blends (e.g., ordinary Portland cement + fly ash) in ground supports and concrete inverts at YM. The phase assemblage resulting from hydration of the raw materials depends on the composition of blending materials used. Different phase assemblages in turn will have different effects on the chemistry of groundwater that interacts with the cementitious material. Published hydration models and a phase rule-based chemical model were evaluated. The latter was selected for use in future calculations. A spreadsheet file was created for calculating the phase assemblage based on the chemical compositions of the cement and the blending additive. Calculation results are consistent with results reported in the literature.

In the next period, TOP-018 documentation for the MULTIFLO code will continue. Estimation of the near-field environment using this computer code will continue as will long-term corrosion tests of Alloy 825. Work will progress on Effects of Microbes on Near-Field Environment—Journal Paper (IM 5708-561-760). Evaluating Portions of the DOE NF Interpretations—Letter Report will be submitted. Review will resume of the DOE Summary and Synthesis Report on Mineralogy and Petrology Studies for the Yucca Mountain Site Characterization Project. Moreover, recently published modifications to the chemical model for predicting equilibrium phase assemblage in cementitious materials will be evaluated. Evaluation of thermodynamic data for cement minerals will resume for future input into MULTIFLO calculations.

Limited close-out activities for the CLST KTI are described here. Review of the Literature Pertaining to Grain Boundary Oxidation of Container Materials—Letter Report [IM 5708-561-775 (originally IM 5708-571-640)] will be transmitted. No new scope of work was performed on this topic in FY97. A draft report was submitted in FY96 as part of the CLST KTI. The final report was prepared after obtaining copyright permission from various journals for reproduction of figures and incorporating technical and editorial corrections of a relatively minor nature. The report documents the survey and assessment of low temperature oxidation literature prepared by a CNWRA contractor. The report concludes that the oxidation rate of carbon steel outer overpack under anticipated repository thermal conditions will be low and intergranular penetration by oxide will be negligibly small. This report concludes the CNWRA activities in CLST KTI.

1.5 Thermal Effects on Flow (TEF)

The study of the causative mechanisms leading to the formation of perched water bodies near the proposed repository area under nonisothermal conditions continued. Analyses are being conducted to calculate the volume of water that can accumulate within each hydrostratigraphic unit and within each of the model layers above, at, and below the repository horizon.

The temperature and relative humidity for a 3D drift scale heat conduction only model were calculated and submitted to TSPAI KTI for use as input for TPA analysis.

The 1988–89 LLNL G-Tunnel heater experiment is being used as the test case to compare results predicted by different conceptual models with those of this heater experiment. To date, a 3D ECM model has been able to successfully replicate temperatures recorded at specific locations on the borehole wall. Future efforts will include incorporation of a discrete fracture in the 3D model to obtain agreement with recorded saturation measurements.

Alternative conceptual models are being explored to assess gravity driven refluxing. One conceptual model is being formulated based on the physics of the gravity driven refluxing. Other models are based on a two continuum model, in which both the matrix and the fracture include capillary forces.

Using the constructed apparatus, activities relevant to measurement of the thermal conductivity of saturated welded tuff samples from the ALTS continued. Tuff from the ALTS is similar to the TSw tuff. Tuff thermal conductivity measurements were completed. Additional apparatus assessment and testing of the saturation of the ALTS tuff continued.

The EBSPAC module (including both EBSPAC fail and release modules) capability is being evaluated for use in assessing the effect of thermohydrologic parameters on proposed repository performance. Preliminary EBSPAC calculations have been performed using temperature and relative humidity predictions reported in the NRC High-Level Radioactive Waste Program—Annual Progress Report, Fiscal Year 1996 (CNWRA 96-01A).

In the next period, TEF KTI plans include (i) analysis of nonisothermal groundwater flow, (ii) laboratory investigation of thermal conductivity, (iii) progress on implementing the MULTIFLO code, (iv) continued assessment of alternative conceptual models, (v) implementation of the EBSPAC modules for use to assess the importance of thermohydrologic parameters on proposed repository performance, and (vi) continuation of sensitivity analyses.

1.6 Total System Performance Assessment and Integration (TSPAI)

A SRD for TPA code Version 3 was transmitted to fulfill Software Requirements Document for TPA (IM 5708-762-710). Development and testing of the TPA-3 code continued, with principal effort focused on integration of NEFTRAN into the SZFT module, revision of the DCAGS and DCAGW dose modules, integration of the ASHPLUME module, and revision of the EXEC driver. The CNWRA staff participated in a two-day meeting on the TPA-3 modules held at the NRC offices in Rockville, Maryland. This meeting identified nine major abstraction issues needing resolution by the end of February to permit timely completion of the TPA-3 code by March 17, 1997. Work began on preparation of a user's guide for the

TPA-3 code. This user's guide will be transmitted as a letter report to fulfill Updated User's Guide for TPA Code--CNWRA Report (IM 5708-762-730). This letter report will be revised at a later date to incorporate new capabilities and options identified by the KTI teams, and then subsequently issued as a CNWRA report.

A report on the FAULTING module was transmitted to fulfill User's Guide for FAULTING Module—Letter Report (IM 5708-762-700). Incorporation of this new module into the TPA-3 code began. This deliverable represents the culmination of a multi-year collaborative effort between the SDS and TSPAI KTIs. The SDS KTI will assume lead responsibility for future enhancements of the FAULTING module.

Preparation of a user's guide for the ASHPLUME module was completed and placed in the CNWRA internal review process. The ASHPLUME module is designed to compute dispersion of volcanic ash and SF resulting from extrusive volcanic events. In addition, a counterpart module called ASHREMOVE was developed to convert SF distributions for times subsequent to the hypothetical volcanic event. This guide will be submitted to fulfill User's Guide for ASHPLUME Module—Letter Report (IM 5708-762-720).

