

*Received with letter
4/26/91*

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

FOR THE FISCAL REPORT PERIOD

March 16, 1991 - April 12, 1991

PMPR No. 91-07

April 25, 1991

9105010099 910426
PDR WASTE
WM-11 426.1 PDR

TABLE OF CONTENTS

| | PAGE |
|--|------|
| 1. SUMMARY | 1-1 |
| 1.1 Technical Status | 1-1 |
| 1.2 Major Problems | 1-6 |
| 1.3 Forecast for Next Period | 1-7 |
| 1.4 Summary Financial Status | 1-8 |
| 2. CNWRA OPERATIONS | 2-1 |
| 2.1 Technical Status | 2-1 |
| 2.2 Major Problems | 2-2 |
| 2.3 Forecast for Next Period | 2-2 |
| 2.4 Element Financial Status | 2-3 |
| 3. WASTE SYSTEMS ENGINEERING AND INTEGRATION | 3-1 |
| 3.1 Technical Status | 3-1 |
| 3.2 Major Problems | 3-3 |
| 3.3 Forecast for Next Period | 3-3 |
| 3.4 Element Financial Status | 3-4 |
| 4. QUALITY ASSURANCE | 4-1 |
| 4.1 Technical Status | 4-1 |
| 4.2 Major Problems | 4-1 |
| 4.3 Forecast for Next Period | 4-1 |
| 4.4 Element Financial Status | 4-2 |
| 5. GEOLOGIC SETTING | 5-1 |
| 5.1 Technical Status | 5-1 |
| 5.2 Major Problems | 5-3 |
| 5.3 Forecast for Next Period | 5-3 |
| 5.4 Element Financial Status | 5-3 |
| 6. ENGINEERED BARRIER SYSTEM | 6-1 |
| 6.1 Technical Status | 6-1 |
| 6.2 Major Problems | 6-2 |
| 6.3 Forecast for Next Period | 6-3 |
| 6.4 Element Financial Status | 6-3 |
| 7. REPOSITORY DESIGN, CONSTRUCTION, AND OPERATIONS | 7-1 |
| 7.1 Technical Status | 7-1 |
| 7.2 Major Problems | 7-2 |
| 7.3 Forecast for Next Period | 7-2 |
| 7.4 Element Financial Status | 7-2 |

TABLE OF CONTENTS (CONT'D)

| | PAGE |
|--|------|
| 8. PERFORMANCE ASSESSMENT | 8-1 |
| 8.1 Technical Status | 8-1 |
| 8.2 Major Problem | 8-2 |
| 8.3 Forecast for Next Period | 8-2 |
| 8.4 Element Financial Status | 8-2 |
| 9. TRANSPORTATION RISK STUDY | 9-1 |
| 10. RESEARCH | 10-1 |
| 10.1 Technical Status | 10-2 |
| 10.2 Major Problems | 10-6 |
| 10.3 Forecast for Next Period | 10-6 |
| 10.4 Element Financial Status | 10-7 |
| 11. LICENSING SUPPORT SYSTEM ADMINISTRATOR | 11-1 |
| 11.1 Technical Status | 11-1 |
| 11.2 Major Problems | 11-1 |
| 11.3 Forecast for Next Period | 11-1 |
| 11.4 Element Financial Status | 11-1 |
| 12. WASTE SOLIDIFICATION SYSTEMS | 12-1 |
| 12.1 Technical Status | 12-1 |
| 12.2 Major Problems | 12-1 |
| 12.3 Forecast for Next Period | 12-2 |
| 12.4 Summary Financial Status | 12-2 |

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

TITLE: Center for Nuclear Waste
Regulatory Analyses

FIN: D1035-8

NRC CNWRA PROGRAM MANAGER: Jesse L. Funches
(301) 492-3324

CONTRACTOR: SwRI

NRC CNWRA DEPUTY PROGRAM MANAGER: Shirley L. Fortuna
(301) 492-0427

CENTER PRESIDENT: John E. Latz
(512) 522-5154

CONTRACT NO: NRC-02-88-005

ESTIMATED BUDGET: \$42,550,000

SITE: 6220 Culebra Road
San Antonio, Texas

PERIOD OF PERFORMANCE: 10/26/87 - 10/26/92

PERIOD OF THIS REPORT: 03/16/91 - 04/12/91

1. SUMMARY

1.1 Technical Status

NMSS Element 1 - CNWRA Operations

NRC and Center management continued effective coordination meetings and conferences addressing a range of day-to-day and long-term management topics (Section 2). Close coordination and appropriate input continued to be provided concerning the FY92 budget development. The Mid-Year Program Review on the Division of High-Level Waste Management and Office of Regulatory Research components of the program was conducted March 14-15, 1991. A meeting of the Center Advisory Board was held this period, together with a visit to the Waste Isolation Pilot Plant site near Carlsbad, New Mexico.

The current status of Center staffing is indicated in the attached tables. Note that these tables have been revised to reflect core staff additions in two important areas which were not included in the April 1990 Staffing Plan. Appropriate modifications will be made to these tables when the Staffing Plan is revised and approved in accordance with revisions to the Operations Plans and Project Plans. Intensive recruitment efforts continued for positions in the hydrogeology, geochemistry, and performance assessment. Review and analysis continued on resumes and other interview information which were previously obtained. Two interviews were conducted for an opening in performance assessment.

NRC comments were received on the Center Five-Year Plan, and revisions are in progress. Closure is awaited on the Center's responses to NRC comments on the ADP Plan.

Work continued to implement the responses to the Corrective Action Request that arose from an Internal QA Audit which was conducted December 4-6, 1990, at the Center. Quality Assurance activities focused on continued development and implementation of the Center QA system (particularly in the area of quality activity planning), surveillances, review of technical operating procedures and development of quality assurance procedures, and QA indoctrination and training.

NMSS Element - 2 Waste Systems Engineering and Integration

Briefings were provided to NRC staff on both the Repository Functional Analysis (RFA) Report, which was transmitted February 28, 1991, and the Regulatory Requirements and Regulatory Elements of Proof Report, which was transmitted March 15, 1991 (Section 3). These briefings had as their aim the familiarization of the NRC staff who would be reviewing the documents and subsequently working with them.

Center staff reviewed and provided comments on the NRC report on general approaches to the reduction of regulatory and institutional uncertainties that were identified in CNWRA 90-003. Review comments were provided March 22, 1991.

As work progresses in the areas noted above, the need has been identified for substantive modifications to PASS Version 2.0 to improve processing speed and functionality. A requirements document has been prepared, outlining the changes needed. Work continues on development and implementation of software quality assurance and configuration control

procedures. In addition, the PASS Security Plan was prepared in accordance with OMB Bulletin 90-08 and transmitted to NRC.

Under the day-to-day direction of the technical program Element Managers, extensive SRA activity continued on the retrievability and coordination of ESF design with repository design topics. The SRA work on retrievability continued to be PARC'd and development of Technical Review Components for coordinating ESF design with repository design continued. In addition, development of information related to the Regulatory Requirements concerning "Substantially Complete Containment" (SSC), natural resources assessment methodology, potentially adverse conditions, favorable conditions, and ground water travel time continued as Element-level activities.

No significant activities were undertaken related to the License Application Review Strategy (LARS) Recommendation Report which was completed and transmitted to NRC on November 30, 1990. Substantive additional work and completion of this document await further interactions with NRC on comments received.

NMSS Element 3 - External Quality Assurance

Staff participated in the NRC Audit Observation team at Los Alamos March 25-29, 1991, and contributed to the resulting report (Section 4). Planning for and coordination of support to future NRC Audit Observation Team activities continued, with emphasis on the upcoming U.S. Geological Survey Observation Audit.

NMSS Element 4 - Geologic Setting

GS Element staff participated in the DOE/NRC technical exchange on Mineral Stability and Applicability of Laboratory Data to Repository Transport Calculations, which was conducted at Los Alamos National Laboratory.

Interactions continued on the development of a work plan on Probabilistic Seismic Hazard Analysis. The scope of the work plan is being revised based on comments on the draft work plan.

SRA work on the Ground Water Travel Time (GWTT) study continued this period, as did technical interactions. Staff briefed cognizant NRC staff and management on work progress to date, including the results presented in the recently submitted RR/REOP report (see Chapter 3).

Intensive technical assistance activities continued by both core staff and contractors on the Natural Resources Assessment Methodology with a focus on development of the technical basis for potential regulatory guidance. Specific work continued on evaluation of potential petroleum resources and associated drilling. Current efforts focus on preparing a cohesive integrated report from the several previous submittals on this topic.

NMSS Element 5 - Engineered Barrier Systems

At NRC direction, the Center initiated a work plan to develop a NUREG/CR report on the Substantially Complete Containment (SCC) elicitation study which was conducted as part of the ongoing Feasibility Study (Section 6). A work plan outline was also begun to address the preparation of a worked example utilizing the methodologies that were identified in the earlier SCC reports.

Activities related to the performance of the engineered barrier subsystem continued with a focus on testing of the Watson crevice corrosion model. The model is being evaluated over a range of crevice gaps and depths. Work also began on modifying the model to consider heat transfer effects.

Review of literature on vitrified waste forms continued. The Center continues to await receipt of certified test specimens.

NMSS Element 6 - Repository Design, Construction, and Operations

Staff reviewed DOE responses to Site Characterization Analysis comments, as a prelude to preparing a report assessing the extent to which DOE has addressed those concerns (Section 7).

Staff participated with NRC in preparation of a draft Staff Technical Position on "Underground Facility Design - Thermal Loads" which will be submitted to the ACNW for review and comment. Development of compliance determination methods for coordinating the ESF and repository designs was initiated. Extensive support was provided to conduct related SRA activities under the WSE&I Element (see Section 3).

Activity 1 on the Repository Operational Criteria (ROC) continued, with the in-depth analyses of the 46 ROC Topics being completed. The draft report on this work is in preparation.

NMSS Element 7 - Performance Assessment

The draft SRA materials on 40 CFR Part 191, comprising Regulatory Requirements and Regulatory Elements of Proofs (REOPs) for the total system performance objective, were revised in accordance with comments received from the NRC (Section 8). Preliminary work continued on development of a Compliance Determination Strategy for the total system performance objective, consistent with the previously developed Performance Assessment Strategy.

Discussions continued this period regarding the impact of budget reductions and reallocations on the Iterative Performance Assessment work. Management and staff participated in the second management teleconference on IPA.

Total System Code development work continued and included a week-long visit by J. Park of the NRC. He trained in the use of the Total System Code, became familiar with the operating system at SwRI which he will access from the NRC, and assisted in the revision of the Requirements Document for the Total System Code.

Work also continued on sensitivity and uncertainty analysis methods and on the source term module. Progress is being made toward coupling the PHREEQE geochemistry code and a version of GLASSOL.

NMSS Element 8 - Transportation Risk Study

No report. Project completed.

Research Project 1 - Overall Research

Laboratory experimentation continued in Building 57 on three Center research projects and in other SwRI facilities (Section 10). Additional equipment continues to be set up in Building 57. The latest modifications to the building were completed in support of materials and earth sciences research activities, ancillary modifications continued.

Staff continued interactions with University of Arizona staff on preparation of the proceedings for the Workshop V Flow and Transport in Unsaturated Fractured Media Related to Radioactive Waste Disposal, which was conducted at the University of Arizona on January 7-10, 1991.

Staff commenced work on the first Research Quarterly Report for calendar year 1991.

The status of each of the ten research Project Plans is provided in Section 10.1 of this PMPR.

Research Project 2 - Geochemistry

Experiments on the kinetics of analcime dissolution continued, with liquid samples being taken for analysis at appropriate time intervals. The UV-Visible spectrophotometry analytical technique is being used for analysis of Al and Si, and an ion-selective electrode is being used for analysis of Na.

Staff assisted in groundwater and mineral chemistry modeling of the Alligators Rivers analog site. In addition, staff presented information on the Center geochemistry projects at the NRC/DOE Technical Exchange on Mineral Stability and Applicability of Laboratory Data to Repository Transport Calculations.

Research Project 3 - Thermohydrology

A focus of activity this period was evaluation of the importance of the 27 dimensionless pi terms. After screening the list to the six most important terms, a sensitivity analysis was conducted by varying each parameter by 25% about a base value which was determined from Test 5 of the Separate Effects Experiments.

Relocation of the thermohydrologics experimental apparatus to Building 57 was completed. This relocation is anticipated to provide better temperature and humidity controls for the future experiments. Work is proceeding on selection of materials and instrumentation for the next round of experiments.

Research Project 4 - Seismic Rock Mechanics

Data collection continued from the 50 extensometers, two triaxial velocity gauges, eight closure point stations, four piezometers, and hydrophone which were installed at the field experimental site at the Lucky Friday Mine. Efforts continued to develop a means to remotely acquire all of the data except the closure measurements (which are manually read).

The paper "Experimental Determination of Properties of Natural Rock Joints in a Welded Tuff" was prepared for submission for peer review. This paper will be presented at the 1991 ASME Geomechanics Symposium which will be held June 16-19, 1991, in Columbus, Ohio. Staff also worked with the NRC Project Manager on preparation of a paper titled "Stability of Underground Openings in Fractured Tuff for High-Level Waste Repository -- Regulatory and Technical Considerations" which is targeted for presentation at the conference on Engineering Solutions to the Management of Solid Radioactive Waste.

Research Project 5 - Integrated Waste Package Experiments

A review of the literature on localized corrosion was completed. The results are being compiled into a report.

Cyclic polarization experiments on 316L were completed, revealing surprising results at low concentrations of chloride. Long-term potentiostatic tests will be needed to verify whether pitting will occur under the observed conditions. Initial tests on CDA-102 and CDA-715 were also completed; analyses are in progress.

Staff attended the Houston Materials Conference where N. Sridhar made a presentation on "Evaluation of Materials for Geologic Disposal of High-Level Nuclear Waste."

Research Project 6 - Stochastic Analysis of Large-Scale Flow and Transport in Unsaturated Fractured Rock

The literature review, data review, and initial development of the modeling approach were completed. Results of the literature review were compiled and summarized in a draft report which was submitted April 1, 1991.

Research Project 7 - Geochemical Analogs

Work continued on the Natural Analog Literature Review Report, in preparation for submittal as a final document.

Preliminary X-ray diffraction studies commenced and thin sections were prepared using the materials obtained from the Peña Blanca site. Plans were made for a visit to another potential analog site located at the McDermitt Caldera.

Staff made several presentations on the project this period and plan for an invited presentation to the Nuclear Waste Technical Review Board (NWTRB) which is planned for April 16-17, 1991.

Research Project 9 - Sorption Modeling

The literature review on this project continued, with resulting information being placed into a special database for ease of access and use. Arrangements were made to acquire a copy of the leading candidate code -- CTM -- from the Pacific Northwest Laboratories.

The work plan on Experimental Studies on Uranium Sorption on Geologic Media was revised based on technical and management reviews. The draft work plan was forwarded to NRC for comment on March 29, 1991. Necessary capital equipment was purchased, in anticipation of approval of the plan and commencement of work.

Research Project 10 - Performance Assessment

Coding for modifying PORFLO-3 continued this period. A saturated fractured porous medium problem was selected as the first test problem for the SNL code DCM-3.

Work commenced on identifying disruptive scenarios, with initial emphasis on tectonic/seismic scenarios.

PORFLO-3 was used to simulate the second Las Cruces Trench experiment. Preliminary results, which used the as-measured data from 180 sampling points to generate a two-dimensional 30,000-node grid, will be summarized for presentation at the upcoming INTRAVAL meeting in Seattle. In addition, computations of equilibrium radioelement solubilities continued, using the EQ3 program and associated database. The literature review on carbon-14 retardation mechanisms continued.

LSSA Support - Development of Access Protocols for Technical Data

Staff visited the State of Nevada offices in Carson City, Nevada, to review their infrastructure and technical data handling procedures (Section 11). A trip report was prepared. Discussions began on LSSA comments on the previously submitted report.

Waste Solidification Systems

Approval was received for the Operations Plan for the Waste Solidification Systems (WSS) Program Element which was transmitted to NRC February 15, 1991 (Section 12). Reviews of material on off-gas generation and treatment continued. A visit to the Commonwealth Edison facilities is planned.

Staff participated in a joint NRC/DOE review meeting of the Integrated Radwaste Treatment System April 2-4, 1991. DOE's schedule indicates completion of the NRC Safety Evaluation Report (SER) by early October 1991.

1.2 Major Problems

Plans have been made to address the previously reported cost variances that have occurred in an update to the Operations Plans and Project Plans. Actions taken to date regarding control measures and project baseline revisions are proving beneficial.

1.3 Forecast for Next Period

Management attention will continue to be principally directed toward (a) prioritization of work, (b) effective assignment of resources necessary for the timely, high-quality completion of tasks defined in the Division of High Level Waste Operations Plans, the Overall Research Project Plan, and the LSSA Operations Plan for FY91-92, and (c) revisions to pertinent Operations and Project Plans. In addition, staffing will continue to be a high priority activity. The Center ADP Plan and Staffing Plan will be revised when comments are received from NRC. Change 1 of Revision 2 of the Center Quality Assurance Manual will continue to be implemented with an emphasis on the oversight of the Program Architecture and Systematic Regulatory Analysis development and review, and research project activities, and Change 2 will be drafted.

Development of the Program Architecture and PASS will continue with an emphasis on further analyses, development of Compliance Determination Strategies, and loading approved SRA into the database. PARC activities will continue to be intense as backup materials to the RR/REOP report and regulatory uncertainties are prepared for entry into the database. Demonstration and training on Version 2.0 of PASS will continue for Center and NRC staff, as appropriate. Revision of the associated Users Guide and further modifications to the code will also continue. The Configuration Management and Control Manual for CNWRA computer systems will continue to be implemented. Effort will also be devoted to revisions of the LARS Recommendation Report, in accordance with guidance received from NRC.

