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

For the Fiscal Reporting Period

September 28, 1996 – October 25, 1996

PMPR No. 97-1

November 8, 1996

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TABLES

ABBREVIATIONS

1D, 2D, 3D	1-Dimensional, 2-Dimensional, 3-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	Arc Macro Language
ANS	American Nuclear Society
ANSI	American National Standards Institute
AO	Annotated Outline
AP	Administrative Procedure
APB	Acid-Producing Bacteria
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
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
DECOVALEX	Development of Coupled Models and their Validation Against Experiments in Nuclear Waste Isolation
DEIS	Draft Environmental Impact Statement
DEM	Digital Elevation Model
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
EMPA	Electron Microprobe Analysis
ENFE	Evolution of the Near-Field Environment

ABBREVIATIONS (cont'd)

ENGB	Engineering and Geosciences Branch
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
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	Fluorinated Ethylene Propylene
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
GEM	General Electrochemical Migration
GEOTRAP	GEOlogic Transport of RAdionuclides Predictions
GERT	General Employee Radiological Training
GET	General Employee Training
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
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
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
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
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
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

ABBREVIATIONS (cont'd)

NFS	Network File Server
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
PEM	Program Element Manager
PER	Pre-Licensing Evaluation Report
PFD	Probabilistic Fault Displacement
PI	Principal Investigator
PMDA	Program Management Decision Analysis
PMPR	Program Manager's Periodic Report
PMT	Photo-Multiplier Tube
PNL	Pacific Northwest Laboratory
PO	Project Officer
PPA	Proposed Program Approach
PPE	Prepassivated Platinum Electrode
PRA	Probabilistic Risk Assessment
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
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
SRESNR	Support Revision of the EPA Standard and NRC Rule
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
SFPO	Spent Fuel Project Office
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

ABBREVIATIONS (cont'd)

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 Ferformance Assessment
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
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
VCS	Version Control System
VF	Vitrification Facility
VIEW_PVH	View Probability of Volcanic Hazards
VSIP	Vertical Slice Implementation Plan
WAN	Wide Area Network
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 1

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:

- Preparation of the U.S. Nuclear Regulatory Commission High-Level Radioactive Waste Program Annual Progress Report for Fiscal Year 1996—the first jointly developed major milestone—was the focus of technical work in period 1.

- The Self-Assessment Report on the CNWRA for September 30, 1995 through September 27, 1996 was transmitted.

- A presentation on the integrated volcano-structural probabilistic models for Yucca Mountain was made at the Geological Society of America Annual Meeting.

- Presentations were made on tectonic models in the Yucca Mountain region (YMR) at the U.S. Department of Energy (DOE) workshop for Probabilistic Seismic Hazard Analysis (PSHA).

The DWM JC year-to-date (YTD) cost variance was 7.7 percent. This variance does not consider the anticipated funding decrement for Fiscal Year 1997.

In the Division of Industrial and Medical Nuclear Safety JC, the CNWRA presented a list of questions and comments based on review of the WVNS-SAR-012. The YTD cost variance was 17.3 percent.

In the Division of Fuel Cycle Safety and Safeguards JC, the CNWRA provided an outline for the first report on subtask 1.1. The YTD cost variance was 92.8 percent, a direct reflection of project authorization occurring well into period 1.

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

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ESTIMATED BUDGET: $89,898,141

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

PERIOD OF THIS REPORT: 9/28/96-10/25/96

1 TECHNICAL

1.1 CNWRA Operations (COPS)

In addition to a wide range of day-to-day activities, COPS accomplishments included (i) delivery of a Proposal for Technical Assistance for Review of Safety Regulatory Guides for Fuels and Materials Facilities (SwRI Proposal No. 20-19959); (ii) transmittal of the Self-Assessment Report on the CNWRA for September 30, 1995 through September 27, 1996; (iii) submittal of an Analysis for Work for Others—Gas Research Institute; (iv) discussions between the NRC and CNWRA management at TWFN concerning revision to the TWRS Operations Plan, UR projects, DFCSS Regulatory Guides Project, and allocation of CNWRA resources to the NRC programs in FY97; (v) conduct of a brief NRC/CNWRA Management Meeting; (vi) participation in weekly KTI Management Board meetings; (vii) corrective action work on the four CARs from the annual CNWRA QA audit, including closing one, continuing procedure development, and conducting surveillance activities; and (viii) support for maintaining LAN operations.

The status of CNWRA staffing is indicated in table 1. Recruitment efforts and interviews continued for two open positions in hydrology, two in PA, one in seismology, and one in chemical engineering.

In the next period, the CNWRA expects to (i) participate in an NRC/CNWRA Management Meeting at TWFN; (ii) provide remedial and corrective actions in response to the three remaining CNWRA audit CARs, coordinate technical staff responses, and perform scheduled QA surveillance of tasks and subtasks; (iv) cooperate with the NRC contractor in testing the CNWRA firewall and provide CNWRA LAN operation/maintenance support; (v) initiate revision to its staffing plan; and (vi) host the annual CNWRA program review November 13–14, 1996, in San Antonio.

1.2 Igneous Activity (IA)

Work this period focused on preparation of multiple reports. Technical and programmatic reviews were completed for the FY96 Annual Report: Section on IA KTI—Joint NRC/CNWRA Report (MM 5708-461-710). The ACNW Volcanism Workshop/ Meeting—Letter Report entitled Constraints on the Potential Subsurface Area of Disruption Associated with YMR Basaltic Volcanoes (IM 5708-461-720) was prepared and technical reviews completed. This report documents results of the CNWRA research at Tolbachik volcano, Kamchatka, Russia—which is analogous to basaltic volcanoes in the YMR. About 3×10^6 m^3 of subsurface rock was disrupted and ejected during the late stage of the eruption in 1975 of Tolbachik. Geologic data are used in the calculations to assert that this volume of rock represents widening of the volcanic conduit from several meters to 49 ± 7 m in diameter within 1–2 km of the surface. Several unusual rock and deposit characteristics associated with this disruptive event at Tolbachik are also observed at the Lathrop Wells volcano and, to a lesser degree, at the Little Black Peak volcano in the YMR. Similarities in subsurface rock abundances and deposit characteristics between the eruption in 1975 of Tolbachik and these YMR volcanoes indicate that similar subsurface disruptive events probably occurred. Although the volume of the YMR disruptive events cannot be calculated because of deposit erosion, the size of these events was likely controlled by eruption volume. The Lathrop Wells volcano has an eruption volume nearly identical to that during the event in 1975 at Tolbachik. Thus, subsurface disruption volumes were likely similar. Little Black Peak has an order of magnitude smaller eruption volume and likely had an order of magnitude smaller disruptive event.