Work on development of the SEISMO module continued. This module will be tailored to represent the current WP design and emplacement geometry. In addition, work continued on the sensitivity study of drift stability. A paper was prepared to document recent results of the sensitivity analysis expected to be presented at the forthcoming International Rock Mechanics Conference. The paper will be expanded into a technical report to fulfill Parametric Study of Repository Stability—Letter Report (IM 5708-761-740).

An evaluation and comparison of TPA and RIP data sets was initiated. In comparing dose conversion factors (for drinking water), an error was identified in the DCF tabulated in TSPA-95. The DCF for Cesium-135 listed in the TSPA-95 report appears to be about six orders of magnitude too high; this error is very likely typographical. A letter report will be prepared to document this comparison that will be submitted to fulfill Comparison of TPA and RIP Data Sets (IM 5708-761-720).

Preparation of the letter report on the detailed review of TSPA-95 continued. In accordance with technical direction from the NRC, the report focuses on three technical topics: (i) container lifetime, (ii) fracture/matrix interactions, and (iii) volcanism scenario. The letter report will be delivered in the next period to fulfill Input to Detailed Review of the DOE TSPA-95—Letter Report (IM 5708-761-710).

Work began on a calculational analysis of galvanic coupling between an outer-container liner of carbon steel and an inner container of Alloy 825. An initial mathematical model of the kinetic cathodic and anodic reactions was formulated and implemented using Mathematica. Galvanic potential values were calculated as a function of thickness of the diffusion layer for various temperatures and surface area ratios of the metallic components. This analysis will be documented in a letter report and submitted to fulfill Auxiliary Analysis on Galvanic Coupling—Letter Report (IM 5708-761-730).

The TSPAI staff met with the NRC staff at TWFN to define activities for both CDOCS and LSSTB.

In the next period, the User's Guide for ASHPLUME Module—Letter Report (IM 5708-762-720) and the Input to Detailed Review of DOE TSPA-95—Letter Report (IM 5708-761-710) will be transmitted. In addition, the letter reports on the Updated User's Guide for TPA Code (IM 5708-762-730) and the Comparison of TPA and RIP Data Sets (IM 5708-761-720) will be finalized. Development, modification, and testing of TPA code Version 3 modules and utilities will continue.

1.7 Activities Related to Development of the U.S. Environmental Protection Agency Yucca Mountain Standard (ARDES)

During this period, only nominal progress was made on activities for the ARDES KTI primarily because of competition for available staff time. Resources were necessarily allocated to deliverables in the TSPAI KTI. With the recent authorization (by the Commission), CNWRA staff participated in an initial meeting to restart the effort on development of a strategy for revising 10 CFR Part 60 (to conform with an anticipated new EPA Standard for HLW disposal). The CNWRA staff reviewed and provided comments on a "think piece" to further development the strategy.

Work related to preparing site-specific exposure scenarios resumed but no major progress was made due to competing demands of TPA code development efforts and related interactions with the NRC staff. It is important to address the issues about how the dose will be calculated because this will impact the parameter needs for the exposure scenario(s) being developed under the ARDES KTI. Site-specific Amargosa Valley soil chemistry data obtained from the USDA, Natural Resources Conservation Service, was conveyed to the NRC staff for use in revising the k_ds used for soil leaching in dose calculations.

Approaches for analysis of dilution resulting from well pumping were outlined and will be summarized in a short note. This document will become an initial plan for a detailed groundwater modeling study of borehole mixing and dilution.

In the next period, the NRC and CNWRA staffs will focus attention on determining any additional parameter information needs and what additional exposure scenarios may need to be considered (e.g., climate change). With approval of the NRC project officer, the detailed analysis of groundwater dilution resulting from pumping will begin.

1.8 Unsaturated and Saturated Flow under Isothermal Conditions (USFIC)

During this period, the results of field investigations in Solitario Canyon were used to modify the watershed-scale model. Progress was made in examining climatic information to reconstruct a climatic signal and in reviewing literature on arid-zone vegetation effects on infiltration. Work continued on modeling drift-scale fluxes and examining saturated-zone mixing. Review of ^{36}Cl Data Collected in the ESF—Letter Report (IM 5708-861-710) was transmitted.

Information gathered during field work in Solitario Canyon was used to alter the saturated hydraulic conductivity, channel widths, and Manning's n in the KINEROS-based distributed watershed model. These changes to the model parameters evidenced decreases in the frequency and magnitude of runoff events. At least for the lower reaches of Solitario Canyon,

these results qualitatively compare with field observations suggesting that runoff events are infrequent. Basic development of the watershed model is complete.

A methodology for interpreting two-well, partially recirculating tracer tests was used to estimate kinematic porosity and longitudinal dispersivity for one of the non-reactive tracer tests conducted at the C-Well complex. Scientific literature on the interpretation of tracer data indicates that recirculation tests generally yield unrealistically large estimates of longitudinal dispersivities. Uncritical use of dispersivities obtained from such tests may lead to nonconservative estimates of saturated zone dilution.

To date the CNWRA studies on infiltration have conservatively assumed that plant transpiration does not occur. A literature review on the influence of arid-zone plants on infiltration continued, which will support evaluation of the DOE implementations of plant transpiration in infiltration models.

Collating and interpreting past climatic information including data from the Devil's Hole progressed. Climatic information will provide estimates of temperature and precipitation for input to models that examine how infiltration at YM may have varied during glacial cycles.