Center and SwRI quality assurance professionals will continue to plan and coordinate upcoming audits and audit observations. Staff will participate on the U.S. Geological Survey NRC Observation Audit Team.

The Geologic Setting Element activities will continue to focus on technical assistance on the potential regulatory guidance on Natural Resources Assessment Methodology, GWTT, and seismic hazard analysis. Staff will support NRC work on the SRA and will participate in technical exchange meetings, as requested.

The EBS Element will develop work plans for continued work on the technical feasibility and elicitation study regarding SCC. Review of ongoing wasteform studies and preparation for round-robin wasteform testing will continue. Implementation of the EBSPAC development plan will continue with a focus on the localized corrosion model.

Activities within the RDCO Element will continue to focus on SRA and technical position and rulemaking activities related to waste retrievability, thermal loads, mining regulations, and coordination of ESF design with repository design. The report analyzing DOE responses to the SCA comments should be completed next period. Work on the ROC will continue in accordance with the approved work plan, with the first report being completed and submitted in draft form.

Work on the various Phase 2 Iterative Performance Assessment activities will continue within the Performance Assessment Element, in accordance with the Operations Plan. SRA of the total system performance objective will also continue with a focus on preparation of a Compliance Determination Strategy.

The draft first Annual Research Report will be revised in preparation for publication as a NUREG/CR. The first Quarterly Report for CY91 will be prepared. Work will continue on all projects, in accordance with the approved Plans. Center staff will interact with the NRC on two proposed new research initiatives.

Staff will meet with the LSSA to discuss and resolve comments on the previously submitted report. Preparation of a draft plan for access protocols to technical data will commence.

Work will focus on activities in Tasks 1 and 2 of the WSS Program Element. Task 3 will also be initiated.

1.4 Summary Financial Status

Table 1 below indicates the financial status of the Center in the context of "authorized" funds established by the NRC. Table 2 displays planned and actual costs without allowance for fee to date on both a per period and a cumulative basis. In addition, these data do not include commitments, and variances are shown on both a dollar and percentage basis. Total commitments of the Center are \$217,680. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

In addition, beginning this fiscal period, we have included cumulative spending plans and actual cumulative costs to date for both the Division of High-Level Waste Management (HLW) and Office of Nuclear Regulatory Research Division of Engineering (RES) components of the Center program. These allow easy comparison of planned versus actual expenditures at the FIN level. (Note that since the LSSA project and WSS project are the only projects within their respective FINs, they are not repeated here.)

Total costs of the Center comport well with planned expenditures to date. However, cost variances associated with individual Elements and Projects are substantial in some cases. The Financial Status section of each chapter should be consulted for these details.

| Table 1. Financial Status | |
|---|--------------|
| FY91 Funds Authorized (a) | \$11,898,801 |
| FY91 Funds Costed to Date (b) | \$ 5,590,342 |
| FY91 Funds Uncosted (c) | \$ 6,308,459 |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

NOTES: (a) Authorized funds remaining after FY90 actual expenditures with fee.
(b) Actual expenditures FY91 YTD without fee.
(c) Difference between (a) and (b).

CENTER CORE STAFF - CURRENT PROFILE (4/15/91)

| EXPERTISE/EXPERIENCE | |
|--|--|
| ADMINISTRATION | J. Latz, R. Adler, H. Garcia, W. Patrick, A. Whiting |
| CODE ANALYST | R. Martin |
| DATA BASE MANAGEMENT AND DATA PROCESSING | S. McFaddin, M. Pape |
| ELECTROCHEMISTRY | G. Cragnolino |
| ENGINEERING GEOLOGY/GEOLOGICAL ENGNG | |
| ENVIRONMENTAL SCIENCES | P. LaPlante |
| GEOCHEMISTRY | W. Murphy, R. Pabalan, E. Percy, J. Prikryl, D. Turner |
| GEOHYDROLOGY/HYDROGEOLOGY | R. Ababou, R. Green, G. Wittmeyer |
| GEOLOGY | J. Russell, M. Miklas |
| GEOMORPHOLOGY/QUATERNARY GEOLOGY | |
| HEALTH PHYSICS | J. Hageman |
| INFORMATION MANAGEMENT SYSTEMS | R. Johnson, R. Marshall |
| MATERIAL SCIENCES | P. Nair, H. Manaktala, N. Sridhar |
| MECHANICAL, INCLUDING DESIGN & FABRICATION | C. Tschoepe |
| MINING ENGINEERING | S-M. Hsiung |
| NUCLEAR ENGINEERING | H. Karimi |
| NUMERICAL MODELING | |
| PERFORMANCE ASSESSMENT | B. Sagar, B. Gureghian |
| QUALITY ASSURANCE | B. Mabrito, R. Brient |
| RADIOCHEMISTRY/ISOTOPE GEOCHEMISTRY | |
| REGULATORY ANALYSIS | S. Spector (Law) |
| RELIABILITY | J. Wu |
| RISK ASSESSMENT/ANALYSIS | |
| ROCK MECHANICS | A. Chowdhury, M. Ahola |
| SEISMOLOGY | R. Hofmann |
| STRUCTURAL GEOLOGY/TECTONICS | G. Stirewalt, S. Young |
| SYSTEMS ENGINEERING | D.T. Romine, P. Mackin |
| VOLCANOLOGY/IGNEOUS PROCESSES | |

CENTER CORE STAFF - HIRING PROFILE AND STATUS (4/15/91)

| EXPERTISE/EXPERIENCE | FISCAL YEAR | | | | | | | | TOTAL REQ'D | OPEN THIS QTR |
|--|-------------|------|------|------|----|----|----|------|----------------|---------------------|
| | FY88 | FY89 | FY90 | FY91 | | | | FY92 | | |
| | | | | 1Q | 2Q | 3Q | 4Q | | | |
| ADMINISTRATION | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 |
| CODE ANALYST | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| DATA BASE MANAGEMENT AND DATA PROCESSING | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 0 |
| ELECTROCHEMISTRY | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| ENGINEERING GEOLOGY/GEOLOGICAL ENGNG (b) | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ENVIRONMENTAL SCIENCES | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| GEOCHEMISTRY | 2 | 2 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 0 |
| GEOHYDROLOGY/HYDROGEOLOGY (b) | | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 0 |
| GEOLOGY | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 0 |
| GEOMORPHOLOGY/QUATERNARY GEOLOGY (b) | | | | | | | 1 | 1 | 1 | 0 |
| HEALTH PHYSICS | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| INFORMATION MANAGEMENT SYSTEMS | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 0 |
| MATERIAL SCIENCES (b) | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 0 |
| MECHANICAL, INCLUDING DESIGN & FABRICATION | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| MINING ENGINEERING | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| NUCLEAR ENGINEERING | | | | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| NUMERICAL MODELING (b) | | | | | 1 | 1 | 1 | 1 | 1 | 0 |
| PERFORMANCE ASSESSMENT (b) (a) (d) | | 1 | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 1 |
| QUALITY ASSURANCE | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 0 |
| RADIOCHEMISTRY/ISOTOPE GEOCHEMISTY (b) | | | | | | | 1 | 1 | 1 | 0 |
| REGULATORY ANALYSIS | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| RELIABILITY | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| RISK ASSESSMENT/ANALYSIS (f) (b) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ROCK MECHANICS (b) | | 1 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 0 |
| SEISMOLOGY | | | | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| STRUCTURAL GEOLOGY/TECTONICS | | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 0 |
| SYSTEMS ENGINEERING | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 0 |
| VOLCANOLOGY/IGNEOUS PROCESSES (b) (a) | | | | | 1 | 1 | 1 | 1 | 1 | 0 |
| TOTAL REQUIRED | 20 | 28 | 40 | 44 | 49 | 50 | 52 | 52 | 52 | 3 |

(a) Interview scheduled next period.

(b) Resumes being solicited.

(c) Offer made.

(d) Offer pending.

(e) Offer accepted.

(f) Position re-opened.

(g) Negative number indicates early hire.

Staffing Summary

| | Professional | Support | Total |
|---------------------|--------------|---------|-------|
| Current | 42 | 14 | 56 |
| Planned This Date* | 46 | 12 | 58 |
| Planned End of FY91 | 52 | 14 | 66 |

*NOTE: Current budget information indicates that FY91-92 staffing will have to be constrained to approximately 46 professionals.

3700-000

CENTER COMPOSITE

Element Status Cost Report

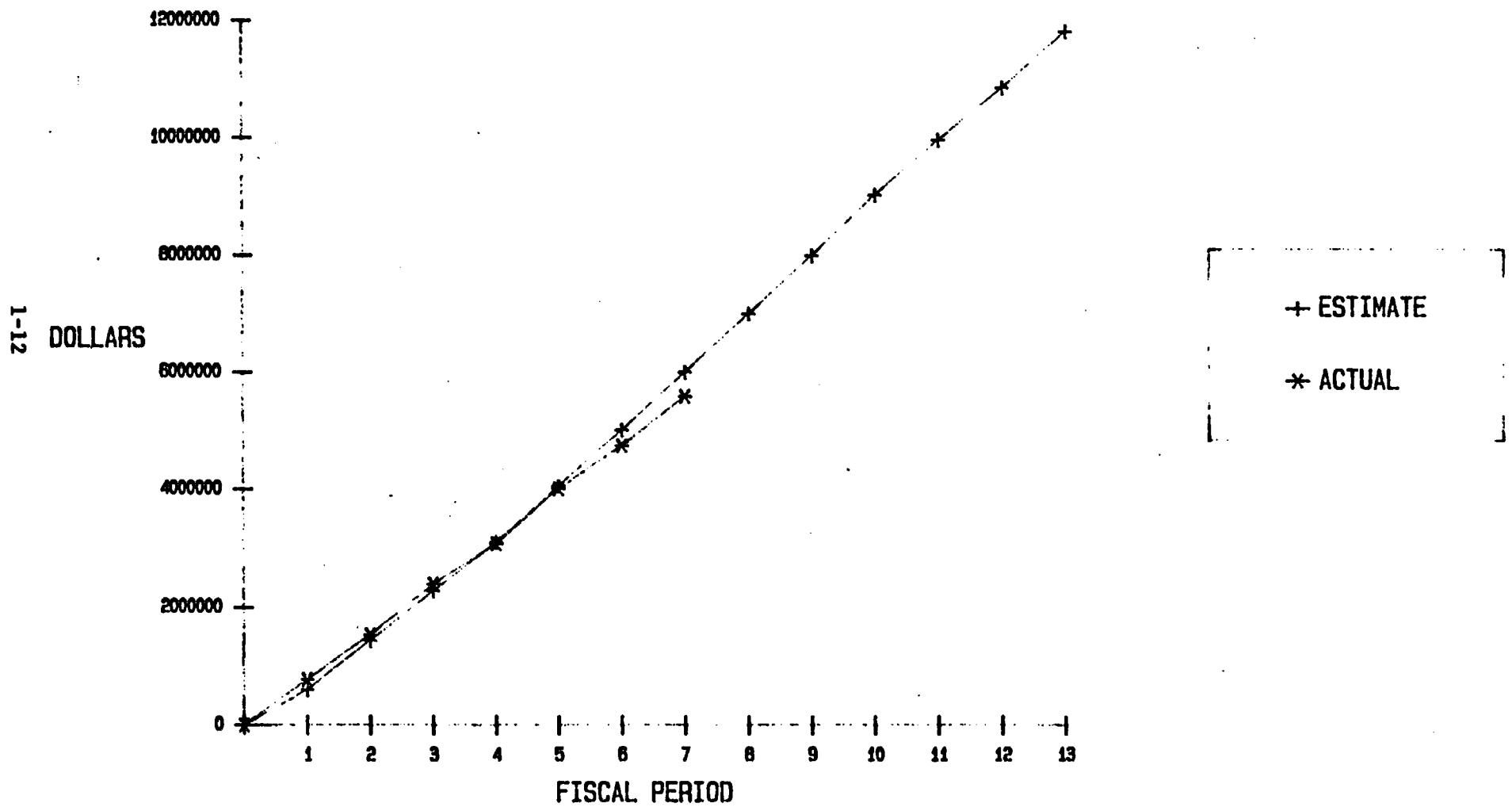
| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|----------|----------|---------|
| EST PERIOD COST | 601629 | 833898 | 850755 | 811297 | 954290 | 970559 | 1004343 | 1004245 | 1006984 | 1035543 | 956001 | 910098 | 965750 | 6026771 |
| ACT. PERIOD COST | 770452 | 763102 | 858023 | 669275 | 888589 | 759331 | 853464 | 0 | 0 | 0 | 0 | 0 | 0 | 5562237 |
| VARIANCE, \$ | -168823 | 70796 | -7268 | 142022 | 65702 | 211228 | 150878 | 0 | 0 | 0 | 0 | 0 | 0 | 464534 |
| VARIANCE, % | -28.1 | 8.5 | -0.9 | 17.5 | 6.9 | 21.8 | 15.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7.7 |
| EST. FY CUMUL | 601629 | 1435527 | 2286283 | 3097579 | 4051870 | 5022428 | 6026771 | 7031016 | 8038000 | 9073543 | 10029544 | 10939642 | 11905392 | |
| ACTUAL FY CUMUL | 770452 | 1533555 | 2391578 | 3060853 | 3949442 | 4708772 | 5562237 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.065 | 0.129 | 0.201 | 0.257 | 0.332 | 0.396 | 0.467 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | -168823 | -98027 | -105295 | 36726 | 102428 | 313656 | 464534 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | -28.1 | -6.8 | -4.6 | 1.2 | 2.5 | 6.2 | 7.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3700-000 CENTER COMPOSITE - FY 91

Estimate vs. Actual



3702

HLW

Element Status Cost Report

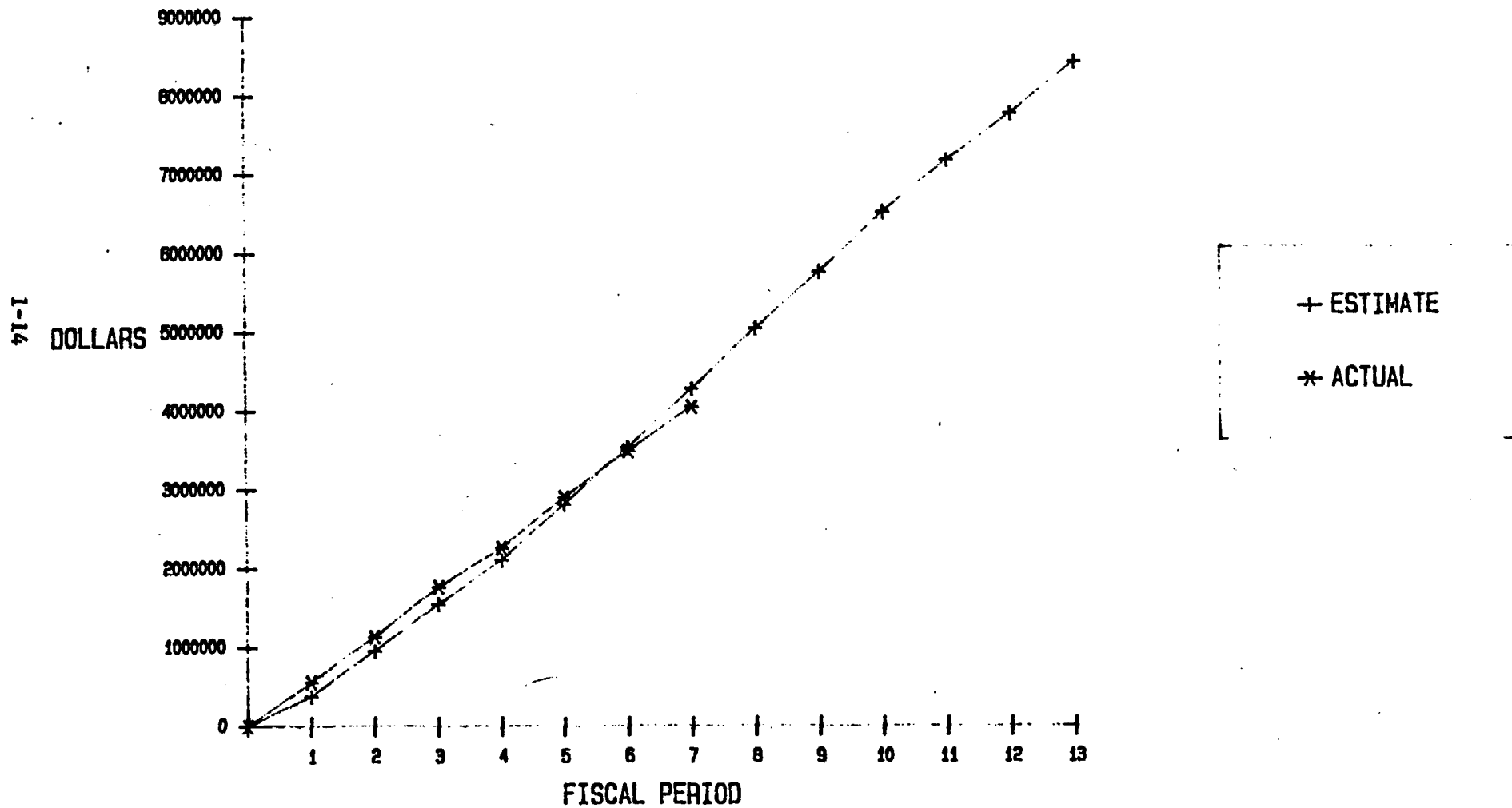
| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| EST PERIOD COST | 385369 | 569722 | 599578 | 557304 | 712291 | 713304 | 752978 | 759847 | 721049 | 753000 | 664750 | 594661 | 659282 | 4290546 |
| ACT. PERIOD COST | 561733 | 574543 | 638506 | 488560 | 646698 | 582490 | 567385 | 0 | 0 | 0 | 0 | 0 | 0 | 4059915 |
| VARIANCE, \$ | -176364 | -4821 | -38928 | 68744 | 65593 | 130814 | 185593 | 0 | 0 | 0 | 0 | 0 | 0 | 230631 |
| VARIANCE, % | -45.8 | -0.8 | -6.5 | 12.3 | 9.2 | 18.3 | 24.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.4 |
| EST. FY CUMUL | 385369 | 955091 | 1554669 | 2111973 | 2824264 | 3537568 | 4290546 | 5050393 | 5771442 | 6524442 | 7189192 | 7783853 | 8443136 | |
| ACTUAL FY CUMUL | 561733 | 1136276 | 1774781 | 2263342 | 2910040 | 3492530 | 4059915 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.067 | 0.135 | 0.210 | 0.268 | 0.345 | 0.414 | 0.481 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | -176364 | -181185 | -220113 | -151369 | -85776 | 45038 | 230631 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | -45.8 | -19.0 | -14.2 | -7.2 | -3.0 | 1.3 | 5.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3702 HIGH LEVEL WASTE - FY 91