Activities continued during this period in support of the TSPAI KTI related to Input to Detailed Review of the DOE TSPA-95—Letter Report (IM 5708-761-720). The calibration between eruption power and duration, critical parameters in dispersion modeling, was refined to more closely reflect interpreted eruption volumes for YMR volcanoes. Calculations were performed with TSPAI staff to assess individual radiological doses from basaltic volcanic activity 20–30 km from the proposed repository site. These calculations examine dose sensitivity to variations in the mean particle diameter of the waste (10 mm to 0.01 mm) and waste incorporation ratio (2:1 to 10:1). Assuming a volcanic eruption penetrates the proposed repository site and a single WP is released (10 MTU), an individual located 20 km south of the site has a mean and 1 sigma standard deviation expected dose between 50 ± 300 mrem/yr (0.01 mm diameter, 2:1 incorporation) and $2 \times 10^{-18} \pm 3 \times 10^{-17}$ mrem/yr (10 mm diameter, 10:1 incorporation). Mean dose drops to between 7 ± 40 and $< 2 \times 10^{-26}$ mrem/yr for these conditions at 30 km. These calculations and technical basis will likely be discussed at the December Appendix 7 meeting with the DOE and others.

IA staff also presented integrated volcano-structural probabilistic models for YM at the GSA Annual Meeting. This work was cited by the GSA for a press release and sent to the NRC for programmatic review during this period. IA and SDS staffs also prepared an in-depth presentation of the integrated probabilistic models for publication in a peer-reviewed journal. This report, currently in CNWRA internal technical review, is the first of several journal articles planned to form the basis for a deliverable on probability model parameters and sensitivities (IM 5708-461-790).

Progress continued on development of the PVH_View code with resolution of several software features that were functioning incorrectly and addition of new options for modifying vector attributes during graphical analyses. Preparations began for presentations at the CNWRA Annual Program Review and the Appendix 7 meeting with the DOE.

In the next period, IA staff will continue preparations for the November CNWRA Annual Program Review, December Appendix 7 meeting with the DOE on volcanism issues, and December CNWRA Annual Management Program Review. Staff will complete the FY96 Annual Report: Section on IA KTI—Joint NRC/CNWRA Report (MM 5708-461-710), finish the ACNW Volcanism Workshop/Meeting—Letter Report entitled Constraints on the Potential Subsurface Area of Disruption Associated with YMR Basaltic Volcanoes (IM 5708-461-720), provide a final report to the TSPAI KTI related to Input to Detailed Review of the DOE TSPA-95—Letter Report (IM 5708-761-720), and prepare presentations for the December AGU Meeting.

1.3 Structural Deformation and Seismicity (SDS)

Work continued on technical and programmatic reviews and subsequent comment resolution for the FY96 Annual Report: Section on SDS KTI—Joint NRC/CNWRA Report (MM 5708-471-700). Final figures for the chapter were completed. The NRC comments from their review of Type 1 Faults in the YMR (MM 5708-471-650) were incorporated into the text. In addition, a section was added to assess sensitivity of various ground motion acceleration models and document the choice of Campbell's 1987 attenuation model for analysis of the Type II Faults in the YMR. The SDS KTI activities table was revised to reflect changing priorities in response to a decreasing budget.

The following IMs were completed and submitted for technical and programmatic review: (i) 3DStress User's Guide for Version 1.2—Letter Report (IM 5708-472-701), (ii) Installation Procedures for 3DStress Version 1.2—Letter Report (IM 5708-472-702), and (iii) Design Verification Report for 3DStress Version 1.2—Letter Report (IM 5708 472-703). The latter two milestones are new and included in table 2.

Preparation for two presentations entitled Structural Control and Progressive Deformation of the Yucca Mountain (Nevada Region) and Kinematic Constraints of the Central Basin and Range Tectonism from Paleomagnetic and Fission Track Studies at Bare Mountain, Nevada, were completed for the GSA Annual Meeting.

The CNWRA staff gave presentations on tectonic models in the YMR at the DOE workshop for PSHA expert elicitation panel on seismic source characterization.

In the next period, the CNWRA staff will complete the FY96 Annual Report: Section on SDS KTI—Joint NRC/CNWRA Report (MM 5708-471-700) and finalize the SDS KTI activities table for revision of the CNWRA OPS. The CNWRA staff will make two presentations at the GSA Annual Meeting. The revised Type 1 Faults in the Yucca Mountain Region (MM 5708-471-650) will be resubmitted in the next period.

1.4 Evolution of the Near-Field Environment (ENFE)

Extended corrosion tests designed to confirm the applicability of repassivation and corrosion potentials as predictive parameters of the long-term behavior of alloy 825 have been conducted for cumulative times up to 878 d. A long-term test with a creviced alloy 825 specimen at the open circuit potential in an aerated 1,000 ppm Cl^- solution at 95 °C has been in progress for a total of 466 d. Short-term CPP tests conducted to determine the pitting and repassivation potentials of ASTM A 516 Grade 60 C-Mn steel in HCO_3^-/CO_3^{2-} solutions containing 0.0003 to 5.0 molar Cl^- concentrations were completed. These tests were accomplished at 25, 65, and 95 °C using solutions of pH 9.0 and 11.0. Data from these tests are being used as input parameters to the corrosion models incorporated in the current development of the EBSPAC code (Version 1.0). Long-term tests using A 516 grade 60 specimens are being initiated to confirm the validity of the repassivation potential for predicting the onset of localized corrosion and to determine the localized corrosion propagation rate.

A draft report entitled Impact of Cement Materials on the Near-Field Environment at the Proposed Waste Repository at Yucca Mountain was received from a CNWRA consultant on cement/near-field interactions. The report concludes that (i) cementitious materials will strongly affect permeating waters which could, in turn, impact the performance of manmade and geologic barriers and (ii) existing data are not adequate to make quantitative predictions of barrier performance and materials interactions. The report recommends a focused program of modeling and experimental activities, with emphasis on principal uncertainties.

Experiments to evaluate the potential for long-term viability of bacteria from YM tuff have concluded. A journal paper on this work was drafted and sent to the NRC co-author for input. This paper will form part of the basis for a yet to be finalized deliverable Input to Issue Resolution Status Report on ENFE—Letter Report (IM 5708-561-750).