Efforts continued toward simulating fracture flow processes at the drift scale using MULTIFLO. Two-dimensional simulations of flow in heterogeneous matrix-only blocks featured a reduction in matrix fluxes due to heterogeneity and minimal dripping fluxes. Incorporation of fractures into the simulations began. These isothermal realizations are closely coordinated with the TEF KTI.

Mixing analysis continued for saturated zone hydrochemical analyses from Amargosa Valley, Fortymile Canyon, Oasis Valley, Crater Flat, and Ash Meadows. Mixing between two and three well combinations is being tested for plausible connections based on hydrochemical information on major element concentrations. Results should include rough estimates of relative proportions of water from different hydrochemical facies.

In the next period, the USFIC staff will (i) draft an IRSR for shallow infiltration, (ii) run additional watershed-scale simulations to assess the impact of spatial variability of rainfall intensity on runoff, (iii) evaluate alternative conceptual models of flow and transport for the C-Well tracer tests to determine ranges of longitudinal dispersivities, (iv) prepare drift-scale simulations of discrete-fracture percolation, and (v) continue investigation of saturated zone subregional-scale mixing processes.

1.9 Waste Solidification Systems (WSS)

Limited activities associated with previous tasking occurred during this period and no additional tasking was received.

In the next period, tasking related to the review of WVDP report on tank heel disposition is anticipated. Discussions will be held with the NRC staff in preparation for this tasking.

1.10 Tank Waste Remediation System (TWRS)

Revision of the interim report, Hanford Tank Waste Remediation System Familiarization Report, combining two milestones (IMs 5709-101-710 and 5709-101-720), continues. In addition to augmentation of the material previously submitted, chapter 3 of the report discusses the nature of Hanford tank wastes, including estimated chemical (inorganic, organic) and radionuclide inventories. Detailed information on individual tanks (tank type, capacity, watch list category, inventory) will be included as an appendix to the report. Discussion of a Geographic Information System-based database developed for the Hanford tanks also has been incorporated. Chapter 4 on safety issues was revised based on new information regarding the close-out of the ferrocyanide safety issue. New material regarding criticality safety and waste compatibility was also added. The delivery date for this report, originally scheduled for February 28, 1997 has been extended to March 7, 1997. Following the NRC review of this draft report, the final report, Hanford Tank Waste Remediation System Familiarization Report, originally entitled Consolidated Hanford Tank Waste Familiarization Report, (IM 5709-101-730), will be submitted by April 25, 1997. The final report will also include information ordered but not received from the DOE for inclusion in the interim report.

Activities in subtasks 1.3 and 1.4 were discontinued in response to the NRC reduction in funding for the program.

Interim Report on the DOE Hanford Tank Waste Classification (IM 5709-105-710) was transmitted on February 14, 1997. The interim report documented the CNWRA assessment of the DOE report Technical Basis for Classification of Low-Activity Waste Fraction from Hanford Site Tanks for the Tank Waste Remediation System (referred to as the technical basis report or TBR). The report also documented the assessment of the Hanford site tank waste characterization. Results of the CNWRA review support the conclusion that if Hanford Site tank wastes are managed using a program compatible with the one presented in the TBR, the NRC can consider the resulting solidified low-activity waste fraction incidental. The CNWRA staff also recommended that an independent performance assessment be conducted for the disposal of the low-activity waste.

The draft outline for the HLW Chemistry Manual (IM 5709-106-710) continues to evolve as new references are acquired. Verification runs of the Environmental Simulation Program Version 5.3 developed by OLI Systems, Inc. were conducted. Hanford scientists use this program to simulate chemical processing (e.g., leaching and washing) of tank wastes. A workshop designed to train users of this software is planned for April 1997.

In subtask 1.7, the Quality Assurance Program Survey (IM 5709-107-710) was completed and is undergoing internal reviews prior to transmittal.

In the next period, the draft report, Hanford Tank Waste Remediation System Familiarization Report (Tank Waste System Status, IM 5709-101-710, and Nature of Tank Wastes and Hazards, IM 5709-101-720), will be finalized. The CNWRA staff will collaborate with those at the NRC to identify any continuing actions required in support of Hanford Site tank waste classification in subtask 1.5. The outline of the report HLW Chemistry Manual (IM 5709-106-710) is to be transmitted for comments. The report, Quality Assurance Program Survey (IM 5709-107-710), will be delivered.

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. Deliverables completed in period 5 are provided in table 3.

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 $164,554. 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, WSS JC, and TWRS JC as well as for COPS and seven KTIs. The planned costs per period for the DWM JC reflect the approved CNWRA OPS, Rev 9 Chg 0.

This period expenditures increased by 23.6 percent from last period. Through period 5, however, the CNWRA composite (all three JCs) was underspent by $778,878 or 18.6 percent, the DWM JC was underspent by $550,591 or 14.9 percent, the WSS JC was underspent by $31,888 or 68.5 percent, and the TWRS JC was underspent by $196,399 or 44.5 percent. This lower level of expenditures in all JCs illustrates the (i) results of staff reduction, attrition, and available mix from two successive fiscal years of budget cuts, (ii) elimination of three KTIs during this fiscal year, and (iii) requisite time for a thorough search for new staff with those critical disciplines to meet the NRC current and anticipated needs. During period 5, the DWM JC spending rose almost 20 percent over the previous period—despite inadequate staffing to accomplish the identified scope of work; expenditures in the WSS JC fell again because of a dearth of additional tasking, while those for the TWRS JC rose from the previous period, notwithstanding the deferment of subtasks 1.3, 1.4 and 1.8, due to additional activity in the certain subtasks.