Estimate vs. Actual



3704

RES

Element Status Cost Report

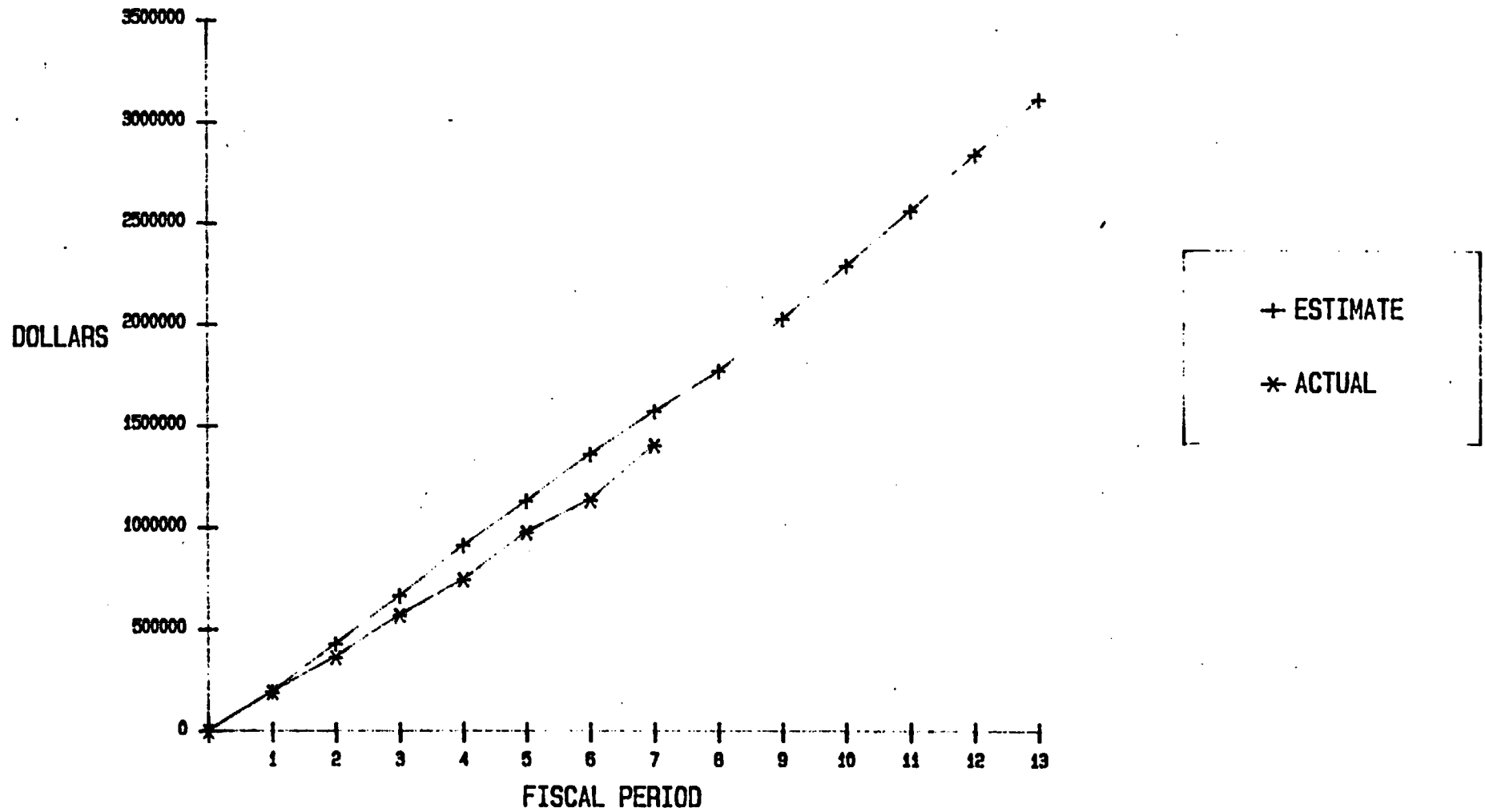
| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|--------|--------|--------|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| EST PERIOD COST | 188126 | 236495 | 239759 | 247763 | 217059 | 229285 | 213528 | 199296 | 255346 | 264709 | 269231 | 280822 | 273079 | 1572016 |
| ACT. PERIOD COST | 189342 | 172182 | 208364 | 176210 | 232994 | 158052 | 267658 | 0 | 0 | 0 | 0 | 0 | 0 | 1404802 |
| VARIANCE, \$ | -1216 | 64313 | 31395 | 71553 | -15935 | 71233 | -54130 | 0 | 0 | 0 | 0 | 0 | 0 | 167214 |
| VARIANCE, % | -0.6 | 27.2 | 13.1 | 28.9 | -7.3 | 31.1 | -25.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 10.6 |
| EST. FY CUMUL | 188126 | 424621 | 664381 | 912144 | 1129203 | 1358488 | 1572016 | 1771312 | 2026659 | 2291368 | 2560598 | 2841420 | 3114500 | |
| ACTUAL FY CUMUL | 189342 | 361524 | 569888 | 746098 | 979093 | 1137144 | 1404802 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.061 | 0.116 | 0.183 | 0.240 | 0.314 | 0.365 | 0.451 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | -1216 | 63097 | 94492 | 166046 | 150111 | 221344 | 167214 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | -0.6 | 14.9 | 14.2 | 18.2 | 13.3 | 16.3 | 10.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3704 RESEARCH - FY 91

Estimate vs. Actual



2. CNWRA OPERATIONS

NRC Program Element Manager: Shirley L. Fortuna

NRC Project Officer: James T. Conway (Task 5)

CNWRA Element Manager: Henry F. Garcia

Key Personnel: J. Latz, H. Garcia, A. Whiting, R. Johnson, W. Patrick,
R. Adler, B. Mabrito

Subcontractors/Consultants: Advisory Board Committee: F. P. Cotter, A. P. Rollins, Jr., G.
T. McBride, Jr., and P. T. Flawn

2.1 Technical Status

The tasks associated with this Element cover a variety of administrative functions, including the numerous management and staff activities described in the current Operations Plan. All projects and/or programs (i.e., management meetings and related discussions, selected internal training sessions, personnel recruitment, quality assurance activities, and development of various plans and programmatically related issues) are proceeding consistent with resource availability and time constraints.

Task 1 - Management and Technical Support

Effective coordination of work activities continued during this period. Center management participated in various meetings including the Center Mid-Year Review and Operations/Project Plans meetings with cognizant personnel from the Division of High Level Waste Management and Office of Nuclear Regulatory Research at the White Flint and Nicholson Lane NRC offices, as well as in San Antonio. Center management and technical staff participated in the visit to Southwest Research Institute by NRC Chairman K. Carr. The Center Advisory Board accompanied by various Center management and technical staff visited the Waste Isolation Pilot Plant in Carlsbad, N.M., site and conducted a meeting of the Board. Center management continued its evaluation of the impact resulting from the temporary reorganization of Center on its operations. Preparations for the Center Mid-Year Review, ACNW Meeting and Operations/Project Plans development coupled with the continuation of budgetary discussions for the following two fiscal years consumed a large measure of management's attention.

Task 2 - Develop and Sustain Technical and Analytical Capabilities

The Center is continuing input of various documents and correspondence into the Technical Document Index and Correspondence Control Log. Center staff maintained their attendance at and contributions to both SwRI and professional society sponsored training courses, conducive to their career development.

Task 3 - Staffing Activities

No Center core staff were added during this period. Two more candidates for a position in Performance Assessment were interviewed. The Center continued its screening of potential candidates for the remaining positions in the geosciences and performance assessment disciplines. Drs. J. Russell and B. Sagar are aware of potential funding constraints that may impact their pursuit of such candidates. The revision of the staff requirements consistent with such constraints has occasioned another re-examination of Center core staff requirements.

Task 4 - Operations Plans and Five Year Plan Development

Comments were received on the draft version of the Center Five-Year Plan. The Center remained in full pursuit of those activities associated with the revision of Operations and Project Plans. The Center awaits closure on its responses to the NRC comments on the ADP Plan conveyed to the NRC last period.

Task 5 - CNWRA Internal QA

Center staff continued implementation of the Center Quality Assurance Manual (CQAM), through development of Quality Assurance Procedures (QAPs), surveillance of work at the Center laboratory, and assistance to the technical staff in developing and implementing Technical Operating Procedures. Work continues on the Corrective Action Request initiated as a result of the December internal audit. The corrective actions provide for phased implementation of software configuration control/documentation and existing data controls, based on the Center's schedule of activities important to quality, and progress is being made to meet the objectives.

Regular project status review meetings continue to take place between Principal Investigators and QA to monitor progress of the research projects and identify surveillance points. QA surveillance reports have been generated on research activities conducted by the Center, and are maintained as QA records.

2.2 Major Problems

None.

2.3 Forecast for Next Period

The Center will deliver the final version of its Five-Year Plan on the final day of May. After receipt of NRC comments, the final versions of the Center ADP and Staffing Plans will be completed. Contingent on the availability of sufficient funding, the Center's recruitment efforts will continue to be focused on the geosciences and performance assessment disciplines. The Center will engage in the revision of the Operations/Project Plans. The PMPR will be produced for the eighth period of FY91. Attendance at professional development events and participation in professional/technical society activities will be encouraged. Work will continue on the introduction of new data in the Technical Document and Correspondence Control Indexes.

The current CQAM will continue to be implemented, as will the actions to respond to the Corrective Action Request. CQAM Revision 2, Change 2 is being written and is essentially a "fine tuning" of the current CQAM (Revision 2, Change 1) with minor modifications in certain areas to better meet the NRC Review Plan for HLW QA Programs and incorporating lessons learned over the past three years. The CQAM change will be sent to the NRC in early May, 1991.

2.4 Element Financial Status

Table 1 below indicates the financial status of this Element in the context of "authorized" funds established by the NRC. Table 2 displays planned and actual costs without allowance for fee to date on both a per period and a cumulative basis. In addition, these data do not include commitments, and variances are shown on both a dollar and percentage basis. Commitments in this Element are \$8,024. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Relatively minor cost variances have been experienced to date. No specific action is required in this Element.

| Table 1. Financial Status | |
|---|-------------|
| FY91 Funds Authorized (a) | \$2,190,639 |
| FY91 Funds Costed to Date (b) | \$1,134,911 |
| FY91 Funds Uncosted (c) | \$1,055,728 |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

NOTES: (a) Authorized funds remaining after FY90 actual expenditures with fee.
 (b) Actual expenditures FY91 YTD without fee.
 (c) Difference between (a) and (b).

3702-070

CNWRA OPS

Element Status Cost Report

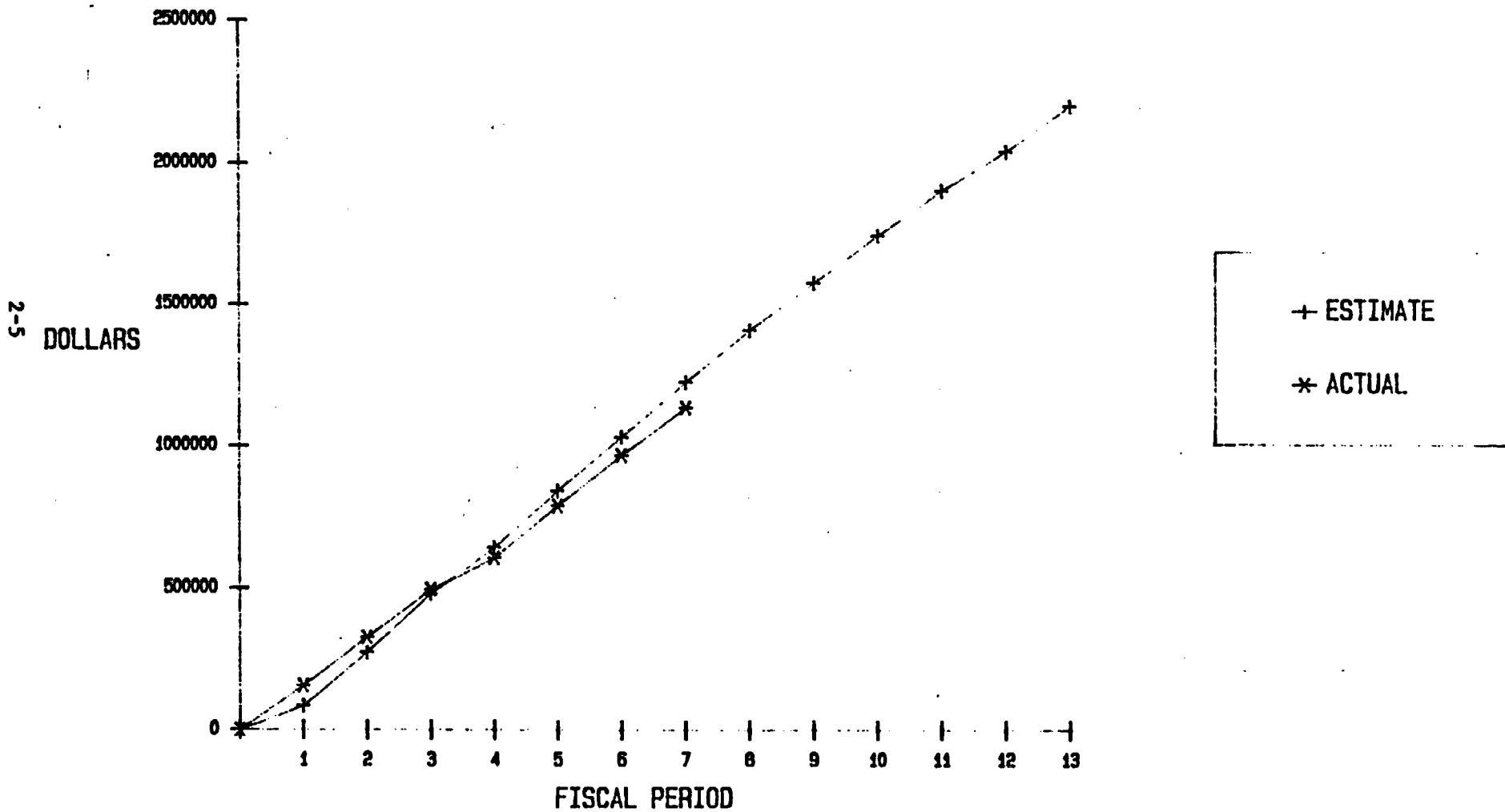
| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|--------|--------|--------|--------|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| EST PERIOD COST | 83748 | 188826 | 208393 | 162437 | 198761 | 188426 | 195169 | 182795 | 168243 | 167357 | 159632 | 140246 | 160563 | 1225760 |
| ACT. PERIOD COST | 154970 | 171371 | 169190 | 111360 | 182216 | 176821 | 168984 | 0 | 0 | 0 | 0 | 0 | 0 | 1134911 |
| VARIANCE, \$ | -71222 | 17455 | 39203 | 51077 | 16545 | 11605 | 26185 | 0 | 0 | 0 | 0 | 0 | 0 | 90849 |
| VARIANCE, % | -85.0 | 9.2 | 18.8 | 31.4 | 8.3 | 6.2 | 13.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7.4 |
| EST. FY CUMUL | 83748 | 272574 | 480967 | 643404 | 842165 | 1030591 | 1225760 | 1408555 | 1576798 | 1744155 | 1903787 | 2044033 | 2204596 | |
| ACTUAL FY CUMUL | 154970 | 326341 | 495530 | 606891 | 789107 | 965927 | 1134911 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.070 | 0.148 | 0.225 | 0.275 | 0.358 | 0.438 | 0.515 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | -71222 | -53767 | -14563 | 36513 | 53058 | 64664 | 90849 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | -85.0 | -19.7 | -3.0 | 5.7 | 6.3 | 6.3 | 7.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3702-070 CNWRA OPS - FY 91

Estimate vs. Actual



3. WASTE SYSTEMS ENGINEERING AND INTEGRATION

NRC Program Element Manager: Philip M. Altomare

NRC Project Officer: Robert L. Johnson (Task 9)

CNWRA Element Manager: D. Ted Romine

Key Personnel: R. Adler, R. Johnson, P. LaPlante, J. Latz, P. Mackin, R. Marshall,
S. McFaddin, M. Pape, W. Patrick, S. Spector, A. Whiting

Subcontractor/Consultant: J. Cooper

3.1 Technical Status

During this period, the major effort of this element of the Center involved presentations to the NRC staff on the development of the Repository Functional Analysis (RFA) (Draft Report delivered to NRC on February 28, 1991), the Regulatory Requirement and Regulatory Element of Proof (RR/REOP) Report (delivered on March 15th), and continuing Systematic Regulatory Analysis (SRA) efforts associated with Substantially Complete Containment (SCC) and Natural Resources. Additional activities included: (1) conducting Center staff training for PASS Version 2.0; (2) PARC and QA review of Regulatory Requirement Synopses in preparation for loading into the PA Database (PADB, Version 2.0); (3) discussions related to the LARS concept; (4) initial steps toward a draft revision of the CDS portion of the SRA procedure consistent with the current LARS approach; and (5) optimizing and extending features of PASS Version 2.0 based on lessons learned.