Technical and programmatic reviews were completed for the FY96 Annual Report: Section on ENFE KTI—Joint NRC/CNWRA Report (MM 5708-561-710).

A poster titled Isotopic Constraints on Radionuclide Transport at Peña Blanca was prepared. It describes the U-Th-Pb isotope geochemistry of the Nopal I natural analog in terms of the timing and nature of U transport. The poster will be presented at the Natural Analog Working Group meeting in Switzerland, October 28–30, 1996.

In the next period, long-term corrosion tests of alloy 825 and A 516 grade 60 will continue. An evaluation and compilation of thermodynamic data on cement minerals, including recent data from the University of Aberdeen, will be initiated. These data will be incorporated into databases for use with the EQ3/6 and MULTIFLO codes. The paper on microbial tuff viability will be finalized.

1.5 Container Life and Source Term (CLST)

Work continued on closing activities in this KTI. Preparations, including transmittal of the EBSPAC code (Version 1.0) are in progress for a workshop to be held at the NRC on November 20–21, 1996. The purpose of the workshop is to train the NRC staff on the code and discuss analyses of container life and source term related to Input to Detailed Review of the DOE TSPA-95 (IM 5708-761-720). Progress has been made in solving minor problems found in Version 1.0β of the code. Multiple runs confirmed that the code can run simulations up to 100,000 yr by using, as an option, the empirical equation for the WP temperature. A probabilistic driver to obtain CDFs of WP failure is under development. The ranges and types of distributions for the various input parameters have been selected. A modification was made in the code to introduce the variation of chloride concentration as a function of time, a critical variable in WP failure by localized corrosion. The CDF calculations will be used to provide input to the detailed review mentioned previously. Initial simulations were compared with those obtained with the WAPDEG code (Version 1.0) used by the DOE in TSPA-95. Resolution of technical and programmatic comments for the FY96 Annual Report: Section on CLST KTI—Joint NRC/CNWRA Report (MM 5708-571-710) has been completed.

In the next period, the workshop on the EBSPAC code (Version 1.0) will be held at the NRC. A brief addendum to the EBSPAC Technical Description and User's Manual (IM 5708-572-640) for Version 1.0β will be provided with the corrections and modifications necessary for transmittal of the EBSPAC code (Version 1.0). Following the workshop, a revised user's manual will be issued. Input in the form of CDF calculations of WP failure will be provided for the Input to Detailed Review of the DOE TSPA-95 (IM 5708-761-720).

1.6 Thermal Effects on Flow (TEF)

Preparation continues on the FY96 Annual Report: Section on TEF KTI—Joint NRC/CNWRA Report (MM 5708-661-710). This section has been reviewed technically and currently is undergoing internal programmatic review.

Study of the causative mechanisms leading to the formation of perched water bodies near the proposed repository area under nonisothermal conditions continued with equivalent continuum properties assigned to the stratigraphic units. These analyses have been undertaken to assess the hypothesis that heating can lead to increased saturation in the repository horizon. These analyses are predicated on assumed infiltration rates of 0.3, 3.0, and 30 mm/yr.

A 3D model of the proposed drift-scale heater test at ESF was assembled to simulate the anticipated thermohydrological response. The model will also be used to simulate alternate thermal load scenarios—in particular, lower thermal load scenarios more like proposed repository conditions.

Evaluation progressed on different conceptual models, including the DCM-3D dual continuum model and the MINC multiple continuum model (a module in TOUGH2). Simulations conducted with these models will be compared to equivalent continuum model simulations. The 1988-89 LLNL G-Tunnel heater experiment is being used as the test case to compare results predicted by the conceptual models with those of the heater experiment.

The bulk thermal conductivity of samples of tuff from the ALTS was measured at temperatures in excess of 200 °C. The rock samples are being saturated to allow measurement under saturated conditions. Rock from the PTn unit at YM has been requested for this experiment.

A TEF KTI team meeting was held to identify FY97 task assignments. As presented in the KTI implementation plan, the list of tasks is being modified in response to budget changes and there is a continuous re-focusing of the TEF KTI objectives to meet deadlines associated with the VA.

In the next period, activities related to the TEF KTI will include (i) analysis of nonisothermal groundwater flow, (ii) laboratory investigation of thermal conductivity, (iii) progress on implementing the MULTIFLO code, (iv) continued assessment of the DCM-3D and TOUGH2 codes, (v) preparation of the FY96 Annual Report: Section on TEF KTI—Joint NRC/CNWRA Report (MM 5708-661-710), (vi) preparation for the CNWRA Annual Review related to the TEF KTI, and (vii) modification of the FY97 OPS.

1.7 Repository Design and Thermal-Mechanical Effects (RDTME)

Preparation of the FY96 Annual Report: Section on RDTME KTI—Joint NRC/CNWRA Report (MM 5708-671-700) continued during this reporting period and all reviews were completed. The RDTME KTI section is being incorporated as chapter 7 of a NUREG/CR report.

In the next period, activities related to the RDTME KTI will include (i) development of the FY96 Annual Report: Section on RDTME KTI—Joint NRC/CNWRA Report (MM 5708-671-700) and (ii) preparation for the CNWRA Annual Review related to the RDTME KTI.

1.8 Total System Performance Assessment and Integration (TSPAI)

After internal technical review on the FY96 Annual Report: Section on TSPAI KTI—Joint NRC/CNWRA Report (MM 5708-761-700), it was submitted for internal programmatic review. The section highlights major accomplishments in FY96, technical activities, and subissues expected to be resolved in the near-term.

Progress was made on the Input to Detailed Review of the DOE TSPA-95—Letter Report (IM 5708-761-720). Focus topics selected for review include drift scale flow, probability and consequences (i.e., dose) of volcanism, probability and consequences of faulting, probabilistic calculation of container lifetime, hydrostratigraphic representation, and analysis of dilution factors.

Work continued on Phase 1 sensitivity analyses, building on calculations performed last FY for the audit review. The TPA code was run for comparison with the audit review results and to investigate importance of fracture flow, discretization of the proposed repository, infiltration distributions, retardation, and solubilities. Runs completed considered (i) the DOE WP failure times and model data as reported in TSPA-95, (ii) model data used in the NRC/CNWRA IPA Phase 2, (iii) higher matrix permeabilities in the unsaturated zone (iv) independent percolation fluxes for each proposed repository subarea, (v) dependent WP

failure times evidencing that all proposed repository subareas fail at the same time, (vi) independent CNWRA estimates for percolation fluxes and hydrostratigraphy, (vii) absence of radionuclide retardation and high radionuclide solubility values, and (viii) lack of radionuclide retardation and independent CNWRA estimates of radionuclide solubilities. When completed, results will fulfill Phase 1 Sensitivity Analyses (Input to TSPA Review)—Letter Report (IM 5708-761-710).