As indicated in table 1, the CNWRA has 40 core and 1 limited-term staff members. The CNWRA will submit revised Staffing and Hiring Plans in mid-March of this year. An operational health physicist joined the staff this period, a hydrologist will begin working in period 6, and a chemical process engineer will assume duties in period 7. The available pool of approved consultants and subcontractors was adjusted to 38. Expenditures for consultants, subcontractors, and SwRI labor in all JCs as a percentage of the CNWRA composite spending were 10.3 percent for period 5 in FY97. For consultants and subcontractors alone, this percentage was 7.1.

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 4 was 14.9 percent.

Expenditures in this JC increased by 19.9 percent from the previous period. Expenses fell in COPS from last period and spending rose over period 4 in all remaining KTIs. Specific rationales for over/underspending for COPS and each KTI follow.

Pursuant to a February 5, 1997 telephonic request from Mr. J. Linehan, the NRC CNWRA Program Manager, CNWRA senior management participated in a teleconference on February 19, 1997 with PMDA and DWM management staff to discuss cost and schedule variances in COPS and the DWM KTIs as of period 5 in the context of the defined scope of work, current staffing and hiring plans, and similar considerations affecting expenditure of NRC funds during FY97. Although this teleconference occurred in period 6, the CNWRA believes it is prudent to document, in this period 5 report, that it provided a paper entitled Status of Center for Nuclear Waste Regulatory Analyses (CNWRA) Expenditures Related to the Repository Program. The paper presented the current status of and projections for COPS and KTIs cost and schedule.

The cost variance for COPS was 10.5 percent. The cost variance was 4.8 percent for the Management, Planning, and Computer Support Subtask (5708-158) and 32.1 percent for the Quality Assurance Subtask (5708-159). These variances reflect the approved spending plan in the most recent CNWRA OPS Rev 9 Chg 0. Expenditures in the former subtask decreased substantively due to adjustments for (i) the incorrect allocation of subcontractor charges associated with scanning data in preparation for input into the CDOCS and (ii) the erroneous application of software cost. Since these data are technical reports and associated material and software are element-specific, the affected WBS accounts received the appropriate debits and credit. Expenses in the latter subtask increased over the last period, as expected, because preparations for the annual QA audit began.

The cost variance for the IA KTI was 7.0 percent. When unpaid commitments are included in budgeting calculations, the cost variance reduces to −0.2 percent. It is anticipated that IA KTI spending will remain on target during the next several periods as analytical and field expenses are incurred.

The cost variance for the SDS KTI was −19.3 percent. With moderation of spending it is anticipated the SDS KTI will continue to reduce the cost variance over the next several periods. Spending should be on target by period 10.

The cost variance for the ENFE KTI was 39.2 percent. The percentage variance is reduced from period 4, although the total variance increased somewhat. Reductions are anticipated as staff become available to support increased activity. A possibility still exists, however, for continued underspending throughout the balance of this fiscal year.

The cost variance for the CLST KTI was −2.9 percent. The slight excess spending reflects contractor invoicing related to completion of Review of the Literature Pertaining to Grain Boundary Oxidation of Container Materials—Letter Report (IM 5708-571-640). The CNWRA account for this KTI was closed January 17, 1997. No further spending in this KTI is anticipated.

The cost variance for the TEF KTI was 12.0 percent, compared to a cost variance of 18.7 percent at the end of period 4. It is anticipated cost variance will decrease further during the next few periods due to greater use of consultants for assigned activities. Spending should be on target by period 8.

The cost variance for the RDTME KTI was 4.1 percent. Although activities related to this KTI terminated at the end of period 4, residual payments for work already performed appeared as expenses in period 5.

The cost variance for the TSPAI KTI was 12.2 percent. This cost variance is significantly lower than the previous period and reflects focused efforts on development, testing, and documentation of the TPA version 3 computer code. Additional use of SwRI staff and consultants has been necessary to ensure the timely completion of TSPAI tasks and deliverables. Spending should remain close to estimated expenditures.

The cost variance for the ARDES KTI was 48.8 percent. This positive variance reflects the reduced activity in this KTI due to staff working on high priority activities associated with the TSPAI KTI. In the next period, expenditures for this KTI are expected to increase but at a relatively gradual rate. The estimated cost for this KTI may not be consistent with possible tasking and a resultant surplus of funding may result.

The cost variance for the USFIC KTI was 32.7 percent. This variance is decreased on a percentage basis from recent periods and is anticipated to further decrease as CNWRA hydrogeology staffing is completed. Unless additional labor resources can be allocated to address scope of work, underspending will probably continue.

The cost variance for the RT KTI was −0.6 percent. This variance is the result of trailing payments related to previous activities.

The cost variance for WSS was 68.5 percent. The spending during the reporting period decreased due to lack of tasking.

The cost variance for the TWRS project was 44.5 percent. Expenditures increased in subtasks 1.1, 1.5, and 1.7 as a result of activities related to preparation of deliverables. The spending plan is being revised because of a budget reduction in FY97. The revision is not anticipated to adversely affect subtasks continuing in FY97.