Task 1 - Statutory and Regulatory Analysis

On April 2, two presentations were made to the NRC staff. The first explained the purpose, content and development process of the RR/REOP Report. The second treated similar subjects for the report of the RFA and the "Sufficiency Test" of Part 60 based on the RFA. These presentations were intended to help prepare the staff for a review of these documents. The NRC response is expected early in the next period.

During this period, Center comments were formally submitted on the body of the uncertainty reduction draft report as WSE&I Intermediate Milestone 3702-031-123 (reference letter from A. Whiting to P. Altomare on March 21, 1991).

Several meetings were held among the Center and the NRC staff and management on schedules NRC staff involvement in the SRA process and associated activities, and other items related to SRA and Program Architecture in general. Extensive discussions were held relative to FY91 and FY92 funding to provide the basis for the Center Operations Plan update scheduled for May 13, 1991.

Throughout this period, the above effort was supported by the PASS and other user systems maintained and serviced by the IMS staff.

Task 2 - Program Architecture Development and Support System

During this period, the RR1001 (System Performance after Permanent Closure) was re-PARC'd and loaded into the database after NRC comments had been addressed.

The Intermediate Milestone 20-3702-032-025 semiannual letter status report on "Loading of PARC'd Data" in the Program Architecture Data Base (PADB) was delivered on March 29, 1991.

A requirements analysis has been prepared for upgrading the PASS Version 2.0 template-based batch input process system. An interactive input process, based on user prompts and guidance on the workstation, with data storage on the hard disk and automated loading on the mainframe, is being developed for use in joint activities involving the NRC and Center staffs.

Center staff involved in loading the PADB are being trained in the input/output functions of PASS Version 2.0 as work has progressed. This is also providing a shakedown of the Version 2.0. Changes based on feedback from Center users are being made to optimize and extend features of PASS operations. A training outline and schedule is being prepared for Center staff and the NRC staff.

The Center configuration management and control system is being implemented on the Center's LAN Server. Specific procedures to utilize such a system for Scientific and Engineering Codes are being implemented. Software summary forms are being completed according to NUREG-0856 documentation standards for the initial systems included in the Center's Configuration Control. Meetings of the Center Configuration Control Board (CCB) are held as necessary and meeting minutes are distributed within the Center.

The PASS Security Plan was updated and delivered in the requested format of OMB Bulletin 90-08.

Task 3 - HLWM Program Analysis and Integration

Updated NRC schedules were analyzed and discussed by Center WSE&I and IMS staff in planning and integrating additional and revised Center project schedules. Center project plans added or changed each period are analyzed relative to integration with overall Center Operation's Plans and NRC, DOE and NWPAA major milestones.

Task 4 - RDCO Related Program Architecture Development for Technical Positions and Rulemaking Basis

SRA activities on waste retrievability and coordination of ESF design with repository design were carried out during this reporting period. The development of technical review components for coordinating ESF design with repository design continued during this period. The SRA on waste retrievability continued to be PARC'd.

Task 5 - GS Related Program Architecture Development for Technical Positions and Rulemaking Basis

SRA activities in this area were related to Natural Resources Assessment and the potential rulemaking on Ground Water Travel Time. This work is reported under the Geologic Setting Program Element.

Task 6 - EBS Related Program Architecture Development for Technical Positions and Rulemaking Basis

Activities related to the RR1002 (Substantially Complete Containment) are discussed under Section 6 of this report.

Task 8 - Performance Assessment Program Architecture Development for Technical Positions and Rulemaking Basis

SRA activities related to the RR1001 (System Performance after Permanent Closure) are discussed under Section 8 of this report.

Task 9 - WSE&I Related Program Architecture Development for Technical Positions and Rulemaking Basis

Only limited activity on the LARS occurred during this period due to limited availability of appropriate Center and NRC staff.

3.2 Major Problems

Previously identified problems (PMPR Period 4 Report) are nearing resolution.

3.3 Forecast for Next Period

Element activities during the next period will be focused on:

- Determining the impact of scope and schedule changes on WSE&I deliverables based on the outcome of several Center/NRC Management Meetings, and updating the Operations Plans accordingly.
- Participation in a meeting on April 25, 1991, between the NRC and Center staffs to resolve the relationship of Sections 112 and 122 of 10 CFR Part 60.
- Continued loading into the PADB of approved SRA information on various Regulatory Requirement Topics, as time permits.
- Preparations for PASS Version 2.0 and SRA training of NRC staff along with the development of examples of SRA from Retrievability (RR0002).
- Completion of a revision to the PASS Version 2.0 User's Guide and a specification for interactive input of data.

- Continued optimization and extension of features in PASS Version 2.0
- Continued implementation of the Configuration Management and Control Manual procedure and tracking systems.
- Begin development of the PASS Version 2.0, interactive support subsystem.
- Continued implementation of software changes for PADB maintenance and configuration-control.
- Anticipating receipt of NRC annotated outline of LARS Document to initiate Center participation in Task Force on said subject.
- Assistance to NRC in developing guidelines for "typing" RR's and a CDS/CDM Procedure and Generic Work Plan for the SRA activities on the three RR Topics to be worked by the NRC staff, and provide a preliminary Compliance Determination Strategy for RR0002 Retrievability.
- Continued preparation for the repeat of Systems Engineering Course to be presented to NRC (May 22-23, 1991). A summary of this course will be presented to Center staff on May 20.
- Preparation for a course on SRA to be presented to the NRC staff on May 29-30, 1991.

3.4 Element Financial Status

Table 1 below indicates the financial status of this Element in the context of "authorized" funds established by the NRC. Table 2 displays planned and actual costs without allowance for fee to date on both a per period and a cumulative basis. In addition, these data do not include commitments, and variances are shown on both a dollar and percentage basis. Commitments in the Element are \$66,663. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Costs incurred to date are being reduced significantly but are still 10% over planned expenditures. It is anticipated that the remaining cost variances will be remedied when the Operations Plans are revised and work efforts are focused and rescheduled consistent with guidance on activity prioritization and resource availability. These Operation Plan updates are anticipated to be completed May 13, 1991, during the next reporting period.

| Table 1. Financial Status | |
|---|-------------|
| FY91 Funds Authorized (a) | \$2,329,667 |
| FY91 Funds Costed to Date (b) | \$1,293,581 |
| FY91 Funds Uncosted (c) | \$1,036,086 |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

NOTES:

- (a) Authorized funds remaining after FY90 actual expenditures with fee.
- (b) Actual expenditures FY91 YTD without fee.
- (c) Difference between (a) and (b).

3702-030

WSE&I

Element Status Cost Report

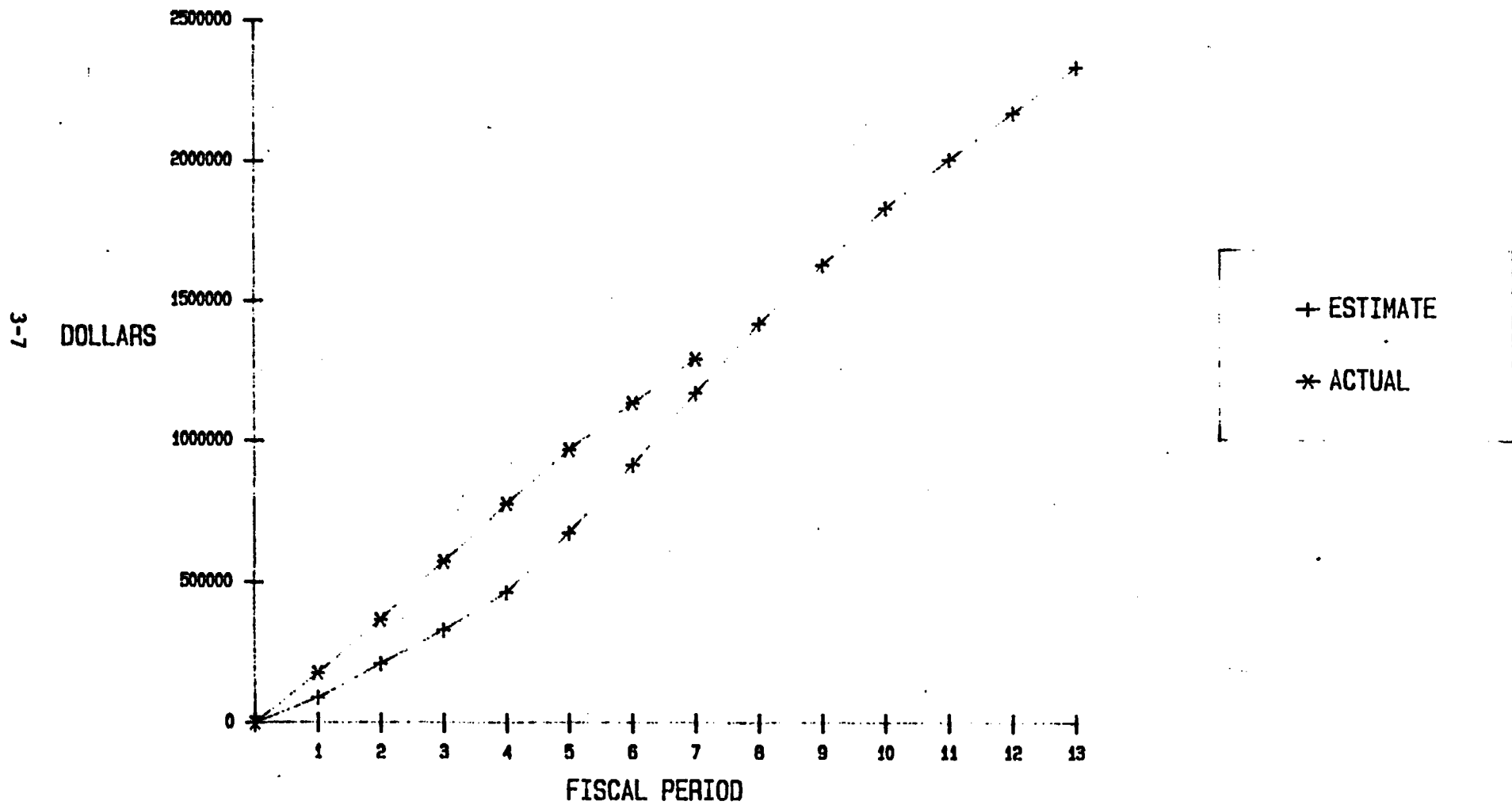
| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| EST PERIOD COST | 88130 | 121982 | 119294 | 134867 | 211174 | 239971 | 257346 | 247080 | 210701 | 205460 | 172290 | 166842 | 163199 | 1172764 |
| ACT. PERIOD COST | 175483 | 191583 | 207239 | 203017 | 190578 | 168953 | 156728 | 0 | 0 | 0 | 0 | 0 | 0 | 1293581 |
| VARIANCE, \$ | -87353 | -69601 | -87945 | -68150 | 20596 | 71018 | 100618 | 0 | 0 | 0 | 0 | 0 | 0 | -120817 |
| VARIANCE, % | -99.1 | -57.1 | -73.7 | -50.5 | 9.8 | 29.6 | 39.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -10.3 |
| EST. FY CUMUL | 88130 | 210112 | 329406 | 464273 | 675447 | 915418 | 1172764 | 1419843 | 1630544 | 1836004 | 2008294 | 2175136 | 2338335 | |
| ACTUAL FY CUMUL | 175483 | 367066 | 574305 | 777322 | 967900 | 1136853 | 1293581 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.075 | 0.157 | 0.246 | 0.332 | 0.414 | 0.486 | 0.553 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | -87353 | -156954 | -244900 | -313049 | -292454 | -221435 | -120817 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | -99.1 | -74.7 | -74.3 | -67.4 | -43.3 | -24.2 | -10.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3702-030 WSE&I - FY 91

Estimate vs. Actual



4. QUALITY ASSURANCE

NRC Program Element Manager: Kenneth R. Hooks

CNWRA Element Manager: Bruce Mabrito

Key Personnel: B. Mabrito, R. Brient, T. Trbovich

Subcontractors/Consultants: None

4.1 Technical Status

Task 1 - DOE QA Site Characterization Audit Observations

A Center QA staff member participated on the NRC Los Alamos Audit Observation Team (AOT) which conducted its work March 25-29, 1991, in New Mexico and contributed to the AOT report. Participation on these NRC teams allows the Center QA staff to maintain familiarity with the DOE HLW activities which are often similar to the Center work and both require rigorous QA systems. In addition, there were preliminary discussions regarding the planned U.S. Geological Survey DOE audit at Denver in May of 1991.

Task 2 - Conduct QA On-Site Visits/Periodic Meetings

During this period Center QA personnel regularly interfaced with NRC QA staff by telephonic and E-Mail communications and kept each other informed on developments in the HLW program. Additionally, the Center Director of Quality Assurance attended the American Society for Quality Control Second International Waste Management Conference in Nevada March 18-20, 1991. A trip report was submitted to the NRC Program Element Manager documenting the ASQC Conference activities.

Task 3 - Review and Update NRC QA Documents And Staff Technical Positions(Unfunded)

No activity this period.

Task 4 - Review DOE QA Program Documents

No activity this period.

4.2. Major Problems

None.

4.3 Forecast for Next Period

Center activities in this area will continue as directed by the NRC Program Element Manager for External QA, and as identified by the Center QA Director. These activities will include preparation for the NRC AOT for the DOE audit of the U.S.G.S. at Denver.

4.4 Element Financial Status

Table 1 below indicates the financial status of this Element in the context of authorized funds established by the NRC. Table 2 displays planned and actual costs, without allowance for fee, to date on both a per period and a cumulative basis. In addition, these data do not include commitments, and variances are shown on both a dollar and percentage basis. Commitments in the Element are \$1,200. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Costs incurred to date are significantly less than planned. This is due to the lower than expected level of audit observation activity, and is to be expected since the DOE "backloads" their audit schedules and more audits are planned for the second half of the FY. It is anticipated that these costs variances will be remedied when the Operations Plans are revised and the pace of audit observations is factored in the costs estimates of this revision.

| Table 1. Financial Status | |
|---|------------|
| FY91 Funds Authorized (a) | \$ 171,592 |
| FY91 Funds Costed to Date (b) | \$ 43,640 |
| FY91 Funds Uncosted (c) | \$ 127,952 |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

NOTES: (a) Authorized funds remaining after FY90 actual expenditures with fee.
(b) Actual expenditures FY91 YTD without fee.
(c) Difference between (a) and (b).

3702-040

QA

Element Status Cost Report

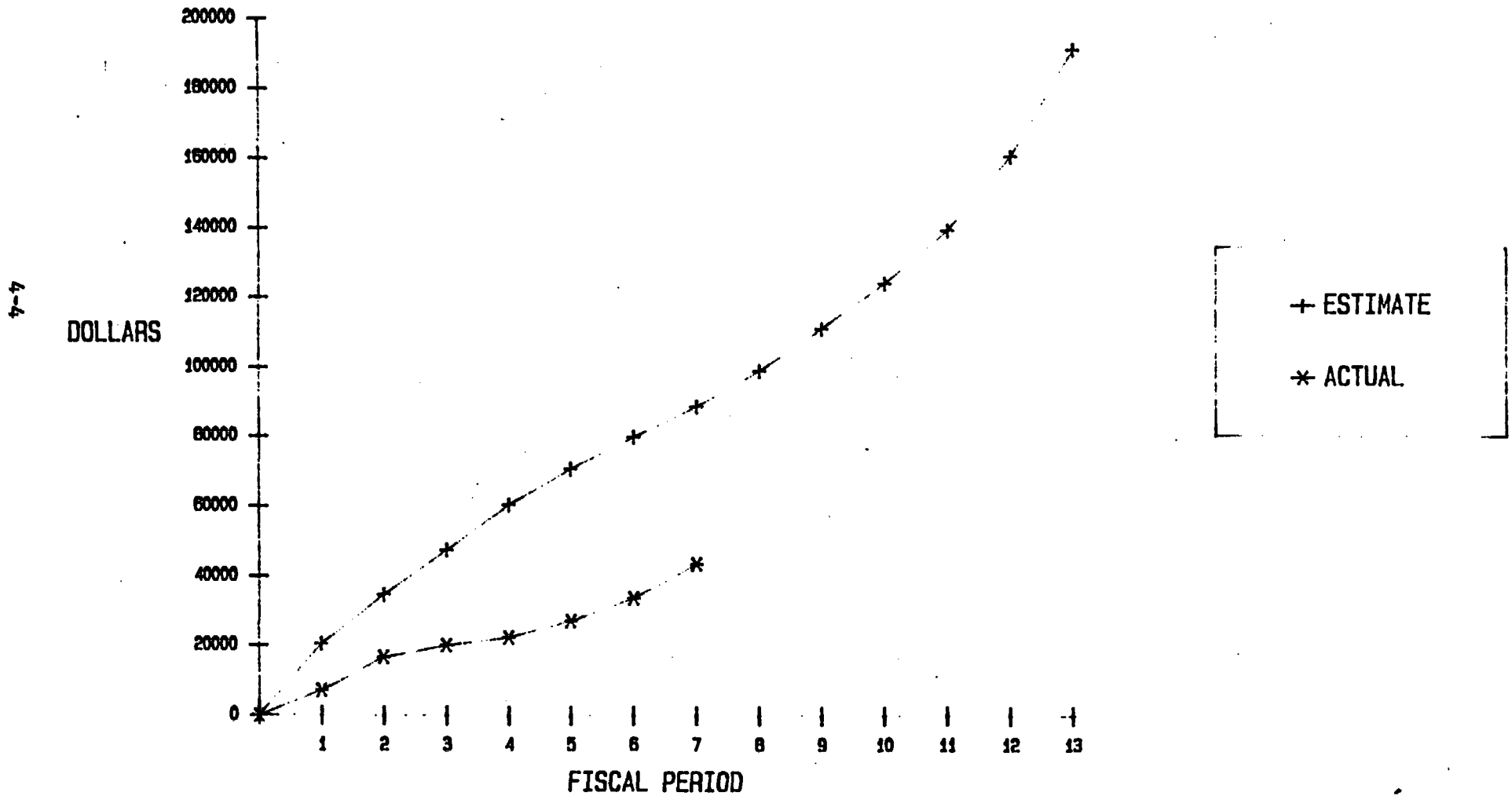
| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|-------|
| EST PERIOD COST | 20466 | 14312 | 12702 | 12931 | 10187 | 9150 | 8984 | 10264 | 12175 | 13060 | 15397 | 21392 | 30707 | 88731 |
| ACT. PERIOD COST | 7162 | 9534 | 3322 | 2382 | 4809 | 6597 | 9834 | 0 | 0 | 0 | 0 | 0 | 0 | 43640 |
| VARIANCE, \$ | 13304 | 4777 | 9380 | 10549 | 5378 | 2553 | -850 | 0 | 0 | 0 | 0 | 0 | 0 | 45091 |
| VARIANCE, % | 65.0 | 33.4 | 73.8 | 81.6 | 52.8 | 27.9 | -9.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 50.8 |
| EST. FY CUMUL | 20466 | 34777 | 47480 | 60410 | 70598 | 79747 | 88731 | 98995 | 111170 | 124230 | 139627 | 161019 | 191726 | |
| ACTUAL FY CUMUL | 7162 | 16696 | 20018 | 22400 | 27209 | 33806 | 43640 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.037 | 0.087 | 0.104 | 0.117 | 0.142 | 0.176 | 0.228 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | 13304 | 18081 | 27461 | 38011 | 43389 | 45941 | 45091 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | 65.0 | 52.0 | 57.8 | 62.9 | 61.5 | 57.6 | 50.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3702-040 QA - FY 91