A letter report was prepared documenting preliminary work on a stylized human intrusion scenario. The letter report describes characteristics of representative boreholes, appropriate ranges for parameters, and rudimentary calculations to estimate the catchment area. This letter report was transmitted to fulfill an AI on Background Information and Recommendations for Stylized Human Intrusion Calculations at YM.

Development began on an SRD for the TPA code (Version 3.0). The SRD, which is a requirement of CNWRA Technical Operating Procedure (TOP) 018, describes the purpose, technical basis, and computational approach of the software. In addition, it illustrates overall data flow, user interfaces, programming language requirements, and hardware platform requirements. This is the first step in updating the TPA code so it can be used more effectively to investigate the relative importance of parameters, processes, and events to repository compliance. Other KTIs are planning sensitivity analyses using the TPA code in conjunction with the TSPAI KTI.

In the next period, development will continue on the Input to Detailed Review of the DOE TSPA-95—Letter Report (IM 5708-761-720) and completion of the FY96 Annual Report: Section on TSPAI KTI—Joint NRC/CNWRA Report (MM 5708-761-700). In addition, review will be completed on replanning FY97 activities and revision to the OPS. Work will begin on modification of the TPA code for use in the KTI sensitivity analyses.

1.9 Support Revision of the EPA Standard and NRC Rule (SRESNR)

Review and revision continued on the FY96 Annual Report: Section on SRESNR KTI—Joint NRC/CNWRA Report (MM 5708-771-700). [Note that the title of this KTI has been changed from "Support Development of the EPA Standard" (SDES) to "Support Revision of the EPA Standard and NRC Rule" (SRESNR) to better reflect the scope of work that is currently underway.] Internal technical review comments were resolved and the authors are currently responding to comments from the internal programmatic review. The section was written in accordance with the outline approved by the NRC KTI co-lead.

A special project to aid the NRC KTI co-lead with establishing a regulatory framework for future development of review procedures and acceptance criteria was discontinued as a result of a KTI Management Board decision to include review procedures and acceptance criteria as aspects of issue resolution reports prepared by the respective KTI teams.

Coordination with the NRC KTI co-lead continued for revision of the technical needs, deliverables, and resource allocations for the SRESNR KTI in response to final FY97 budget allocations.

In the next period, the FY96 Annual Report: Section on SRESNR KTI—Joint NRC/CNWRA Report (MM 5708-771-700) will be completed. If the updated EPA Standard for YM is formally published in the *Federal Register*, the CNWRA staff will assist the NRC in the review and comment process.

1.10 Unsaturated and Saturated Flow under Isothermal Conditions (USFIC)

During this period, activities within this KTI were largely devoted to planning FY97 studies and completion of the FY96 Annual Report: Section on USFIC KTI—Joint NRC/CNWRA Report (MM 5708-861-700). Significant progress was made on reviewing the C-Well tracer tests; limited progress occurred in reviewing infiltration-model assumptions. In addition, an analysis for examining drift-scale moisture redistribution was initiated.

The FY96 Annual Report: Section on USFIC KTI—Joint NRC/CNWRA Report (MM 5708-861-700) received internal technical and programmatic reviews. Changes were made in response to comments. This section describes the overall objectives and scope of work for the KTI, significant technical accomplishments for FY96, an assessment of progress made toward meeting KTI objectives, and a description of how activities conducted in this KTI were integrated with those conducted in other KTIs.

Effort was devoted to the acquisition and development of methods to determine if the non-reactive tracer tests conducted at the C-well complex can be used to estimate the effect of matrix diffusion on radionuclide concentrations in the saturated zone. For the convergent tracer tests, an existing computer code was acquired and used to estimate matrix diffusion. For the two well recirculation tracer tests, an existing analytical procedure is being modified to account for matrix diffusion and sources and sinks of unequal strength.

Work to date at the CNWRA on infiltration has assumed that any flow in welded-tuff bedrock occurs within fractures. Using simulations with bedrock properties based on outcrop core sample data, the microstratigraphic units for which this assumption is appropriate are being determined.

The quantity, timing, and composition of water entering the drifts is one of the key factors in proposed repository performance. Planning for an analysis of the movement of moisture, heat, and chemical species in the drift-scale environment was initiated in collaboration with other KTIs. Using consistent representations of rock properties at the drift scale, isothermal, thermal, and geochemical analyses will be accomplished under the USFIC, TEF, and ENFE KTIs. In particular, analysis of the pre-emplacement and post-cool down percolation-flux behavior in the vicinity of the proposed repository would be accomplished under the USFIC KTI.

Documentation continued of methodology for estimating percolation fluxes by simultaneously constraining perched water body hydrology and geochemistry using numerical simulations.

In the next period, staff will (i) continue evaluating the C-Well tracer tests, (ii) progress in evaluating infiltration-model behavior and assumptions, (iii) begin assembling available climatic data into a form suitable for predictions of future infiltration rates, (iv) proceed with development of the saturated zone subregional-scale 3D hydrostratigraphic model, and

(v) continue to document methodology for estimating percolation fluxes using information regarding perched water bodies.

1.11 Radionuclide Transport (RT)

Evaluation of CNWRA experimental data on Np(5+) sorption on montmorillonite was completed. Data will be used to derive surface complexation model parameters to allow prediction of Np(5+) sorption over ranges of geochemical conditions. These interpretations support development of the Neptunium Sorption Modeling—Journal Paper (IM 5708-871-710).

Internal technical and programmatic reviews were conducted on the FY96 Annual Report: Section on RT KTI—Joint NRC/CNWRA Report (MM 5708-871-700).

In the next period, the FY96 Annual Report: Section on RT KTI—Joint NRC/CNWRA Report (MM 5708-871-700) will be completed. A presentation will be made at the Annual CNWRA Program Review describing results from the RT KTI. Development will continue on the Neptunium Sorption Modeling—Journal Paper (IM 5708-871-710).

1.12 Waste Solidification Systems (WSS)

The CNWRA staff received the West Valley SAR for Fuel Receiving and Storage Facility (WVNS-SAR-012, Revision 0, Draft C). Based on a review of this SAR, a list of questions and comments was developed and transmitted electronically to the NRC staff for forwarding to WVDP.