Table 1. CNWRA Core Staff—Current Profile and Hiring Plan* (Period 5)

EXPERTISE/EXPERIENCE	CURRENT NO.	PROFESSIONAL STAFF	POSITIONS OPEN FY97
ADMINISTRATION	4	H.GARCIA, W.PATRICK, J.RUSSELL, B.SAGAR	
CHEMICAL PROCESSING ENGNG.	0		1
CODE ANALYSIS/DEVELOPMENT	2	R.JANETZKE, R.MARTIN	1
DOSE/RISK/HAZARD ANALYSIS	0		2
ELECTROCHEMISTRY	1	G.CRAGNOLINO	
ENGINEERING GEOLOGY/GEOLOGICAL ENGNG	2	R.CHEN, G.OFOEGBU	
ENVIRONMENTAL SCIENCES	1	P.LaPLANTE	
GEOCHEMISTRY/PHYS.CHEM.	5	W.MURPHY, R.PABALAN, E.PEARCY, J.PRIKRYL, D.TURNER	
GEOHYDROLOGY/HYDROGEOLOGY	3	R.GREEN, S.STOTHOFF, J.WINTERLE	2
GEOLOGY	2	L.McKAGUE, M.MIKLAS	
HYDROLOGIC TRANSPORT	1	G.WITTMEYER	2
INFORMATION MANAGEMENT SYSTEMS	1	R.MARSHALL	
MATERIAL SCIENCES	2	D.DUNN, N.SRIDHAR	
MINING ENGINEERING	1	S-M.HSIUNG	
NUCLEAR ENGINEERING	1	M.JARZEMBA	1
OPERATIONAL HEALTH PHYSICS	1	J.WELDY	
PERFORMANCE ASSESSMENT	2	R.BACA, S.MOHANTY	3
QUALITY ASSURANCE	1	B.MABRITO	
RADIOISOTOPE GEOCHEMISTRY	1	D.PICKETT	
ROCK MECHANICS, INCLUDING CIVIL/STRUC. ENGR.	3	M.AHOLA, A.CHOWDHURY, A.GHOSH	
SOURCE-TERM/SPENT FUEL DEGRAD	1	P.LICHTNER	
STRUCTURAL GEOLOGY/SEISMO-TECTONICS	2	D.FERRILL, J.STAMATAKOS	
SYSTEMS ENGINEERING	1	P.MACKIN	
VOLCANOLOGY/IGNEOUS PROCESSES	2(1)†	C.CONNOR, B.HILL, M.CONWAY†	
TOTAL	**40(1)†**		**12**

* SEE STAFFING PLAN FOR DETAILS (Open positions will be filled in FY97 on a selective basis due to budget reduction.)
† LIMITED TERM

Table 2. Summary of Schedule Changes (Period 5)

MILESTONE NUMBER	TYPE	DESCRIPTION	ORIGINAL DATE	REVISED DATE	RATIONALE FOR CHANGE
5708-158-750	IM	FY97 CNWRA Computer Security Plan Update—Letter Report	04/07/97	06/16/97	Delayed to incorporate the content of the CNWRA Computer Certification—Letter Report (IM 5708-158-730) due 04/28/97.
5708-761-720	IM	Comparison of TPA and RIP Data Sets	03/17/97	04/30/97	Delayed because of staff commitments to complete TPA-3 code development and documentation.
5708-762-740	IM	EBSPAC, V 1.0 User's Manual	03/28/97	04/30/97	Delayed because of staff commitments to complete TPA-3 code development and documentation.
5708-861-715	IM	Input to Issue Resolution Status Report on Present-Day Shallow Infiltration	03/31/97	05/12/97	Delayed at request of NRC PEM.
5709-101-710	IM	Hanford Tank Waste Remediation System Familiarization Report – Chapter 2: Description of Site and Facilities	02/28/97	03/07/97	Submitted originally on December 19, 1996. NRC staff required revisions to the report. Awaiting new information from DOE for inclusion in the report.
5709-101-720	IM	Hanford Tank Waste Remediation System Familiarization Report – Chapters 3 and 4: Nature of Tank Wastes and Hazards	02/28/97	03/07/97	Delayed for submission with the previous report (IM 5709-101-710).
5709-101-730	IM	Hanford Tank Waste Remediation System Familiarization Report (Originally entitled Consolidated Hanford Tank Waste Familiarization Report)	03/28/97	04/25/97	Delayed to provide more time for review by NRC staff and inclusion of new information from DOE, if necessary.

Table 3. Deliverables (Period 5)

MILESTONE NO.	TYPE	DESCRIPTION	ORIGINAL COMPLETION DATE	REVISED DATE	# OF REVISIONS	ACTUAL COMPLETION DATE	REASON (IF DELAYED)
5708-561-720	IM	Summary Results from Peña Blanca and Santorini—Journal Paper	02/21/97			01/24/97	
5708-762-700	IM	User's Guide for FAULTING Module—Letter Report	01/31/97			01/30/97	
5708-762-710	IM	Software Requirements Document for TPA	01/31/97			01/28/97	
5708-861-710	IM	Review of ^{36}Cl Data Collected in the ESF— Letter Report	02/15/97			02/13/97	
5709-105-710	IM	Interim Report on the DOE Hanford Tank Waste Classification	04/29/97	02/21/97	1	02/14/97	

Table 4. Financial Status (Period 5)

COPS/KTI/WSS/TWRS	Funds Authorized	Funds Costed to Date	Funds Uncosted	Commitments
COPS	2,662,624	1,756,620	906,003	1,200
IA	1,433,884	986,579	447,305	1,393
SDS	1,999,476	1,553,473	446,003	12,801
ENFE	1,562,394	857,260	705,134	64,900
CLST	825,741	794,305	31,436	0
TEF	1,188,005	756,108	431,897	66,164
RDTME	835,512	800,384	35,128	9,923
TSPAI	3,044,654	1,936,367	1,108,287	7,672
ARDES	926,026	519,201	406,825	0
USFIC	1,415,714	712,066	703,648	500
RT	496,803	478,665	18,138	0
DWM COSTS	16,390,834	11,151,030	5,239,805	
DWM AWARD FEE	0	0	0	
DWM BASE FEE	0	432,562	(432,562)	
TOTAL DWM	16,390,834	11,583,591	4,807,243	164,554
WSS COSTS	620,126	566,950	53,176	0
WSS AWARD FEE	0	0	0	
WSS BASE FEE	0	25,842	(25,842)	
TOTAL WSS	620,126	592,792	27,334	0
TWRS COSTS	505,654	245,529	260,125	0
TWRS AWARD FEE	33,600	0	33,600	
TWRS BASE FEE	20,746	9,521	11,225	
TOTAL TWRS	560,000	255,050	304,950	0
TOTAL	17,570,960	12,431,434	5,139,527	164,554
Note: Additional authorized funds of $348,910 for DWM have not been allocated.				