Estimate vs. Actual



5. GEOLOGIC SETTING

NRC Program Element Manager: David Brooks

CNWRA Element Manager: John L. Russell

Key Personnel: R. Hofmann, M. Miklas, W. Murphy, R. Pabalan, E. Percy, J. Russell, G. Stirewalt, D. Turner, S. Young

Subcontractors/Consultants: L. McKague

5.1 Technical Status

General

G. Stirewalt attended the NRC Yucca Mountain "team meetings" on March 27 and April 3 and 10, and other NRC meetings at Rockville, Maryland pertinent to the Center's Geologic Setting Program Element (GSPE) technical activities. J. Russell presented information on the Geologic Setting Element during the NRC's Mid-Year Program Review of the Center which was held in San Antonio. Another major effort consisted of preparation of a revised FY91-92 Operations Plans for the DHLWM.

Geologic Setting Program Element Interfaces With Other Center Activities

Center geoscientists conducted work for the Performance Assessment, WSE&I, and Repository Design Construction and Operations Program Elements, promoting integration of technical input from the geosciences into technical assistance activities of the Center's other Program Elements, and in support of the Licensing Support System Administrator. GSPE staff supported preparation of materials for the portions of the Center's Regulatory Requirement- Regulatory Element of Proof deliverable pertinent to the GSPE. Center geoscientists were also heavily involved with the conduct of geochemistry research performed in three Center research projects. These activities are reported in the appropriate sections of this PMPR.

Task 1 - Prelicensing Activity

Subtask 1.1 - Review DOE's Site Characterization Plan (SCP) Progress Reports and Support NRC/DOE Prelicensing Technical Exchange Meetings

R. Pabalan, W. Murphy, and D. Turner participated in a NRC-DOE Technical Exchange Meeting on Mineral Stability and Applicability of Laboratory Data to Repository Transport Calculations. This technical exchange was conducted at Los Alamos, New Mexico. The Center staff made a presentation on certain aspects of CNWRA geochemical modeling and experimentation investigations. Center representation was also provided at ACNW Meetings.

Subtask 1.2 - Review DOE's Study Plans

No activity occurred in this subtask during the reporting period.

Subtask 1.3 - Support NRC in On-Site Visits

No activity occurred in this subtask during the reporting period.

Task 2 - Regulatory and Technical Guidance Development

Subtask 2.1 - Assistance in the Development of Staff Positions and Related Regulatory Guidance

Subtask 2.1.1 - Assistance in Developing a Probabilistic Seismic Hazard Analysis Staff Position
(Center Technical Leader - R. Hofmann)

Center staff continued review of NRC and DOE documents to develop the background for Center activities on Probabilistic Seismic Hazard Analysis activities.

Definition of the scope (and therefore cost and schedule) of the Center's continuing work in the draft work plan was revised by the Center. The scope of the work plan was adjusted based upon comments provided on the draft work plan by the cognizant NRC staff. A revised draft work plan was transmitted to the NRC staff.

Subtask 2.1.2 - Assistance in the Development of Hydrology Methodology for Unsaturated Media Regulatory Guidance
(Center Technical Leader - G. Wittmeyer)

No activity occurred on this Subtask during Period 7. This is in concert with the decision made during NRC and CNWRA management meetings conducted February 20 and 21 where the decision was made to close work on this activity in deference to higher priority work in Subtask 2.1.3 and in performance assessment.

Subtask 2.1.3 - Assistance in the Preparation of Groundwater Travel Time/Disturbed Zone Rule Regulatory Guidance (Center Technical Leader - R. Green)

Center staff continued activities on the delineation of technical and regulatory alternatives to the groundwater travel time subsystem requirement. During Period 7, the Center staff presented to cognizant NRC staff a summary of work progress for this subtask. This presentation also included a discussion of work pertinent to this subtask which was delivered to the NRC in the RR/REOP Report.

Subtask 2.1.4 - Assistance in Developing the Technical Basis of SRA Defined Regulatory Guidance (Center Technical Leader- M. Miklas)

Intensive work effort on Natural Resources Assessment Methodology occurred during Period 7. The technical basis for potential regulatory guidance options continued to be

developed. Background material related to evaluation of potential petroleum resources and drilling which could be reasonably expected to be associated with exploration for petroleum resources was in preparation by Center staff. Activities were continued to establish potential relationships between natural resources regulatory requirements and the performance objectives. The integration of previous Center natural resources assessment methodology deliverables into the options report culminating the efforts in this subtask also continued in Period 7. The Center staff presented to cognizant NRC staff a summary of work progress for this subtask. This presentation also included a discussion of work pertinent to this subtask which was included in the Center's RR/REOP Report.

Subtask 2.2 - Assistance in the Development of Rules and Amendments

No activity occurred in this subtask during the reporting period. This subtask is held in reserve for potential future activity. No funding presently exists for this subtask.

Subtask 2.3 - Preparation of Technical Input for Other Guidance Documents

No activity occurred in this subtask during the reporting period. This subtask is held in reserve for potential future activity. No funding presently exists for this subtask.

Task 3 - Analysis, Codes and Methods

No activity occurred in this task during the reporting period. This task is held in reserve for potential future activity. No funding presently exists for this task.

5.2 Major Problems

None to report.

5.3 Forecast for Next Period

Technical assistance supporting the development of potential regulatory guidance for natural resources assessment methodology and groundwater travel time will continue. It is anticipated that discussions between the Center and NRC will occur on finalization of appropriate modifications for technical assistance activities which will be presented in the revised FY91-92 Operations Plans. Discussions between the Center and NRC should be sufficient to enable preparation of a final work plan for probabilistic seismic hazard analysis. Support will be provided to NRC/DOE technical exchange meetings and related meetings, as appropriate. Period 8 activities will include preparation of a major revision of the CNWRA FY 91-92 Operations Plans for the Development of High-Level Waste Management.

5.4 Element Financial Status

Table 1 below indicates the financial status of this Element in the context of "authorized" funds established by the NRC. Table 2 displays planned and actual costs without

allowance for fee to date on both a per period and a cumulative basis. In addition, these data do not include commitments, and variances are shown on both a dollar and percentage basis. Commitments for this Element are \$15,429. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Cumulative Costs incurred to date are significantly higher than planned. This is due to the higher than expected level of: (a) Task 1 support to NRC precicensing activity which was in the form of participation in meetings, (b) structural modeling activities extended into FY91 from FY90, and (c) extension of the duration of work on natural resources. The greatest negative cost variance between planned and actual costs of \$73,433 occurred in Period 1. Corrective actions including decreases in trips anticipated with Task 1 and cessation of work on structural modeling have been implemented and have resulted in a positive cost variance of \$6,170 for Period 7. Variations between actual cumulative costs and planned cumulative costs for FY91 are being controlled by limiting work in Task 1 in deference to accomplishing work in Task 2. Lack of NRC requests for the GSPE to accomplish Task 1 reviews of DOE Study Plans and Site Characterization Plan Progress Reports and to support NRC in on-site visits has allowed this adjustment of work to be possible. It is anticipated that the cost variances will be remedied when the FY91-92 Center Operations Plans are revised.

| Table 1. Financial Status | |
|---|------------|
| FY91 Funds Authorized (a) | \$ 727,355 |
| FY91 Funds Costed to Date (b) | \$ 371,721 |
| FY91 Funds Uncosted (c) | \$ 355,634 |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

NOTES: (a) Authorized funds remaining after FY90 actual expenditures with fee.
 (b) Actual expenditures FY91 YTD without fee.
 (c) Difference between (a) and (b).

3702-000

GS

Element Status Cost Report

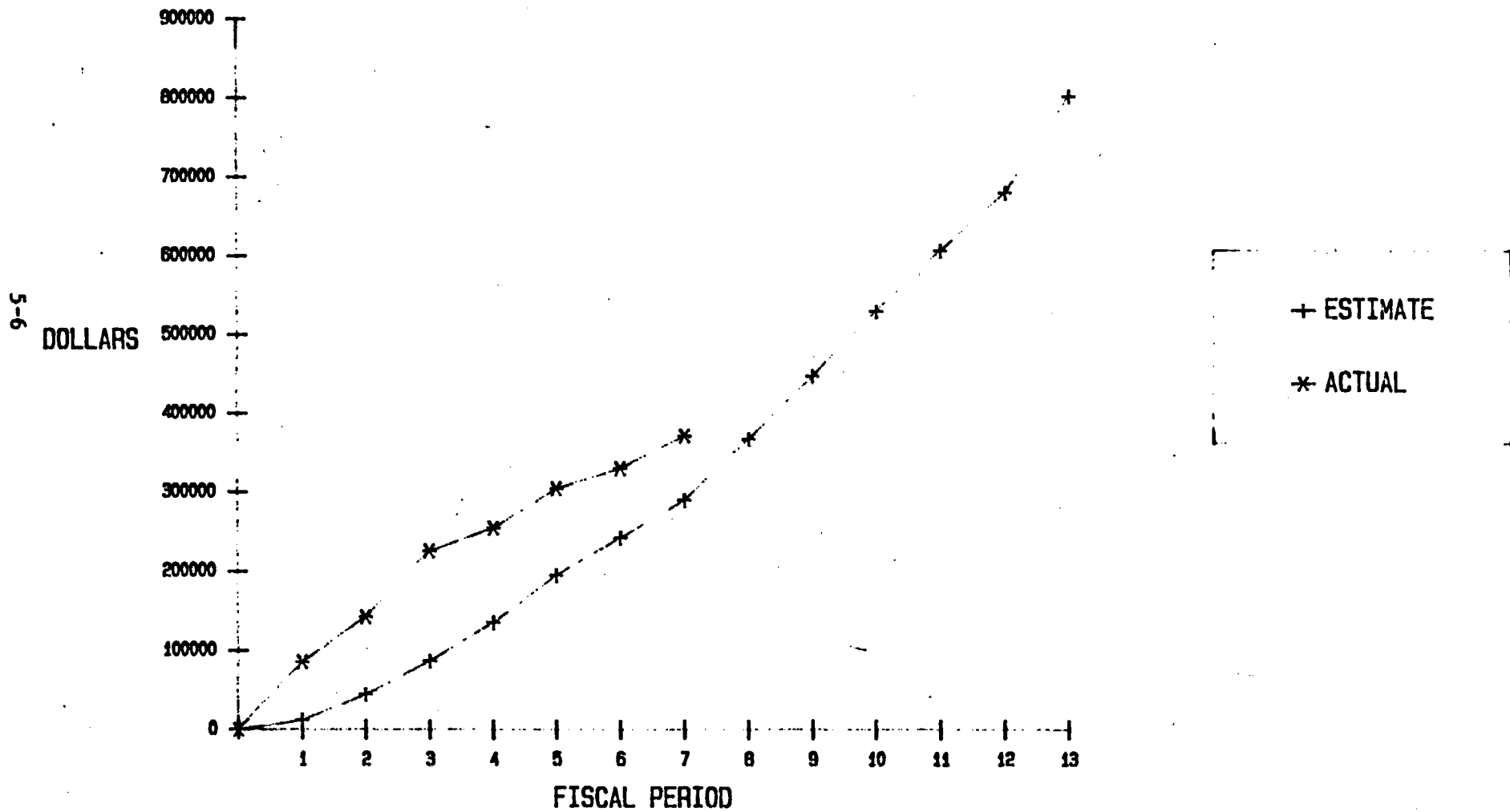
| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|--------|--------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| EST PERIOD COST | 12022 | 32114 | 42705 | 49189 | 59138 | 47315 | 47491 | 77642 | 80525 | 82622 | 76926 | 73250 | 123268 | 289973 |
| ACT. PERIOD COST | 85455 | 57066 | 83661 | 29066 | 49284 | 25869 | 41321 | 0 | 0 | 0 | 0 | 0 | 0 | 371721 |
| VARIANCE, \$ | -73433 | -24952 | -40956 | 20122 | 9854 | 21447 | 6170 | 0 | 0 | 0 | 0 | 0 | 0 | -81748 |
| VARIANCE, % | -610.8 | -77.7 | -95.9 | 40.9 | 16.7 | 45.3 | 13.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -28.2 |
| EST. FY CUMUL | 12022 | 44135 | 86841 | 136029 | 195167 | 242483 | 289973 | 367616 | 448140 | 530763 | 607689 | 680939 | 804207 | |
| ACTUAL FY CUMUL | 85455 | 142521 | 226182 | 255248 | 304531 | 330400 | 371721 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.106 | 0.177 | 0.281 | 0.317 | 0.379 | 0.411 | 0.462 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | -73433 | -98385 | -139341 | -119219 | -109364 | -87918 | -81748 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | -610.8 | -222.9 | -160.5 | -87.6 | -56.0 | -36.3 | -28.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3702-000 GS - FY 91

Estimate vs. Actual



6. ENGINEERED BARRIER SYSTEM

NRC Program Element Manager: Jerome R. Pearring

NRC Project Officer: Kien C. Chang (Tasks 1 and 3), Charles G. Interrante (Task 2)

CNWRA Element Manager: Prasad K. Nair

Key Personnel: G. Cragnolino, H. Manaktala, P. Nair, W. Patrick,
N. Sridhar, E. Tschoepe, A. Whiting, and Y. Wu

Subcontractors/Consultants: H. Pennick

6.1 Technical Status

During this reporting period the EBS staff continued its support to the Performance Assessment Program Element in the iterative PA activities.

Professional Activities

- Technical presentations were made to Dr. S. Muraoka, Head of the Engineered Barrier Materials Laboratory, Japan Atomic Energy Research Institute, who visited the Center on March 21, 1991. The presentations by H. Manaktala, N. Sridhar, G. Cragnolino, H. Pennick covered the activities of the Center EBS Element both in the areas of research and technical assistance. J. Latz, W. Patrick, and P. Nair provided the management overview.
- H. Manaktala has been appointed Program Chairman and an Executive Board member to the American Society for Materials' (ASM) Alamo Chapter in San Antonio, Texas, for the 1991-93 term.

Task 1 - Prelicensing Activities

No planned activity.

Task 2 - Regulatory and Technical Guidance Development

At the direction of the NRC, the Center has initiated a work plan to develop a NUREG/CR report on the "Substantially Complete Containment" elicitation study conducted early this year. The Center provided technical support to the NRC during the Elicitation study which was conducted by NRC staff involving a NRC-selected elicitation panel. The work plan will be incorporated in the current EBS Program Element Plan. It will be submitted to the NRC with the ongoing update to the HLW Operations Plans. The work will be conducted as part of the SCC Support activity in the EBS Operations Plan.

Following the completion of the SCC Feasibility Study, the NRC has directed the Center to develop a worked example to demonstrate the application of the methodologies identified in the SCC-related NUREG/CR reports. A plan outline is under preparation. This activity is consistent with the current EBS Operations Plan. However, the scope of the example problem will be such that the activities on "Gradual Release Rate" under this task will be delayed to FY93. This assumes the availability of no new additional resource for this task.

Task 3 - Analysis Codes and Methods

During Period 7, the primary EBSPAC activities dealt with writing a free-format read routine for data input to the crevice corrosion model, reviewing and assessing materials on fault tree analysis, and running and evaluating analysis test cases for the developed baseline crevice corrosion isothermal model.