In the next period, it is anticipated that WVDP will respond to the comments and questions on SAR-012. Following satisfactory resolution of these questions and comments, the CNWRA staff will transmit Review of SAR-012 (IM 5706-001-701) to assist the NRC in preparing an SER. The current anticipated schedule for the NRC to transmit their SER to WVDP is December 18, 1996. This schedule will depend, in part, on the responses provided by WVDP and the extent of independent calculations needed to verify WVDP analyses.

1.13 Tank Waste Remediation System (TWRS)

This project was initiated on October 16, 1996. Following a meeting with the NRC staff, an outline for the first report in Subtask 1.1, Tank Waste System Status—Interim Report (IM 5709-101-710), was prepared and sent to the NRC staff. Review of Hanford TWRS literature and the DOE QA requirements is proceeding among the various subtasks.

In the next period, preparation of the Tank Waste System Status—Interim Report (IM 5709-101-710) will continue after incorporation of modifications to the outline that are expected from the NRC staff. Review of the TWRS literature and DOE QA requirements will continue.

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. No deliverables were transmitted during period 1.

5 SUMMARY OF FINANCIAL STATUS

Table 3 summarizes the CNWRA financial status in the context of authorized funds provided by the NRC. Total commitments of the CNWRA are $100,070. 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, DIMNS JC, and DFCSS JC as well as for COPS and 10 KTIs. Three of these KTIs will be terminated in period 4 (see B. Meehan to W. Patrick, September 27, 1996). The planned costs per period for the DWM JC do not reflect the funding decrement for FY97. Therefore, the DWM JC cost variance for period 1 is not accurate.

This period's expenditures fell by 18.2 percent from last period (period 13, FY96). Based on currently approved estimated spending, the CNWRA composite, all three JCs, was underspent by $155,844 or 15.6 percent, the DWM JC was underspent by $69,255 or 7.7 percent, the DIMNS JC was underspent by $3,701 or 37.1 percent, and the DFCSS JC was underspent by $82,888 or 92.8 percent. Expenditures in the DWM JC must average about 23 percent below the current plan to conform to the FY97 budget. Thus, expenditures in this JC must decrease substantially in subsequent periods. During period 2, the DWM JC will record costs for work conducted in FY96; expenditures in the DIMNS and DFCSS JCs are anticipated to increase as activity progresses in these JCs.

As indicated in table 1, the CNWRA has 47 core and 2 limited-term staff members. Expected changes to CNWRA key personnel are stated in a letter from W. Patrick to B. Meehan dated October 31, 1996. In addition, there will be a reduction in force of four other core staff members effective next period. The available pool of approved consultants and subcontractors remains 46. Expenditures for consultants, subcontractors, and SwRI labor in all JCs as a percentage of the CNWRA composite spending are 17.7 percent for FY97 YTD. For consultants and subcontractors alone, this percentage is 16.5. The relatively higher (over the last two periods in FY96) spending for consultants and subcontractors in the DWM JC is the result of payment of outstanding commitments from the previous periods in FY96. This percentage is expected to decline significantly after all vouchers for FY96 have been paid.

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

DWM JC

The DWM JC cumulative cost variance through period 1 was 7.7 percent.

Expenditures in this JC decreased by 18.9 percent from the previous period (period 13, FY96). Spending declined over the previous period (period 13, FY96) in all KTIs except SDS and TSPAI. Expenses fell in COPS during this same period. Specific rationales for over/underspending for COPS and each KTI follow.

The cost variance for COPS was −0.1 percent. The cost variance for the Management, Planning, and Computer Support Subtask (5708-158) was −6.4 percent and for the Quality Assurance Subtask (5708-159) was 24.5 percent. As indicated previously, payment of vouchers for outstanding commitments from FY96 increased spending this period, and the approved spending plan in Revision 8, Change 0, of the CNWRA OPS does not reflect the funding decrement related to COPS FY97 work.

The cost variance for the IA KTI was 13.8 percent at the end of period 1. This represents a significant decrease from the previous period. Spending will increase significantly during period 2 due to carryover expenses associated with field work and analytical services that occurred late in FY96.

The cost variance for the SDS KTI was −108.1 percent. This overrun reflects charges for consultants and subcontractors carried forward from FY96. It is anticipated that the overrun will decrease slightly next period followed by more significant decreases in future periods.

The cost variance for the ENFE KTI was 25.7 percent. This variance will change in the future as budgets for FY97 are finalized.

The cost variance for the CLST KTI was 33.3 percent. This variance, however, does not reflect the revised budget; spending must decrease further to comport with the close out of this KTI.

The cost variance for the TEF KTI was −0.6 percent. The expenditures in this KTI during period 1 of FY97 do not reflect anticipated changes in funding.

The cost variance for the RDTME KTI was 65.7 percent. This underspending will accommodate the proposed reduced budget for this KTI.

The cost variance for the TSPAI KTI was −18.3 percent. This negative variance is attributed to FY96 commitments and does not reflect changes in funding as the result of reduced budget allocations.

The cost variance for the SRESNR KTI was 19.0 percent. Although not reflective of budget adjustments, this positive variance indicates a decline in the allocation of CNWRA labor resources. These were primarily involved in other KTI and WFO activities.

The cost variance for the USFIC KTI was 41.2 percent. This underrun does not consider changes in funding, however, it is likely to continue in coming periods until staff additions are completed.

The cost variance for the RT KTI was 50.7 percent. This variance is consistent with the reduced budget for the RT KTI associated with its termination. The variance will decrease once the revised budget is in place.

The cost variance for WSS was 37.1 percent. The spending reflects the delay in receipt of SAR-012.

The cost variance for the TWRS project was 92.8 percent. This large cost variance reflects the late start of the project in this reporting period. Spending is expected to increase significantly in the next period due to activities initiated in several subtasks.