APPENDIX A
Planned and Actual Costs, and Cost Variances Period 5, FY97

CNWRA COMPOSITE
TOTAL ESTIMATE COST

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	878,378	848,730	837,397	845,753	766,579	785,238	763,971	786,879	760,086	788,919	758,839	792,719	757,915	4,176,837
Act Pd Cost	845,277	652,931	629,882	568,010	701,860	0	0	0	0	0	0	0	0	3,397,960
Variance, $	33,101	195,799	207,516	277,742	64,719	0	0	0	0	0	0	0	0	778,878
Variance, %	3.8%	23.1%	24.8%	32.8%	8.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	18.6%
Est FY Cumul	878,378	1,727,108	2,564,505	3,410,258	4,176,837	4,962,075	5,726,046	6,512,925	7,273,011	8,061,930	8,820,769	9,613,488	10,371,403	
Act FY Cumul	845,277	1,498,208	2,128,089	2,696,099	3,397,960	0	0	0	0	0	0	0	0	
% Complete	8.2%	14.4%	20.5%	26.0%	32.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	33,101	228,900	436,416	714,159	778,878	0	0	0	0	0	0	0	0	
Cumul Var, %	3.8%	13.3%	17.0%	20.9%	18.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

DIVISION OF WASTE MANAGEMENT (DWM)
5708-000

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	779,279	749,755	739,764	743,686	678,003	682,676	674,161	684,100	670,906	686,027	669,772	688,443	668,914	3,686,487
Act Pd Cost	832,548	596,259	581,181	512,833	614,075	0	0	0	0	0	0	0	0	3,137,896
Variance, $	(53,269)	153,496	158,583	230,853	60,928	0	0	0	0	0	0	0	0	550,591
Variance, %	-6.8%	20.5%	21.4%	31.0%	9.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	14.9%
Est FY Cumul	779,279	1,529,034	2,268,798	3,012,484	3,688,487	4,371,163	5,045,324	5,729,424	6,400,329	7,086,356	7,756,128	8,444,571	9,113,485	
Act FY Cumul	832,548	1,428,806	2,009,988	2,522,821	3,137,896	0	0	0	0	0	0	0	0	
% Complete	9.1%	15.7%	22.1%	27.7%	34.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	(53,269)	100,227	258,810	489,663	550,591	0	0	0	0	0	0	0	0	
Cumul Var, %	-6.8%	6.6%	11.4%	16.3%	14.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

CNWRA OPERATIONS (COPS) 5708-150														
ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	124,493	124,594	123,421	123,635	123,421	123,636	123,244	123,908	123,243	124,053	122,971	124,341	122,800	619,564
Act Pd Cost	138,117	106,238	113,089	138,661	58,224	0	0	0	0	0	0	0	0	554,330
Variance, $	(13,624)	18,355	10,332	(15,026)	65,197	0	0	0	0	0	0	0	0	65,234
Variance, %	-10.9%	14.7%	8.4%	-12.2%	52.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	10.5%
Est FY Cumul	124,493	249,087	372,508	496,143	619,564	743,200	866,445	990,353	1,113,597	1,237,649	1,360,620	1,484,961	1,607,761	
Act FY Cumul	138,117	244,355	357,445	496,106	554,330	0	0	0	0	0	0	0	0	
% Complete	8.6%	15.2%	22.2%	30.9%	34.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	(13,624)	4,731	15,063	37	65,234	0	0	0	0	0	0	0	0	
Cumul Var, %	-10.9%	1.9%	4.0%	0.0%	10.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
IGNEOUS ACTIVITY (IA) 5708-460														
ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	61,936	62,060	61,695	62,522	61,659	62,547	61,393	62,628	61,158	62,661	61,166	63,052	61,085	309,892
Act Pd Cost	56,487	66,448	47,904	49,147	68,279	0	0	0	0	0	0	0	0	288,265
Variance, $	5,450	(4,368)	13,791	13,375	(6,620)	0	0	0	0	0	0	0	0	21,627
Variance, %	8.8%	-7.0%	22.4%	21.4%	-10.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.0%
Est FY Cumul	61,936	124,016	185,711	248,233	309,892	372,439	433,833	496,461	557,629	620,290	681,456	744,508	805,593	
Act FY Cumul	56,487	122,935	170,839	219,986	288,265	0	0	0	0	0	0	0	0	
% Complete	7.0%	15.3%	21.2%	27.3%	35.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	5,450	1,081	14,872	28,247	21,627	0	0	0	0	0	0	0	0	
Cumul Var, %	8.8%	0.9%	8.0%	11.4%	7.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

STRUCTURAL DEFORMATION AND SEISMICITY (SDS) 5708-470														
ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est d Cost	80,954	75,326	73,577	74,537	73,547	74,874	73,453	74,846	73,087	75,071	73,085	75,153	73,085	377,941
Act Pd Cost	161,282	80,540	73,497	55,866	79,808	0	0	0	0	0	0	0	0	450,993
Variance, $	(80,327)	(5,214)	80	18,671	(6,261)	0	0	0	0	0	0	0	0	(73,052)
Variance, %	-99.2%	-6.9%	0.1%	25.0%	-8.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-19.3%
Est FY Cumul	80,954	156,281	229,857	304,394	377,941	452,815	526,069	600,914	674,001	749,073	822,158	897,311	970,396	
Act FY Cumul	161,282	241,822	315,319	371,185	450,993	0	0	0	0	0	0	0	0	
% Complete	16.6%	24.9%	32.5%	38.3%	46.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	(80,327)	(85,541)	(85,462)	(66,791)	(73,052)	0	0	0	0	0	0	0	0	
Cumul Var, %	-99.2%	-54.7%	-37.2%	-21.9%	-19.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