The read routine is keyword driven and allows one to input data using integer or floating point data forms. Data items need only be separated by a comma or a blank space. Data for each keyword driven data stream may be continued on as many cards as needed and only the data items which are different from the default values need be input. This read routine has been integrated into the crevice corrosion isothermal model and is being used to run the crevice corrosion model test cases.

Test cases for the crevice corrosion model have been run for uniform crevice gaps of 0.0001 and 0.001 cm. and for crevice depths of 0.0001, 0.025, 0.25, 2.5 and 25 cm. The minimum simulation time for each of these cases was 1.5 hours. However, some results were obtained for crevice depths of 0.25 and 2.5 cm. (with the above mentioned crevice gaps) at simulation times of 25 hours. These results are being reviewed and evaluated.

Work continued this period on designing the framework for the material degradation module driver. This driver framework will control the logic of the interactions among the material degradation models and will provide a key link in integrating EBSPAC with a fault tree analysis. Also this period, work commenced on modifying the baseline crevice corrosion model for heat transfer effects.

Review of literature on vitrified wasteforms is continuing, with the intent of identifying key parameters and developing a mechanistic understanding of the source-term for calculating release in the near-field upon loss of containment by the waste package.

6.2 Major Problems

None.

6.3 Forecast for Next Period

Complete work plans for a SCC Alternatives Evaluation report and for the development of an example problem to demonstrate the application of the quantitative framework developed in the SCC TFA study.

Review of the ongoing wasteform studies will continue.

Modelling activities in EBSPAC for the local corrosion model will continue.

6.4 Element Financial Status

Table 1 below indicates the financial status of this Element in the context of "authorized" funds established by the NRC. Table 2 displays planned and actual costs without allowance for fee to date on both a per period and a cumulative basis. In addition, these data do not include commitments, and variances are shown on both a dollar and percentage basis. Commitments for this Element are \$3,025. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Expenditures for this program element are about 30% greater than planned. This results primarily from greater than anticipated support activities to the SCC potential rulemaking and accelerated activities on EBSPAC. Possible modifications to the spending plan and/or the rate of expenditure and consequent accomplishment of work will be considered in the Operation Plans update.

| Table 1. Financial Status | |
|---|------------|
| FY91 Funds Authorized (a) | \$ 557,748 |
| FY91 Funds Costed to Date (b) | \$ 292,329 |
| FY91 Funds Uncosted (c) | \$ 265,419 |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

NOTES: (a) Authorized funds remaining after FY90 actual expenditures with fee.
(b) Actual expenditures FY91 YTD without fee.
(c) Difference between (a) and (b).

3702-010

EBS

Element Status Cost Report

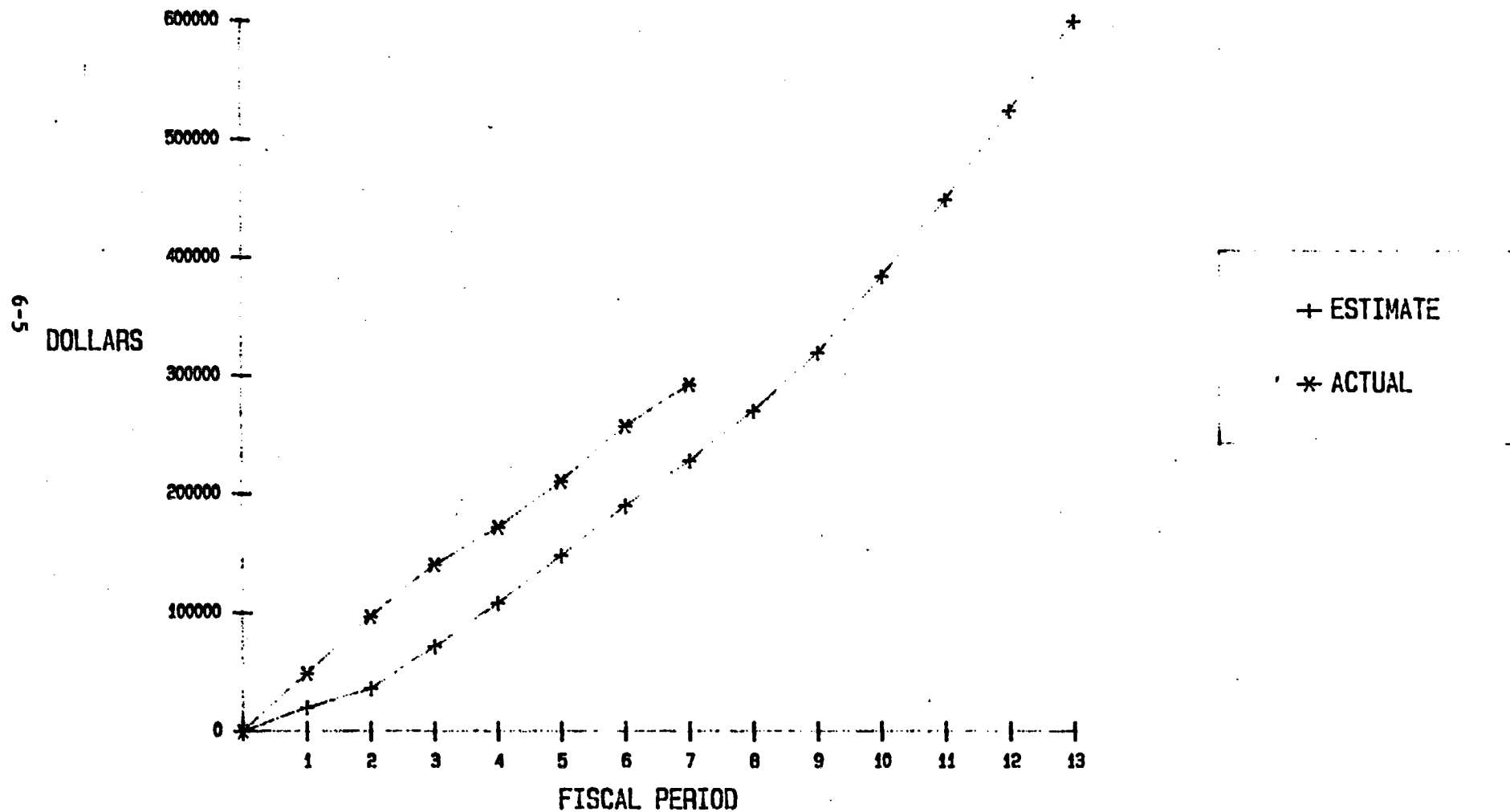
| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| EST PERIOD COST | 19874 | 16136 | 35642 | 36443 | 40255 | 41668 | 37578 | 42311 | 48931 | 64746 | 65277 | 75320 | 75495 | 227597 |
| ACT. PERIOD COST | 48573 | 48246 | 43728 | 31568 | 38172 | 46765 | 35275 | 0 | 0 | 0 | 0 | 0 | 0 | 292329 |
| VARIANCE, \$ | -28699 | -32110 | -8086 | 4875 | 2083 | -5097 | 2302 | 0 | 0 | 0 | 0 | 0 | 0 | -64732 |
| VARIANCE, % | -144.4 | -199.0 | -22.7 | 13.4 | 5.2 | -12.2 | 6.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -28.4 |
| EST. FY CUMUL | 19874 | 36010 | 71652 | 108096 | 148351 | 190019 | 227597 | 269908 | 318838 | 383584 | 448861 | 524181 | 599676 | |
| ACTUAL FY CUMUL | 48573 | 96820 | 140548 | 172116 | 210288 | 257053 | 292329 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.081 | 0.161 | 0.234 | 0.287 | 0.351 | 0.429 | 0.487 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | -28699 | -60809 | -68896 | -64020 | -61937 | -67034 | -64732 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | -144.4 | -168.9 | -96.2 | -59.2 | -41.8 | -35.3 | -28.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3702-010 EBS - FY 91

Estimate vs. Actual



7. REPOSITORY DESIGN, CONSTRUCTION, AND OPERATIONS

NRC Program Element Manager: Jerome R. Pearring

NRC Project Officers: Dinesh C. Gupta (Task 1), Naiem S. Tanious (Task 2)

CNWRA Element Manager: Asadul H. Chowdhury

Key Personnel: M. Ahola, A. Chowdhury, J. Daemen, J. Hageman, S. Hsiung, H. Karimi,
L. Lorig, W. Patrick, E. Tschoepe

Subcontractors/Consultants: Itasca Consulting Group, Inc., J. Daemen, R. Field, C. Shih

7.1 Technical Status

During this reporting period, the RDCO staff performed activities for the RDCO, WSE&I, Waste Solidification System (WSS), and CNWRA Operations Program Elements.

The CNWRA Mid-Year Program Review meeting was held at the CNWRA on April 10-11, 1991. A. Chowdhury made presentations on both technical assistance in Repository Design, Construction, and Operations, and the Seismic Rock Mechanics Research Project.

Task 1 - Relicensing Activities

The evaluation of DOE responses to NRC Site Characterization Analysis (SCA) was carried out during this period. One objection, twenty-five comments, and thirty-one questions in the SCA are relevant to RDCO. The DOE responses to these comments, questions, and objections were evaluated by S. Hsiung, L. Lorig, and J. Daemen. The results of this evaluation will be submitted to NRC as RDCO Intermediate Milestone No. 20-3702-021-010-000.

Task 2 - Regulatory and Technical Guidance Development

A. Chowdhury of CNWRA and T. Brandshaug of Itasca visited the NRC on March 21-22, 1991, to participate in the preparation of the preliminary draft Staff Technical Position (STP) on "Underground Facility Design - Thermal Loads." This preliminary draft STP was prepared for submission to the ACNW for its review and comment in anticipation of April 23, 1991, ACNW briefing. On March 20, 1991, A. Chowdhury attended the NRC staff briefing to ACNW on the Staff Technical Position (STP) on "Regulatory Considerations in the Design and Construction of the Exploratory Shaft Facility."

The development of the compliance determination method(s) for coordinating the ESF design with the repository design was initiated during this period. S. Hsiung and M. Ahola are carrying out this activity.

Task 3 - Analysis Codes and Methods

Not funded in FY91.

Task 6 - Repository Operational Criteria Feasibility Studies

Activities 1 and 2 of the Repository Operational Criteria (ROC) Feasibility Studies were carried out during this period. In-depth analysis of all the 46 ROC Topics has been completed. The draft ROC Report #1 (NUREG/CR-#1) is in preparation. This report will be submitted to NRC as RDCO Intermediate Milestone No. 20-3072-026-153-000 during the next reporting period. J. Hageman, S. Hsiung, H. Karimi, M. Ahola, E. Tschoepe, R. Field, J. Burkes, R. Hofmann, G. Stirewalt, A. Chowdhury, L. Lorig, and J. Daemen performed ROC activities.

7.2 Major Problems

None.

7.3 Forecast for Next Period

Work on the evaluation of DOE responses on the SCA, the technical position on thermal loads, development of compliance determination method for coordinating ESF design with repository design and repository operational criteria feasibility studies will continue during the next report period.

7.4 Element Financial Status

Table 1 below indicates the financial status of this Element in the context of "authorized" funds established by the NRC. Table 2 displays planned and reported actual costs without allowance for fee to date on both a per period and a cumulative basis. In addition, these data do not include commitments, and variances are shown on both a dollar and percentage basis. Commitments in the Element are \$45,074. The attached figure displays the estimated cumulative spending plan and the reported actual cumulative costs to date.

Costs incurred to date are as planned.

| Table 1. Financial Status | |
|---|------------|
| FY91 Funds Authorized (a) | \$ 876,445 |
| FY91 Funds Costed to Date (b) | \$ 502,155 |
| FY91 Funds Uncosted (c) | \$ 374,290 |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

NOTES: (a) Authorized funds remaining after FY90 reported actual expenditures with fee.
(b) Reported actual expenditures FY91 YTD without fee.
(c) Difference between (a) and (b).

3702-020

RDCO

Element Status Cost Report

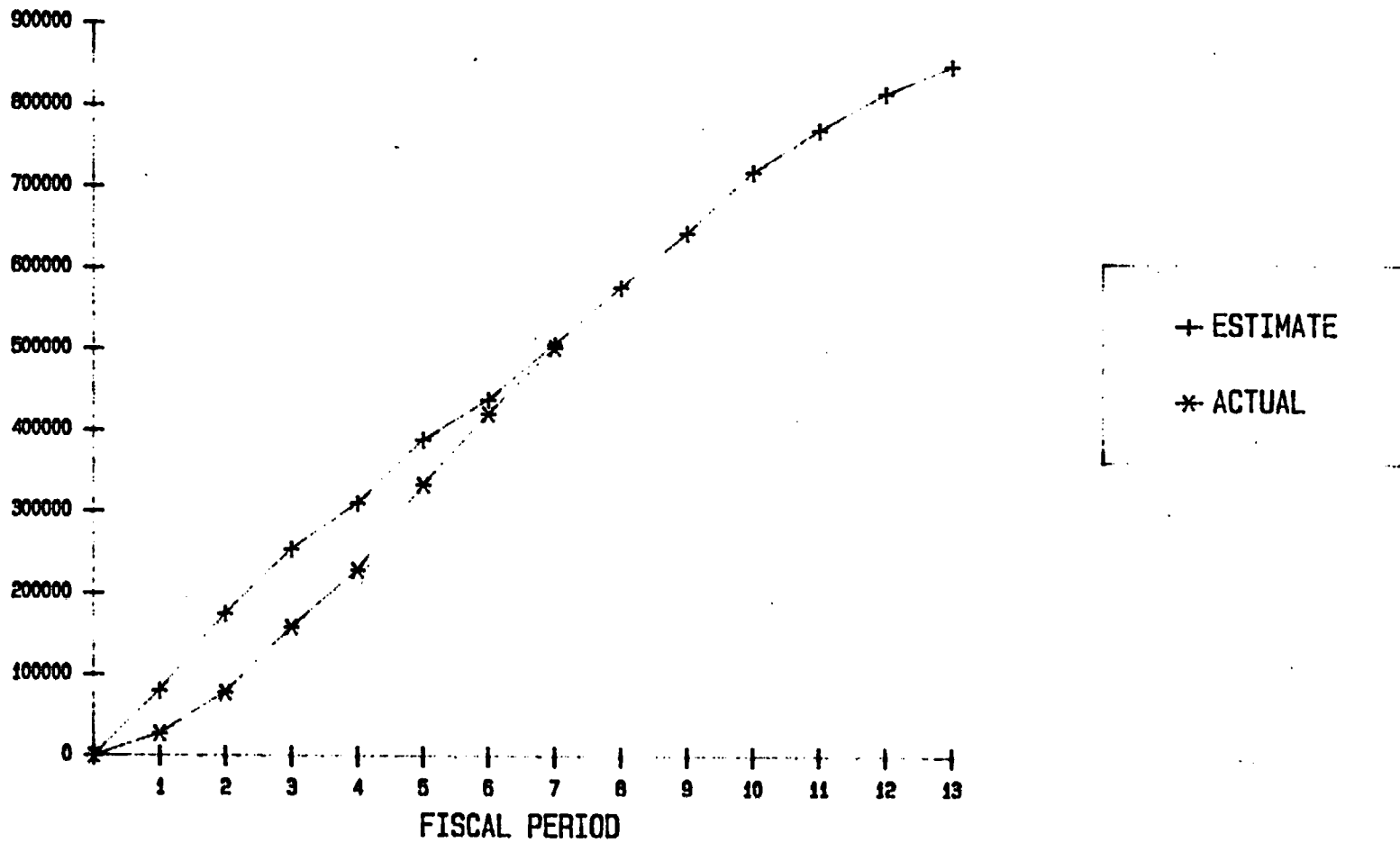
| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| EST PERIOD COST | 80330 | 94490 | 79409 | 56263 | 78162 | 49304 | 68363 | 70499 | 66805 | 75618 | 51651 | 45657 | 33677 | 506320 |
| ACT. PERIOD COST | 27495 | 50848 | 80077 | 70259 | 104466 | 87520 | 81489 | 0 | 0 | 0 | 0 | 0 | 0 | 502155 |
| VARIANCE, \$ | 52835 | 43641 | -668 | -13996 | -26305 | -38216 | -13127 | 0 | 0 | 0 | 0 | 0 | 0 | 4165 |
| VARIANCE, % | 65.8 | 46.2 | -0.8 | -24.9 | -33.7 | -77.5 | -19.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 |
| EST. FY CUMUL | 80330 | 174820 | 254229 | 310491 | 388653 | 437957 | 506320 | 576819 | 643624 | 719242 | 770893 | 816550 | 850227 | |
| ACTUAL FY CUMUL | 27495 | 78343 | 158420 | 228679 | 333145 | 420666 | 502155 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.032 | 0.092 | 0.186 | 0.269 | 0.392 | 0.495 | 0.591 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | 52835 | 96477 | 95808 | 81812 | 55508 | 17291 | 4165 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | 65.8 | 55.2 | 37.7 | 26.3 | 14.3 | 3.9 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3702-020 RDCO - FY 91

Estimate vs. Actual



8. PERFORMANCE ASSESSMENT

NRC Program Element Manager: S. Coplan

NRC Project Officers: P. Brooks (Tasks 1-4), N. Eisenberg (Task 5)

CNWRA Element Manager: Budhi Sagar

Key Personnel: R. Ababou, R. Green, A. Gureghian, R. Janetzke, H. Manaktala, W. Murphy,
R. Pablan, E. Percy, G. Wittmeyer, Y. Wu

Subcontractors/Consultants: None

8.1 Technical Status

Task 1 - Prelicensing Reviews

No activity this period.

Task 2 - Regulatory and Technical Guidance Development

Subtask 2.1 - Rules and Amendment Support to Conform to the EPA Standard

Preliminary work on developing the Compliance Determination Strategy (CDS) for the EPA rule is proceeding. The Performance Assessment Strategy developed earlier under Task 5 will provide the basis for the CDS.