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

EXPERTISE/EXPERIENCE	CURRENT NO.	PROFESSIONAL STAFF	POSITIONS OPEN FY96
ADMINISTRATION	4	H.GARCIA, W.PATRICK, J.RUSSELL, B.SAGAR	
CODE ANALYSIS/DEVELOPMENT	3	B.HENDERSON, R.JANETZKE, R.MARTIN	
DATABASE MANAGEMENT AND DATA PROCESSING	0		1
ELECTROCHEMISTRY	1	G.CRAGNOLINO	
ENGINEERING GEOLOGY/GEOLOGICAL ENGNG	2	R.CHEN, G.OFOEGBU	
ENVIRONMENTAL SCIENCES	1	P.LaPLANTE	
GEOCHEMISTRY	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	2	A.BAGTZOGLOU, G.WITTMEYER	
INFORMATION MANAGEMENT SYSTEMS	1	R.MARSHALL	1
MATERIAL SCIENCES	3(1)†	P.ANGELL†, D.DUNN, H.MANAKTALA, N.SRIDHAR	
MECHANICAL, INCLUDING DESIGN AND FABRICATION	1	C.TSCHOEPE	
MINING ENGINEERING	1	S-M.HSIUNG	
NUCLEAR ENGINEERING	1	H.KARIMI	
PERFORMANCE ASSESSMENT	4	R.BACA, R.MANTEUFEL, S.MOHANTY, M.JARZEMBA	2
QUALITY ASSURANCE	1	B.MABRITO	
RADIOISOTOPE GEOCHEMISTRY	1	D.PICKETT	
REGULATORY ANALYSIS	0		
ROCK MECHANICS	3	M.AHOLA, A.CHOWDHURY, A.GHOSH	
SEISMOLOGY	0		1
SOURCE-TERM/SPENT FUEL DEGRAD	1	P.LICHTNER	
STRUCTURAL GEOLOGY/SEISMO-TECTONICS	3	D.FERRILL, G.STIREWALT, J.STAMATAKOS	
SYSTEMS ENGINEERING	2	A.DeWISPELARE, P.MACKIN	
VOLCANOLOGY/IGNEOUS PROCESSES	2(1)†	C.CONNOR, B.HILL, M.CONWAY†	
TOTAL	47 (2)†		7

* SEE STAFFING PLAN FOR DETAILS (Open positions will be filled in FY96 on a selective basis due to budget reduction.)
† LIMITED TERM

Table 2. Summary of Schedule Changes (Period 1)

MILESTONE NUMBER	TYPE	DESCRIPTION	ORIGINAL DATE	REVISED DATE	RATIONALE FOR CHANGE
5708-461-710	MM	FY96 Annual Report: Section on Igneous Activity KTI Joint NRC/CNWRA Report	10/30/96	11/22/96	Postponed per NRC's request to allow additional time for reviews
5708-471-700	MM	FY96 Annual Report: Section on Structural Deformation and Seismicity KTI Joint NRC/CNWRA Report	10/30/96	11/22/96	Postponed per NRC's request to allow additional time for reviews
5708-472-702	IM	Installation Procedures for 3DStress Version 1.2—Letter Report	11/14/96		New Intermediate Milestone
5708-472-703	IM	Design Verification Report for 3DStress Version 1.2—Letter Report	11/14/96		New Intermediate Milestone
5708-481-790	IM	Probability Model Parameters and Sensitivities	07/24/97		New Intermediate Milestone
5708-561-710	MM	FY96 Annual Report: Section on Evolution of the Near-Field Environment KTI Joint NRC/CNWRA Report	10/30/96	11/22/96	Postponed per NRC's request to allow additional time for reviews
5708-571-710	MM	FY96 Annual Report: Section on Container Life and Source Term KTI Joint NRC/CNWRA Report	10/30/96	11/22/96	Postponed per NRC's request to allow additional time for reviews
5708-661-710	MM	FY96 Annual Report: Section on Thermal Effects on Flow KTI Joint NRC/CNWRA Report	10/30/96	11/22/96	Postponed per NRC's request to allow additional time for reviews
5708-671-700	MM	FY96 Annual Report: Section on Repository Design and Thermal-Mechanical Effects KTI Joint NRC/CNWRA Report	10/30/96	11/22/96	Postponed per NRC's request to allow additional time for reviews
5708-761-700	MM	FY96 Annual Report: Section on TSPA and Integration KTI Joint NRC/CNWRA Report	10/30/96	11/22/96	Postponed per NRC's request to allow additional time for reviews
5708-761-710	IM	Phase 1 Sensitivity Analyses (Input to TSPA Review—Letter Report)	11/27/96	01/31/97	Delayed to permit incorporation of new modules in TPA code
5708-761-720	IM	Input to Detailed Review of DOE TSPA-95—Letter Report	12/20/96	02/28/97	Delayed to permit incorporation of new modules in TPA code

Table 2. Summary of Schedule Changes (Period 1) (Cont'd)

MILESTONE NUMBER	TYPE	DESCRIPTION	ORIGINAL DATE	REVISED DATE	RATIONALE FOR CHANGE
5708-771-700	MM	FY96 Annual Report: Section on EPA Standard KTI Joint NRC/CNWRA Report	10/30/96	11/22/96	Postponed per NRC's request to allow additional time for reviews
5708-861-700	MM	FY96 Annual Report: Section on Isothermal Flow KTI Joint NRC/CNWRA Report	10/30/96	11/22/96	Postponed per NRC's request to allow additional time for reviews
5708-871-700	MM	FY96 Annual Report: Section on Radionuclide Transport KTI Joint NRC/CNWRA Report	10/30/96	11/22/96	Postponed per NRC's request to allow additional time for reviews

Table 3. Financial Status (Period 1)

COPS/KTI/TWRS	Funds Authorized	Funds Costed to Date	Funds Uncosted	Commitments
COPS	1,392,358	1,340,408	51,951	4,100
IA	816,147	754,801	61,346	28,034
SDS	1,225,910	1,263,762	(37,852)	25,556
ENFE	724,464	673,606	50,857	4,035
CLST	778,091	756,556	21,536	413
TEF	576,136	554,818	21,318	2,329
RDTME	776,430	735,176	41,255	25,810
TSPAI	1,448,005	1,419,000	29,005	7,080
SRESNR	471,218	444,491	26,727	0
USFIC	529,375	474,507	54,868	1,010
RT	445,566	428,559	17,007	1,702
DWM COSTS	9,183,698	8,845,683	338,016	
DWM AWARD FEE	0	0	0	
DWM BASE FEE	0	343,300	(343,300)	
TOTAL DWM	9,183,698	9,188,982	(5,284)	100,070
WSS COSTS	620,126	558,583	61,542	0
WSS AWARD FEE	0	0	0	
WSS BASE FEE	0	24,174	(24,174)	
TOTAL WSS	620,126	582,757	37,369	0
TWRS COSTS	54,000	6,445	47,555	0
TWRS AWARD FEE	3,600	0	3,600	
TWRS BASE FEE	2,400	251	2,149	
TOTAL TWRS	60,000	6,696	53,304	0
TOTAL	9,863,824	9,778,435	85,389	100,070
Note: Additional authorized funds of $24,126 for DWM have not been allocated.				