EVOLUTION OF THE NEAR-FIELD ENVIRONMENT (ENFE) 5708-560														
ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	81,110	80,823	80,614	81,142	80,445	81,342	80,161	81,593	79,704	81,881	79,483	82,166	79,482	404,135
Act Pd Cost	62,233	52,181	38,993	30,224	82,256	0	0	0	0	0	0	0	0	245,888
Variance, $	18,877	28,642	41,621	50,918	18,189	0	0	0	0	0	0	0	0	158,248
Variance, %	23.3%	35.4%	51.6%	62.8%	22.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	39.2%
Est FY Cumul	81,110	161,933	242,548	323,690	404,135	485,477	565,638	647,231	726,935	808,816	888,299	970,465	1,049,947	
Act FY Cumul	62,233	114,414	153,407	183,631	245,888	0	0	0	0	0	0	0	0	
% Complete	5.9%	10.9%	14.6%	17.5%	23.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	18,877	47,519	89,140	140,059	158,248	0	0	0	0	0	0	0	0	
Cumul Var, %	23.3%	29.3%	36.8%	43.3%	39.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

CONTAINER LIFE AND SOURCE TERM (CLST) 5708-570														
ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	30,612	20,094	20,521	20,094	0	0	0	0	0	0	0	0	0	91,322
Act Pd Cost	56,243	15,698	13,946	7,257	848	0	0	0	0	0	0	0	0	93,992
Variance, $	(25,630)	4,396	6,575	12,837	(848)	0	0	0	0	0	0	0	0	(2,670)
Variance, %	-83.7%	21.9%	32.0%	63.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-2.9%
Est FY Cumul	30,612	50,707	71,228	91,322	91,322	91,322	91,322	91,322	91,322	91,322	91,322	91,322	91,322	
Act FY Cumul	56,243	71,940	85,886	93,144	93,992	0	0	0	0	0	0	0	0	
% Complete	61.6%	78.8%	94.0%	102.0%	102.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	(25,630)	(21,234)	(14,659)	(1,822)	(2,670)	0	0	0	0	0	0	0	0	
Cumul Var, %	-83.7%	-41.9%	-20.6%	-2.0%	-2.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
THERMAL EFFECTS ON FLOW (TEF) 5708-660														
ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	58,817	58,899	58,512	59,028	58,154	59,028	58,121	59,189	58,037	59,457	58,035	59,570	58,032	293,410
Act Pd Cost	56,775	43,156	39,111	52,125	66,898	0	0	0	0	0	0	0	0	258,066
Variance, $	2,042	15,743	19,401	6,903	(8,745)	0	0	0	0	0	0	0	0	35,344
Variance, %	3.5%	26.7%	33.2%	11.7%	-15.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	12.0%
Est FY Cumul	58,817	117,716	176,229	235,256	293,410	352,438	410,558	469,747	527,784	587,241	645,277	704,846	762,878	
Act FY Cumul	56,775	99,932	139,043	191,168	258,066	0	0	0	0	0	0	0	0	
% Complete	7.4%	13.1%	18.2%	25.1%	33.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	2,042	17,784	37,186	44,089	35,344	0	0	0	0	0	0	0	0	
Cumul Var, %	3.5%	15.1%	21.1%	18.7%	12.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

REPOSITORY DESIGN AND THERMAL-MECHANICAL EFFECTS (ROTME) 5708-670														
ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	25,569	23,337	23,707	23,337	0	0	0	0	0	0	0	0	0	95,950
Act Pd Cost	26,768	23,095	32,011	8,424	1,679	0	0	0	0	0	0	0	0	91,976
Variance, $	(1,199)	243	(8,304)	14,913	(1,679)	0	0	0	0	0	0	0	0	3,974
Variance, %	-4.7%	1.0%	-35.0%	63.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.1%
Est FY Cumul	25,569	48,906	72,613	95,950	95,950	95,950	95,950	95,950	95,950	95,950	95,950	95,950	95,950	
Act FY Cumul	26,768	49,862	81,873	90,297	91,976	0	0	0	0	0	0	0	0	
% Complete	27.9%	52.0%	85.3%	94.1%	95.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	(1,199)	(956)	(9,261)	5,653	3,974	0	0	0	0	0	0	0	0	
Cumul Var, %	-4.7%	-2.0%	-12.8%	5.9%	4.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
TOTAL SYSTEM PERFORMANCE ASSESSMENT AND INTEGRATION (TSPAI) 5708-760														
ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	166,837	156,613	150,062	150,893	150,062	150,955	149,527	151,347	148,129	151,852	147,855	152,542	147,555	774,468
Act Pd Cost	162,260	111,904	124,509	105,297	175,657	0	0	0	0	0	0	0	0	679,628
Variance, $	4,576	44,709	25,553	45,596	(25,595)	0	0	0	0	0	0	0	0	94,841
Variance, %	2.7%	28.5%	17.0%	30.2%	-17.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	12.2%
Est FY Cumul	166,837	323,450	473,513	624,406	774,468	925,424	1,074,951	1,226,298	1,374,426	1,526,278	1,674,133	1,826,675	1,974,231	
Act FY Cumul	162,260	274,164	398,673	503,970	679,628	0	0	0	0	0	0	0	0	
% Complete	8.2%	13.9%	20.2%	25.5%	34.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	4,576	49,286	74,839	120,436	94,841	0	0	0	0	0	0	0	0	
Cumul Var, %	2.7%	15.2%	15.8%	19.3%	12.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