Subtask 2.2 - Implementing the EPA HLW Standard

NRC comments on the draft report on the Regulatory Requirements (RR) and the associated Regulatory Elements Of Proof (REOPs) associated with the EPA rule have been incorporated. The revised report has been transmitted to the NRC.

Task 5 - Iterative Performance Assessment

A number of discussions occurred between the Center and NRC staffs regarding the impact of reduced IPA funding in FY92. It was decided that the IPA program plan along with the already agreed to milestones be submitted to the NRC management with a note that because of reduced funding, work for some of the milestones may either be delayed or aborted or reduced in scope. In order not to impact the ongoing work of IPA, however, specific decisions on the milestones were left for the future.

Mr. Jim Park of the NRC visited the Center for a week from 8-12 April. He worked with Ron Janetzke and B. Sagar on the Total System Code. While at the Center, Mr. Park revised the Requirements Document for the Total System Code currently under development. He also became familiar with the VAX8700 computer system at the Institute which he can now access from Washington. Mr. Park was able to run the

Institute which he can now access from Washington. Mr. Park was able to run the existing version of the Total System Code on this system, and provided suggestions for improvement of the code.

A Requirements Document for the Total System Code was prepared and transmitted to the IPA teams. This document was prepared jointly by the Center (R. Janetzke and B. Sagar) and NRC (J. Park and N. Eisenberg). It provides details about the various features of the code as well as hints to other participants in IPA that would help in the development of the individual consequence modules.

A document titled "Procedure for Configuration Management and Control of Scientific and Engineering Computer Codes" was submitted to the NRC for review. This document was also sent to all IPA team leaders. The procedure outlined will be implemented to manage codes used in IPA as well as other codes received at the Center.

Five DOE codes received from the NRC were classified as inactive and were subjected to the appropriate items of the configuration management procedure.

Drs. Gureghian and Wu continued to work on subtask 621 of IPA. A suggested approach for this subtask was prepared and sent to all team leaders on March 21, 1991. No comments on the approach were received.

Dr. Manaktala will visit NRC offices on April 22-23 to discuss the progress on task 4 of IPA. Progress is being made in coupling the PHREEQE and GLASSOL codes for the source term module. An abstract of a paper dealing with the source term module was prepared and submitted to NRC for approval.

8.2 Major Problems

None.

8.3 Forecast for Next Period

Work on several of the Phase 2 Iterative Performance activities will continue. So will the work on the SRA of 40 CFR Part 191.

8.4 Element Financial Status

Table 1 below indicates the financial status of this Element in the context of "authorized" funds established by the NRC. Table 2 displays planned and actual costs without allowance for fee to date on both a per period and a cumulative basis. In addition, these data do not include commitments, and variances are shown on both a dollar and percentage basis. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Costs incurred to date are significantly less than planned. This is because: (a) no DOE study plans have been received for review under Task 1, (b) the subtasks related to

Conforming and Implementation of the EPA rule in Task 2 are being worked at a low level, pending the completion of the SRA work, and (c) costs on Task 5 are also significantly less than planned due to our inability to hire PA staff and the assignment of existing staff to other high priority tasks. With regard to the last item, reprioritization has increased efforts and associated costs by about 60% in the past two periods.

| Table 1. Financial Status | |
|---|-------------|
| FY91 Funds Authorized (a) | \$1,482,508 |
| FY91 Funds Costed to Date (b) | \$ 403,442 |
| FY91 Funds Uncosted (c) | \$1,079,066 |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

NOTES: (a) Authorized funds remaining after FY90 actual expenditures with fee.
 (b) Actual expenditures FY91 YTD without fee.
 (c) Difference between (a) and (b).

3702-060

PA

Element Status Cost Report

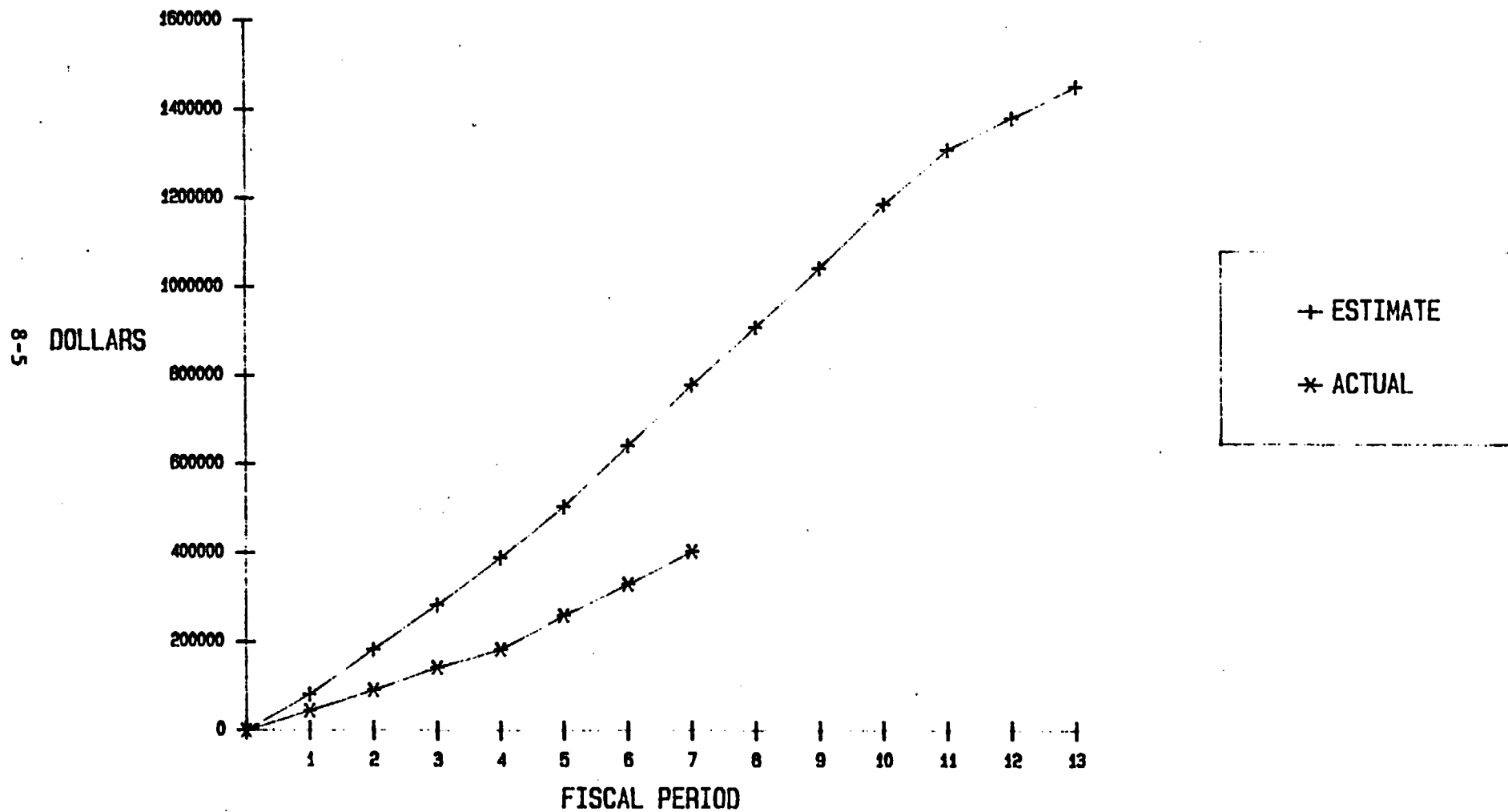
| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|-------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|---------|--------|
| EST PERIOD COST | 80799 | 101863 | 101433 | 105175 | 114614 | 137469 | 138048 | 129256 | 133670 | 144137 | 123577 | 71955 | 72373 | 779401 |
| ACT. PERIOD COST | 44461 | 45894 | 51289 | 40908 | 77173 | 69965 | 73753 | 0 | 0 | 0 | 0 | 0 | 0 | 403442 |
| VARIANCE, \$ | 36339 | 55969 | 50144 | 64266 | 37441 | 67504 | 64295 | 0 | 0 | 0 | 0 | 0 | 0 | 375958 |
| VARIANCE, % | 45.0 | 54.9 | 49.4 | 61.1 | 32.7 | 49.1 | 46.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 48.2 |
| EST. FY CUMUL | 80799 | 182662 | 284095 | 389270 | 503884 | 641353 | 779401 | 908657 | 1042327 | 1186464 | 1310041 | 1381996 | 1454369 | |
| ACTUAL FY CUMUL | 44461 | 90355 | 141644 | 182552 | 259725 | 329689 | 403442 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.031 | 0.062 | 0.097 | 0.126 | 0.179 | 0.227 | 0.277 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | 36339 | 92308 | 142452 | 206718 | 244159 | 311663 | 375958 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | 45.0 | 50.5 | 50.1 | 53.1 | 48.5 | 48.6 | 48.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3702-060 PA - FY 91

Estimate vs. Actual



9. TRANSPORTATION RISK STUDY

NRC Program Element Manager: John Cook

NRC Program Subelement Manager: Russell R. Rentschler

CNWRA Subelement Manager: John P. Hageman

Key Personnel: R. Weiner (P.I.), P. LaPlante, S. Logan

Subcontractor/Consultant: None

The project has been suspended as of June 15, 1990.

Subelement Financial Status

Table 1 below indicates the financial status of this Element in the context of "authorized" funds established by the NRC. Table 2 displays planned and actual costs without allowance for fee to date on both a per period and a cumulative basis. In addition, these data do not include commitments, and variances are shown on both a dollar and percentage basis. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

| Table 1. Financial Status | |
|---|--------|
| FY91 Funds Authorized (a) | \$ -0- |
| FY91 Funds Costed to Date (b) | \$ -0- |
| FY91 Funds Uncosted (c) | \$ -0- |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

NOTES:(a) Authorized funds remaining after FY90 actual expenditures with fee.

(b) Actual expenditures FY91 YTD without fee.

(c) Difference between (a) and (b).

10. RESEARCH

NRC Program Element Manager:
John R. Randall

NRC Project Officer for Geochemistry Research
Research Project: George F. Birchard

NRC Project Officer for Thermohydrology
Research Project: Timothy S. Margulies

NRC Project Officer for Seismic Rock
Mechanics Research Project: Jacob Philip

NRC Project Officer for Waste Package
Experiments Research Project: Phillip R. Reed

NRC Project Officer for Geochemical Analogs
Research Project: Linda A. Kovach

NRC Project Officer for Stochastic Analysis
Research Project: Thomas Nicholson

NRC Project Officer for Sorption Modelling
Mechanisms Research Project: George F.
Birchard

NRC Project Officer for Performance
Assessment Research: Timothy S. Margulies

CNWRA Project Manager for Overall Research
Project: Prasad K. Nair

CNWRA Project Manager for Geochemistry
Research Project: John L. Russell

CNWRA Project Manager for Thermohydrology
Research Project: Budhi Sagar

CNWRA Project Manager for Seismic Rock
Mechanics Research Project: Asadul H.
Chowdhury

CNWRA Project Manager for Integrated Waste
Package Experiments Research Project: Prasad
K. Nair

CNWRA Project Manager for Geochemical
Analogs Research Project: John L. Russell

CNWRA Project Manager for Stochastic
Analysis Research Project: Budhi Sagar

CNWRA Project Manager for Sorption
Modelling Mechanisms Research Project: John
L. Russell

CNWRA Project Manager for Performance
Assessment Research: Budhi Sagar

Key Personnel: R. Ababou, M. Ahola, A. Chowdhury, G. Cragnolino, F. Dodge, R. Green,
R. Hart, S. Hsiung, D. Kana, F. Lyle, H. Manaktala, W. Murphy, P. Nair,
R. Pabalan, E. Percy, J. Russell, N. Sridhar, D. Turner, G. Wittmeyer, and
B. Vanzant

Subcontractors/Consultants: Itasca, ABC, Inc., Ohio State University, University of Arizona,
University of Texas-San Antonio, P. Goodell, J. Altamirano

10.1 Technical Status

Major expansion and modification continued for the IWPE/EBS and geosciences laboratories at the Center. The modified and expanded facilities for IWPE/EBS will accommodate experimental set-ups required for leaching studies on vitrified wasteforms and metallurgical phase stability studies on waste package container materials. The expanded lab facilities will include additional chemical hoods, work bench space, connections for high voltage furnaces, and cooling water lines. Laboratory modification activities are expected to be completed during the next period.

Research Project 1 - Overall Research Plan

Staff worked on the first Quarterly Research Report for CY91.

Center personnel continued to interact with the University of Arizona staff in the preparation of the workshop proceedings for the Workshop V: Flow and Transport through Unsaturated Fractured Rock Related to High-Level Radioactive Waste Disposal which was held January 6-10, 1991, at Tucson, Arizona.

Planning for the Natural Analogs Workshop continued.

The CNWRA Mid-Year Program Review meeting was held at the Center on April 10-11, 1991. Staff made presentations on each Research Project.

The status of the Research Project Plans, identified in the Overall Research Project Plan is shown below.

| PROJECT | TITLE | REVISED PLAN COMPLETION DATE | APPROVAL STATUS |
|-------------|--|---------------------------------|---|
| Research 1 | Overall Research Plan | 11/01/90 | Approved |
| Research 2 | Geochemistry | 01/13/89 | Approved, Revision Required |
| Research 3 | Thermohydrology | 05/12/89 | Approved, Revision Required |
| Research 4 | Seismic Rock Mechanics | 09/21/90 | Approved |
| Research 5 | Integrated Waste Package | 12/20/90 | Rev 3 and 3 Test Plans submitted to NRC |
| Research 6 | Stochastic Analysis of Unsaturated Flow and Transport | 11/01/90 | Await Approval |
| Research 7 | Geochemical Analog of Contaminant Transport | 01/04/90 | Approved |
| Research 8 | Climatology/Recharge | TBD | TBD |
| Research 9 | Sorption Modeling Mechanisms | 09/10/90 | Approved |
| Research 10 | Performance Assessment | 08/28/90 | Approved |
| Research 11 | Volcanic Systems | TBD | Draft SOW Received 3/26/91, Comments Provided to NRC |

Research Project 2 - Geochemistry

Experiments to study the kinetics of analcime dissolution continued. Aliquots of aqueous solutions reacting with analcime powder were taken on a periodic basis for chemical analysis of Si, Al, Na and pH. The aqueous samples were analyzed for Si and Al using UV-Visible spectrophotometry. Na was analyzed using an ion-selective electrode. Results were incorporated in the Center's Quarterly Research Progress Report.

For the modeling task of the project, modeling of groundwater and mineral chemistry of the Alligator Rivers analog site was conducted to provide an insight into the geochemical processes that have occurred at that site.

W. Murphy and R. Pabalan presented the studies being conducted by the Center in its Geochemistry Research Project, during the NRC-DOE Technical Interchange on Mineral Stability and Applicability of Laboratory Data.

Research Project 3 - Thermohydrology

The twenty-seven dimensionless pi terms have been evaluated and six of these terms have been further evaluated to assess their importance. A specific parameter in each pi term was selected for perturbation. Each parameter was varied by 25% to assess the sensitivity of the flow regime to changes in the pi term. The impact of varying the parameters, and hence, the pi terms was accomplished using the original version of the TOUGH code. The nominal case from which the parameters were chosen based upon the physical characteristics of the laboratory-scale, separate-effects experiment Test 5. The flow regime demonstrated little difference in response to changes in the parameters for several of the pi terms. Dramatic changes in the flow regime were observed for variations in the pi terms associated with capillary pressure. Other changes, such as changes in tortuosity, did not significantly change the flow regime. The results of this analysis are to be submitted to an ASME symposium on Two-Phase Flow Through Porous Media to be held in December, 1991.

The apparatus for the laboratory experiments has been moved to Building 57. This new laboratory location should provide a higher level of environmental control for future experiments. The material and instrumentation for the next experiment are currently being evaluated.

The project plan for the Thermohydrology Research Project Plan is currently being revised. Tim Margulies, NRC-RES, visited the CNWRA on April 8-9, 1991 to discuss the proposed revisions in the project plan.

Research Project 4 - Seismic Rock Mechanics Studies

As in the previous periods, the collection of instrumented field studies data from the Lucky Friday Mine, Mullan, Idaho, continued. Significant displacement response of rock was observed, however, no measurable geohydrologic response has been noted. Work is underway to connect the data acquisition system computer located at the Lucky Friday Mine with a computer at the Center. This will make it possible to retrieve the instrumented field studies data directly from the computer at the Center, except the deformation response of the two tunnel openings which will continue to be measured manually. A plan is being developed to stop the leakage of water from the long borehole at the 5700 foot level that has been caused by the malfunction of one packer assembly.

The full-length paper entitled "Experimental Determination of Properties of Natural Rock Joints in a Welded Tuff" was prepared for submission to the ASME Publication Committee for peer review. This paper will be presented at the 1991 ASME Geomechanics

Symposium to be held in Ohio State University, Columbus, Ohio, June 16-19, 1991. It will also be published in the Symposium Proceedings as a Special Publication. A. Chowdhury assisted J. Philip to prepare the draft of a paper entitled "Stability of Underground Openings in Fractured Tuff for a High-Level Waste (HLW) Repository – Regulatory and Technical Considerations." This paper is for presentation at the conference on Engineering Solutions to the Management of Solid Radioactive Waste to be held in Manchester, U.K. on November 13-15, 1991.