APPENDIX A
Planned and Actual Costs, and Cost Variances Period 1, FY97

CNWRA COMPOSITE
TOTAL ESTIMATE COST

ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	1,001,121	1,002,192	996,663	1,007,859	988,384	1,011,071	984,299	1,012,511	979,907	1,016,401	978,465	1,021,347	976,405	1,001,121
Act Pd Cost	845,277	0	0	0	0	0	0	0	0	0	0	0	0	845,277
Variance, $	155,844	0	0	0	0	0	0	0	0	0	0	0	0	155,844
Variance, %	15.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	15.6%
Est FY Cumul	1,001,121	2,003,313	2,999,976	4,007,835	4,996,219	6,007,290	6,991,589	8,004,100	8,984,007	10,000,408	10,978,873	12,000,220	12,976,625	
Act FY Cumul	845,277	0	0	0	0	0	0	0	0	0	0	0	0	
% Complete	6.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	155,844	0	0	0	0	0	0	0	0	0	0	0	0	
Cumul Var, %	15.6%	0.0%	0.0%	0.0%	0.0%	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	901,802	902,869	898,753	905,443	897,192	907,917	894,096	909,235	890,674	912,950	889,343	916,434	887,350	901,802
Act Pd Cost	832,548	0	0	0	0	0	0	0	0	0	0	0	0	832,548
Variance, $	69,255	0	0	0	0	0	0	0	0	0	0	0	0	69,255
Variance, %	7.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.7%
Est FY Cumul	901,802	1,804,671	2,703,424	3,608,867	4,506,059	5,413,975	6,308,071	7,217, .06	8,107,979	9,020,929	9,910,273	10,826,706	11,714,056	
Act FY Cumul	832,548	0	0	0	0	0	0	0	0	0	0	0	0	
% Complete	7.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	69,255	0	0	0	0	0	0	0	0	0	0	0	0	
Cumul Var, %	7.7%	0.0%	0.0%	0.0%	0.0%	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	137,967	138,223	137,875	138,468	137,844	138,469	137,813	138,609	137,812	138,671	137,532	138,967	137,363	137,967
Act Pd Cost	138,117	0	0	0	0	0	0	0	0	0	0	0	0	138,117
Variance, $	(150)	0	0	0	0	0	0	0	0	0	0	0	0	(150)
Variance, %	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%
Est FY Cumul	137,967	276,191	414,066	552,534	690,378	828,847	966,660	1,105,269	1,243,080	1,381,751	1,519,283	1,658,250	1,795,614	
Act FY Cumul	138,117	0	0	0	0	0	0	0	0	0	0	0	0	
% Complete	7.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	(150)	0	0	0	0	0	0	0	0	0	0	0	0	
Cumul Var, %	-0.1%	0.0%	0.0%	0.0%	0.0%	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	65,566	65,708	65,360	65,972	65,327	66,175	65,125	66,395	64,842	66,644	64,840	67,171	64,759	65,566
Act Pd Cost	56,487	0	0	0	0	0	0	0	0	0	0	0	0	56,487
Variance, $	9,079	0	0	0	0	0	0	0	0	0	0	0	0	9,079
Variance, %	13.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	13.8%
Est FY Cumul	65,566	131,274	196,634	262,606	327,933	394,108	459,233	525,628	590,470	657,114	721,955	789,126	853,885	
Act FY Cumul	56,487	0	0	0	0	0	0	0	0	0	0	0	0	
% Complete	6.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	9,079	0	0	0	0	0	0	0	0	0	0	0	0	
Cumul Var, %	13.8%	0.0%	0.0%	0.0%	0.0%	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 Pd Cost	77,497	77,501	77,011	77,878	76,839	78,048	76,650	78,158	76,368	78,406	76,278	78,770	76,197	77,497
Act Pd Cost	161,282	0	0	0	0	0	0	0	0	0	0	0	0	161,282
Variance, $	(83,784)	0	0	0	0	0	0	0	0	0	0	0	0	(83,784)
Variance, %	-108.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-108.1%
Est FY Cumul	77,497	154,998	232,009	309,887	386,726	464,773	541,423	619,581	695,949	774,355	850,633	929,403	1,005,600	
Act FY Cumul	161,282	0	0	0	0	0	0	0	0	0	0	0	0	
% Complete	16.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	(83,784)	0	0	0	0	0	0	0	0	0	0	0	0	
Cumul Var, %	-108.1%	0.0%	0.0%	0.0%	0.0%	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	83,796	83,859	83,564	84,143	83,395	84,395	82,783	84,396	82,335	84,846	82,253	85,119	81,975	83,796
Act Pd Cost	62,233	0	0	0	0	0	0	0	0	0	0	0	0	62,233
Variance, $	21,563	0	0	0	0	0	0	0	0	0	0	0	0	21,563
Variance, %	25.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	25.7%
Est FY Cumul	83,796	167,655	251,219	335,362	418,757	503,152	585,935	670,331	752,666	837,513	919,765	1,004,885	1,086,860	
Act FY Cumul	62,233	0	0	0	0	0	0	0	0	0	0	0	0	
% Complete	5.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	21,563	0	0	0	0	0	0	0	0	0	0	0	0	
Cumul Var, %	25.7%	0.0%	0.0%	0.0%	0.0%	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	84,373	84,519	83,971	84,660	83,833	84,911	83,284	85,034	83,112	85,458	83,080	85,628	82,971	84,373
Act Pd Cost	56,243	0	0	0	0	0	0	0	0	0	0	0	0	56,243
Variance, $	28,131	0	0	0	0	0	0	0	0	0	0	0	0	28,131
Variance, %	33.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	33.3%
Est FY Cumul	84,373	168,892	252,864	337,524	421,357	506,268	589,552	674,588	757,700	843,158	926,238	1,011,867	1,094,838	
Act FY Cumul	56,243	0	0	0	0	0	0	0	0	0	0	0	0	
% Complete	5.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	28,131	0	0	0	0	0	0	0	0	0	0	0	0	
Cumul Var, %	33.3%	0.0%	0.0%	0.0%	0.0%	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	56,440	56,442	56,139	56,653	55,861	56,984	55,720	56,984	55,636	57,421	55,573	57,502	55,510	56,440
Act Pd Cost	56,775	0	0	0	0	0	0	0	0	0	0	0	0	56,775
Variance, $	(336)	0	0	0	0	0	0	0	0	0	0	0	0	(336)
Variance, %	-0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.6%
Est FY Cumul	56,440	112,882	169,020	225,673	281,534	338,517	394,237	451,221	506,857	564,278	619,851	677,352	732,862	
Act FY Cumul	56,775	0	0	0	0	0	0	0	0	0	0	0	0	
% Complete	7.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	(336)	0	0	0	0	0	0	0	0	0	0	0	0	
Cumul Var, %	-0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