ACTIVITIES RELATED TO DEVELOPMENT OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY YUCCA MOUNTAIN STANDARD (ARDES) 5708-770														
ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	44,410	44,312	44,154	44,392	43,901	44,392	43,757	44,426	43,613	44,608	43,444	44,784	43,253	221,167
Act Pd Cost	38,571	21,176	14,667	8,653	30,213	0	0	0	0	0	0	0	0	113,282
Variance, $	5,838	23,134	29,487	35,739	13,688	0	0	0	0	0	0	0	0	107,886
Variance, %	13.1%	52.2%	66.8%	80.5%	31.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	48.8%
Est FY Cumul	44,410	88,721	132,875	177,267	221,167	265,559	309,316	353,742	397,355	441,963	485,407	530,190	573,443	
Act FY Cumul	38,571	59,749	74,416	83,069	113,282	0	0	0	0	0	0	0	0	
% Complete	6.7%	10.4%	13.0%	14.5%	19.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	5,838	28,972	58,459	94,198	107,886	0	0	0	0	0	0	0	0	
Cumul Var, %	13.1%	32.7%	44.0%	53.1%	48.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
UNSATURATED AND SATURATED FLOW UNDER ISOTHERMAL CONDITIONS (USFIC) 5708-860														
ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	85,799	85,640	84,921	86,069	84,814	86,101	84,505	86,163	83,925	86,443	83,734	86,835	83,622	427,243
Act Pd Cost	50,108	58,439	62,069	46,546	70,504	0	0	0	0	0	0	0	0	287,667
Variance, $	35,691	27,201	22,851	39,523	14,310	0	0	0	0	0	0	0	0	139,576
Variance, %	41.6%	31.8%	26.9%	45.9%	16.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	32.7%
Est FY Cumul	85,799	171,440	256,360	342,429	427,243	513,344	597,849	684,012	767,936	854,379	938,113	1,024,948	1,108,571	
Act FY Cumul	50,108	108,547	170,617	217,163	287,667	0	0	0	0	0	0	0	0	
% Complete	4.5%	9.8%	15.4%	19.6%	25.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	35,691	62,892	85,743	125,266	139,576	0	0	0	0	0	0	0	0	
Cumul Var, %	41.6%	36.7%	33.4%	36.6%	32.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

RADIONUCLIDE TRANSPORT (RT)
5708-870

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	18,741	18,036	18,581	18,036	0	0	0	0	0	0	0	0	0	73,394
Act Pd Cost	23,704	17,381	21,384	10,633	707	0	0	0	0	0	0	0	0	73,810
Variance, $	(4,963)	655	(2,803)	7,403	(707)	0	0	0	0	0	0	0	0	(416)
Variance, %	-26.5%	3.6%	-15.1%	41.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.6%
Est FY Cumul	18,741	36,777	55,358	73,394	73,394	73,394	73,394	73,394	73,394	73,394	73,394	73,394	73,394	
Act FY Cumul	23,704	41,085	62,469	73,102	73,810	0	0	0	0	0	0	0	0	
% Complete	32.3%	56.0%	85.1%	99.6%	100.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	(4,963)	(4,308)	(7,112)	291	(416)	0	0	0	0	0	0	0	0	
Cumul Var, %	-26.5%	-11.7%	-12.8%	0.4%	-0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

WASTE SOLIDIFICATION SYSTEMS (WSS)
5706-000

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	9,767	9,640	9,193	9,640	8,298	9,894	8,265	9,990	8,045	9,991	8,043	10,165	8,041	46,538
Act Pd Cost	6,285	249	4,316	2,799	1,002	0	0	0	0	0	0	0	0	14,651
Variance, $	3,482	9,391	4,877	6,841	7,296	0	0	0	0	0	0	0	0	31,888
Variance, %	35.7%	97.4%	53.1%	71.0%	87.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	68.5%
Est FY Cumul	9,767	19,407	28,600	38,240	46,538	56,432	64,697	74,687	82,731	92,722	100,765	110,930	118,971	
Act FY Cumul	6,285	6,534	10,849	13,648	14,651	0	0	0	0	0	0	0	0	
% Complete	5.3%	5.5%	9.1%	11.5%	12.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	3,482	12,874	17,751	24,592	31,888	0	0	0	0	0	0	0	0	
Cumul Var, %	35.7%	66.3%	62.1%	64.3%	68.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

TANK WASTE REMEDIATION SYSTEM (TWRS) 5709-000														
ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	89,332	89,334	88,441	92,426	82,278	92,668	81,545	92,789	81,136	92,901	81,024	94,111	80,960	441,812
Act Pd Cost	6,445	56,423	44,385	52,378	85,783	0	0	0	0	0	0	0	0	245,413
Variance, $	82,888	32,912	44,056	40,048	(3,505)	0	0	0	0	0	0	0	0	196,399
Variance, %	92.8%	36.8%	49.8%	43.3%	-4.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	44.5%
Est FY Cumul	89,332	178,667	267,107	359,534	441,812	534,481	613,026	708,815	789,951	882,852	963,876	1,057,987	1,138,947	
Act FY Cumul	6,445	62,867	107,252	159,630	245,413	0	0	0	0	0	0	0	0	
% Complete	0.6%	5.5%	9.4%	14.0%	21.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	82,888	115,799	159,856	199,904	196,399	0	0	0	0	0	0	0	0	
Cumul Var, %	92.8%	64.8%	59.8%	55.8%	44.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	