REPOSITORY DESIGN AND THERMAL-MECHANICAL EFFECTS (RDTME) 5708-670														
ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	78,119	78,120	77,975	78,262	77,834	78,590	77,741	78,731	77,572	78,960	77,510	79,452	77,129	78,119
Act Pd Cost	26,768	0	0	0	0	0	0	0	0	0	0	0	0	26,768
Variance, $	51,351	0	0	0	0	0	0	0	0	0	0	0	0	51,351
Variance, %	65.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	65.7%
Est FY Cumul	78,119	156,239	234,215	312,477	390,311	468,901	546,642	625,373	702,944	781,904	859,415	938,867	1,015,995	
Act FY Cumul	26,768	0	0	0	0	0	0	0	0	0	0	0	0	
% Complete	2.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	51,351	0	0	0	0	0	0	0	0	0	0	0	0	
Cumul Var, %	65.7%	0.0%	0.0%	0.0%	0.0%	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	137,140	137,303	136,833	137,728	136,772	137,978	136,058	138,335	134,930	139,068	134,552	139,463	134,191	137,140
Act Pd Cost	162,260	0	0	0	0	0	0	0	0	0	0	0	0	162,260
Variance, $	(25,120)	0	0	0	0	0	0	0	0	0	0	0	0	(25,120)
Variance, %	-18.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-18.3%
Est FY Cumul	137,140	274,444	411,277	549,005	685,777	823,755	959,813	1,098,147	1,233,077	1,372,146	1,506,697	1,646,160	1,780,351	
Act FY Cumul	162,260	0	0	0	0	0	0	0	0	0	0	0	0	
% Complete	9.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	(25,120)	0	0	0	0	0	0	0	0	0	0	0	0	
Cumul Var, %	-18.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

SUPPORT REVISION OF THE EPA STANDARD AND NRC RULE (SRESNR) 5708-770														
ITEM	01	02	03	04	05	06	07	08	09	10	11	12	13	Total
Est Pd Cost	47,642	47,766	47,445	47,846	47,027	48,047	46,857	48,079	46,854	48,402	46,827	48,658	46,826	47,642
Act Pd Cost	38,571	0	0	0	0	0	0	0	0	0	0	0	0	38,571
Variance, $	9,070	0	0	0	0	0	0	0	0	0	0	0	0	9,070
Variance, %	19.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	19.0%
Est FY Cumul	47,642	95,407	142,852	190,698	237,725	285,772	332,628	380,707	427,561	475,963	522,790	571,447	618,273	
Act FY Cumul	38,571	0	0	0	0	0	0	0	0	0	0	0	0	
% Complete	6.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	9,070	0	0	0	0	0	0	0	0	0	0	0	0	
Cumul Var, %	19.0%	0.0%	0.0%	0.0%	0.0%	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	85,152	85,234	84,839	85,497	84,749	85,847	84,467	85,957	83,688	86,318	83,374	86,540	83,167	85,152
Act Pd Cost	50,108	0	0	0	0	0	0	0	0	0	0	0	0	50,108
Variance, $	35,044	0	0	0	0	0	0	0	0	0	0	0	0	35,044
Variance, %	41.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	41.2%
Est FY Cumul	85,152	170,386	255,225	340,721	425,471	511,317	595,785	681,742	765,430	851,747	935,121	1,021,662	1,104,828	
Act FY Cumul	50,108	0	0	0	0	0	0	0	0	0	0	0	0	
% Complete	4.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	35,044	0	0	0	0	0	0	0	0	0	0	0	0	
Cumul Var, %	41.2%	0.0%	0.0%	0.0%	0.0%	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	48,110	48,192	47,740	48,336	47,710	48,476	47,598	48,557	47,525	48,756	47,524	49,163	47,262	48,110
Act Pd Cost	23,704	0	0	0	0	0	0	0	0	0	0	0	0	23,704
Variance, $	24,406	0	0	0	0	0	0	0	0	0	0	0	0	24,406
Variance, %	50.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.7%
Est FY Cumul	48,110	96,302	144,043	192,379	240,089	288,564	336,162	384,720	432,244	481,000	528,524	577,687	624,948	
Act FY Cumul	23,704	0	0	0	0	0	0	0	0	0	0	0	0	
% Complete	3.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	24,406	0	0	0	0	0	0	0	0	0	0	0	0	
Cumul Var, %	50.7%	0.0%	0.0%	0.0%	0.0%	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	9,986	9,989	9,470	9,989	8,914	10,486	8,658	10,487	8,098	10,550	8,098	10,802	8,095	9,986
Act Pd Cost	6,285	0	0	0	0	0	0	0	0	0	0	0	0	6,285
Variance, $	3,701	0	0	0	0	0	0	0	0	0	0	0	0	3,701
Variance, %	37.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	37.1%
Est FY Cumul	9,986	19,975	29,445	39,434	48,348	58,834	67,492	77,979	86,077	96,627	104,725	115,527	123,622	
Act FY Cumul	6,285	0	0	0	0	0	0	0	0	0	0	0	0	
% Complete	5.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	3,701	0	0	0	0	0	0	0	0	0	0	0	0	
Cumul Var, %	37.1%	0.0%	0.0%	0.0%	0.0%	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	89,332
Act Pd Cost	6,445	0	0	0	0	0	0	0	0	0	0	0	0	6,445
Variance, $	82,888	0	0	0	0	0	0	0	0	0	0	0	0	82,888
Variance, %	92.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	92.8%
Est FY Cumul	89,332	178,667	267,107	359,534	441,812	534,481	616,026	708,815	789,951	882,852	963,876	1,057,987	1,138,947	
Act FY Cumul	6,445	0	0	0	0	0	0	0	0	0	0	0	0	
% Complete	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Cumul Var, $	82,888	0	0	0	0	0	0	0	0	0	0	0	0	
Cumul Var, %	92.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	