Research Project 5 - Integrated Waste Package Experiments

Cyclic polarization experiments on 316L stainless steel have been completed and the results are being analyzed. Surprisingly, some experiments indicated that this material pitted in the 6 ppm chloride solution at 95°C. To verify this, the tests were repeated several times and the results indicated that the material pitted consistently in this solution. Previous tests on 316L and 304L stainless steels in simulated J-13 water showed that 304L stainless steel did not exhibit pitting in the 6 ppm chloride solution whereas 316L showed pitting. This is rather unexpected because all the literature on localized corrosion, based on tests in relatively high chloride solutions has shown that the higher Mo containing 316L stainless steel shows better resistance to pitting. It is possible that the high applied potentials required to initiate pitting in these short term tests in the 6 ppm chloride solutions result in the inversion in the expected ranking of alloys. Long-term, potentiostatic tests are needed to verify this possibility.

Initial tests on CDA-102 and CDA-715 have been completed. The results are being analyzed.

The review of literature on localized corrosion has been completed and the document is being readied for submittal. Both high-level waste literature and external literature pertinent to the alloys in the HLW program were reviewed.

N. Sridhar attended the Houston Materials Conference sponsored by ASM and made a presentation entitled "Evaluation of Materials for Geologic Disposal of High-Level Nuclear Waste". No written paper was required for this conference.

Research Project 6 - Stochastic Analysis of Large-Scale Flow and Transport in Unsaturated Fractured Rock

During this period, work focussed on the Task 1 literature review activity. A delay in Task 1 was granted to allow acceleration of computational work in Task 2 activities which require the utilization of Cray-2 supercomputer time which the Center had available at no cost from a NASA grant expiring on the first week of March 1991. This activity has led to the successful testing of modified flow solvers which, according to preliminary results, are at least 20 times faster than the unmodified or previously used flow solvers. The draft report for Task 1 was completed and delivered on April 1, 1991. The final report is due on May 1, 1991.

Research Project 7 - Geochemical Analogs

During Period 7, progress continued in Task 2 (Investigation of Sites and Development of Workplans). Preliminary X-ray diffraction studies of rock samples from the Peña Blanca, Mexico, site were begun and samples were cut for thin section analyses. Planning and preparation for field research at uranium deposits at McDermitt Caldera and Virgin Valley, Nevada, continued with a trip scheduled for mid-April.

A number of presentations on progress within the Geochemical Natural Analog Project were made during Period 7. E. C. Percy made presentations to Dr. Muraoka of JAERI (3/20/91) and at the CNWRA Mid-Year Program Review (4/5/91). E. C. Percy also briefed NRC Commissioner Carr on the progress of field research in the analog project (4/2/91). In addition, preparations were made for a presentation at the NWTRB meeting on natural analogs scheduled for April 16-17, 1991.

Work continued on the Final Draft of the Natural Analogs Literature Review Report to accommodate late changes and new information.

Research Project 9 - Sorption Modeling

The literature review of Task 1 continued. An annotated bibliographic database is being developed using the bibliographic database PROCITE. As part of Task 1, arrangements were made with C. Hostetler of Pacific Northwest Laboratories (PNL) to acquire the CTM code for hydrogeochemical modeling, with the help of G. Birchard and F. Ross of NRC. A report on the progress of the research project was prepared for the CNWRA Quarterly Research Progress Report.

Revisions to the 'Work Plan on Experimental Studies on Uranium Sorption on Geologic Media' was made subsequent to a Center technical and management review. Draft copies of this work plan were sent to NRC on March 29, 1991 for review and approval. Analytical equipment, such as a microprocessor-controlled polarograph and an alpha-spectrometry system have been purchased, anticipating NRC approval of the work plan.

R. Pabalan, W. Murphy, and D. Turner participated in NRC-DOE Technical Interchange on Mineral Stability and Applicability of Laboratory Data to Repository Transport Calculations. R. Pabalan presented the Center's project on sorption experiments and modeling. Favorable feedback regarding the Center's work plan for conducting uranium sorption studies was received from some LANL and LLNL principal investigators. Interactions with LANL investigators were undertaken regarding experimental and analytical techniques being used to study radionuclide sorption and transport.

During the NRC Mid-Year Program Review, a presentation was made regarding the accomplishments during the past 6 months and projected activities for the Sorption Project.

R. Pabalan presented during one of the Center's lunchtime seminars a talk on 'Uranium Sorption on Geologic Media: Experimental and Modeling Studies'. This talk was an outcome of the literature review conducted under Task 1 of the Sorption Project.

Research Project 10 - Performance Assessment

Task 1: Technology Transfer. This task has been completed.

Task 2: Two-Phase Flow and Transport. A test problem was attempted with the modified code. The test problem was taken from the NORIA computer code. The results were not entirely satisfactory indicating the need for debugging of the code.

Task 3: Evaluation and Modification of SNL Technology. Work on the test problem for the DCM-3D code is continuing.

Task 4: Identification of Phenomena Important to Repository Performance. R. Hofmann started work on the mechanics of defining the tectonic/seismic scenario. He is currently reviewing the Sandia methodology.

Task 7: Methodology for Validation of Models. Simulation results of the Las Cruces trench experiment were prepared for inclusion in Center's Quarterly Research Report and also for presentation at the INTRAVAL meeting in Seattle, April 22-26. Dr. Wittmeyer will attend the meeting. Four simulations were performed which differed in the assignment of initial and boundary conditions. The results, e.g., distribution of moisture and tracer were found to be quite sensitive to these changes in the initial and boundary conditions. For example, the contaminant plume depends strongly on whether the boundary condition at the source strip is assigned zero flux or zero concentration at the time the tracer application is stopped. The tracer plume seems to follow closely a zone of initial relatively high moisture content which is located directly below the strip. Interesting questions regarding interpretation of field data for input to simulation models are raised by this work. For instance, even though the data is measured at a dense grid, interpolation is still required for incorporating it in the numerical model. Depending on the interpolation method (splines versus representative blocks), an entirely different interpretation of the data is produced. We intend to explore this question in some detail.

A paper on procedures for testing and validating flow models is currently under preparation for inclusion in a special issue of the Journal of Advanced Hydrology. The special issue will be devoted to Validation of Flow Models. This work is a joint effort between the Stochastic Hydrology research project (PI: Dr. R. Ababou) and Task 7 of Performance Assessment Research Project. Some parts of this paper will also be presented by Dr. Ababou at the INTRAVAL meeting in Seattle.

10.2 Major Problems

See Element Financial Status, below.

10.3 Forecast for Next Period

Research activities will continue in accordance with the approved Project Plans.

10.4 Element Financial Status

Tables 1 through 9 below indicate the financial status of this Element in the context of "authorized" funds established by the NRC. Table 10 displays planned and actual costs without allowance for fee to date on both a per period and a cumulative basis. In addition, these data do not include commitments, and variances are shown on both a dollar and percentage basis. The commitments in this Element total \$76,370. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Cost incurred to date for the Overall Research Project are significantly less than planned. This is due to the lower than expected level of research project plan preparation which may be attributed to lack of receipt by the Center of statements of work for two anticipated research projects, i.e., volcanism/tectonics project and climatology/recharge project. It is anticipated that a significant amount of the cost underrun will be remedied when charges are received for the \$20,000 subcontract with the University of Arizona for Workshop V and with the initiation of preparing project plans for one of the anticipated research projects. In addition, charges associated with the development of the Natural Analogs Workshop will increase through the remainder of the fiscal year.

Costs for the Geochemistry Research Project are similar to those planned.

Cost incurred to date for the Thermohydrology Research Project are somewhat less than planned. This is due to a lower than expected level of labor expenditure during the operation of Test 6 experimentation. It is anticipated that the cost variance will be remedied when the separate effects experiments are completed and interpretation of results occurs. In addition, increased costs will be incurred when Task 4 and 5 thermohydrology experiments are moved to Building 57 to improve maintenance of environmental controls.

Costs incurred to date for the Seismic Rock Mechanics Research Project are significantly more than planned. This is due to: (a) the accelerated drilling and instrumentation for collection of mechanical and geohydrologic response data for the Lucky Friday Mine, (b) earlier collection of Nevada Test Site (NTS) weapons tests data from the Defense Nuclear Agency (DNA), and (c) the costs incurred for drilling and instrumentation at the Lucky Friday Mine were found to be higher than originally estimated. The drilling and instrumentation for field studies at the Lucky Friday Mine was completed about 11 months ahead of Project Plans to accommodate Seismic Rock Mechanics field study activities with the activities of the mining and drilling company. The major sources where costs incurred were higher than originally estimated are expendable equipment, change of drilling method for mechanical response measurement, and efforts needed to assemble and install the packer system for geohydrologic response measurement, including training of Center and Itasca technical personnel. It is anticipated that these cost variances will be remedied by deferring other activities of Seismic Rock Mechanics Research Project which had been scheduled for FY91, as well as reallocation of funds available from other research projects. This information will be provided in the coming periods when the Project Plan will be updated.

IWPE project is currently somewhat over budget. It is anticipated that these cost variances

will be largely resolved with the acceptance of Revision 3 of the Project Plan.

Costs less than planned for the Stochastic Research Project are primarily attributed to the greater than anticipated expenditure of R. Ababou's time on Performance Assessment and other task work. The cost variance will be remedied by R. Ababou expending a greater proportion of his time on the Stochastic Research Project in conjunction with his use of CRAY-2 time available from a NASA grant.

Costs significantly lower than planned for the Geochemical Analogs Research Project are attributable to delayed initiation of the planned level of field and laboratory work associated with identification of a potential study site or sites. The cost variance is being significantly decreased by the conduct of field work at the Peña Blanca site and, subsequent to field investigation, of laboratory analyses currently underway to determine the suitability of the Peña Blanca site for more exhaustive studies.

The cost variance for the Sorption Mechanisms Research Project can be attributed to: (a) the diversion of planned labor to other projects to produce deliverables, and (b) delays in the acquisition of necessary laboratory instrumentation and materials. The cost variance will be decreased by greater expenditure of R. Pabalan's and D. Turner's time on the project. In addition, J. Prikryl will develop technical operating procedures for certain project activities.

Costs variances associated with the Performance Assessment Project are attributable to insufficient availability of staff. As noted in Chapter 2 of this report, hiring in this area remains a high priority.

Overall Research

| Table 1. Financial Status | |
|---|------------|
| FY91 Funds Authorized (a) | \$ 157,002 |
| FY91 Funds Costed to Date (b) | \$ 73,420 |
| FY91 Funds Uncosted (c) | \$ 83,582 |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

Geochemistry

| Table 2. Financial Status | |
|---|------------|
| FY91 Funds Authorized (a) | \$ 268,331 |
| FY91 Funds Costed to Date (b) | \$ 112,479 |
| FY91 Funds Uncosted (c) | \$ 155,852 |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

Thermohydrology

| Table 3. Financial Status | |
|---|------------|
| FY91 Funds Authorized (a) | \$ 286,671 |
| FY91 Funds Costed to Date (b) | \$ 119,357 |
| FY91 Funds Uncosted (c) | \$ 167,314 |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

Seismic Rock Mechanics

| Table 4. Financial Status | |
|---|-------------|
| FY91 Funds Authorized (a) | \$ 433,591 |
| FY91 Funds Costed to Date (b) | \$ 470,775 |
| FY91 Funds Uncosted (c) | \$ (37,184) |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

Integrated Waste Package

| Table 5. Financial Status | |
|---|------------|
| FY91 Funds Authorized (a) | \$ 443,859 |
| FY91 Funds Costed to Date (b) | \$ 253,780 |
| FY91 Funds Uncosted (c) | \$ 190,079 |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

Stochastic Analysis

| Table 6. Financial Status | |
|---|------------|
| FY91 Funds Authorized (a) | \$ 185,737 |
| FY91 Funds Costed to Date (b) | \$ 83,875 |
| FY91 Funds Uncosted (c) | \$ 101,862 |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

Geochemical Analogs

| Table 7. Financial Status | |
|---|------------|
| FY91 Funds Authorized (a) | \$ 501,432 |
| FY91 Funds Costed to Date (b) | \$ 68,650 |
| FY91 Funds Uncosted (c) | \$ 432,782 |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

Sorption

| Table 8. Financial Status | |
|---|------------|
| FY91 Funds Authorized (a) | \$ 366,716 |
| FY91 Funds Costed to Date (b) | \$ 98,405 |
| FY91 Funds Uncosted (c) | \$ 268,311 |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

Performance Assessment

| Table 9. Financial Status | |
|---|------------|
| FY91 Funds Authorized (a) | \$ 545,470 |
| FY91 Funds Costed to Date (b) | \$ 124,060 |
| FY91 Funds Uncosted (c) | \$ 421,410 |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

NOTES: (a) Authorized funds remaining after FY90 actual expenditures with fee.
(b) Actual expenditures FY91 YTD without fee.
(c) Difference between (a) and (b).

3704-000

OVERALL

Element Status Cost Report

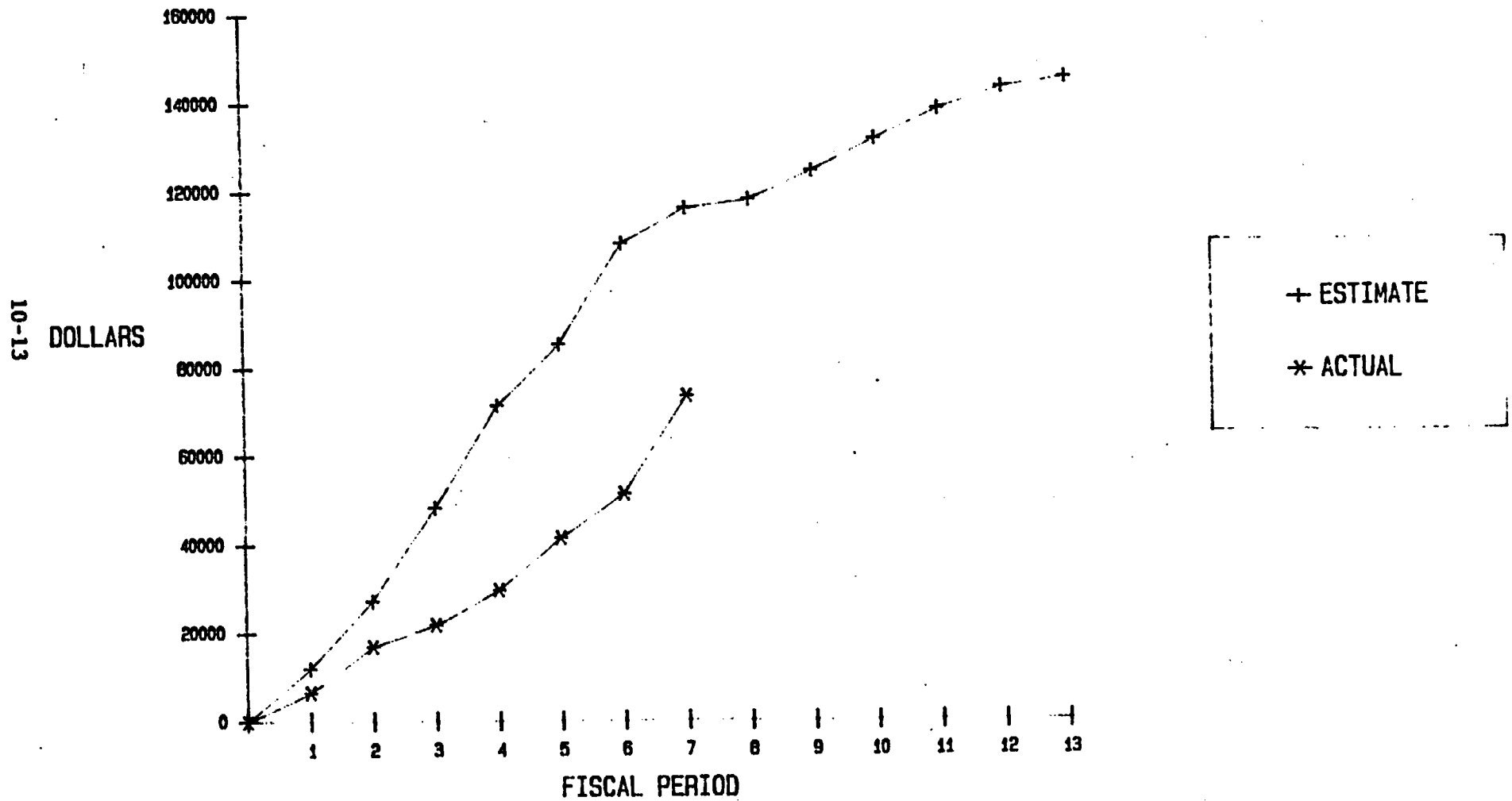
| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| EST PERIOD COST | 11937 | 15330 | 21023 | 23146 | 13828 | 22883 | 7990 | 1941 | 6456 | 7244 | 6643 | 4918 | 2219 | 116138 |
| ACT. PERIOD COST | 6531 | 10352 | 4930 | 7918 | 11720 | 9852 | 22117 | 0 | 0 | 0 | 0 | 0 | 0 | 73420 |
| VARIANCE, \$ | 5406 | 4978 | 16094 | 15228 | 2108 | 13031 | -14127 | 0 | 0 | 0 | 0 | 0 | 0 | 42717 |
| VARIANCE, % | 45.3 | 32.5 | 76.6 | 65.8 | 15.2 | 56.9 | -176.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 36.8 |
| EST. FY CUMUL | 11937 | 27266 | 48290 | 71436 | 85264 | 108147 | 116138 | 118079 | 124535 | 131779 | 138422 | 143340 | 145559 | |
| ACTUAL FY CUMUL | 6531 | 16883 | 21812 | 29731 | 41451 | 51303 | 73420 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.045 | 0.116 | 0.150 | 0.204 | 0.285 | 0.352 | 0.504 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | 5406 | 10384 | 26477 | 41705 | 43813 | 56845 | 42717 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | 45.3 | 38.1 | 54.8 | 58.4 | 51.4 | 52.6 | 36.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3704-000 OVERALL - FY 91

Estimate vs. Actual



3704-010

GEOCHEM

Element Status Cost Report

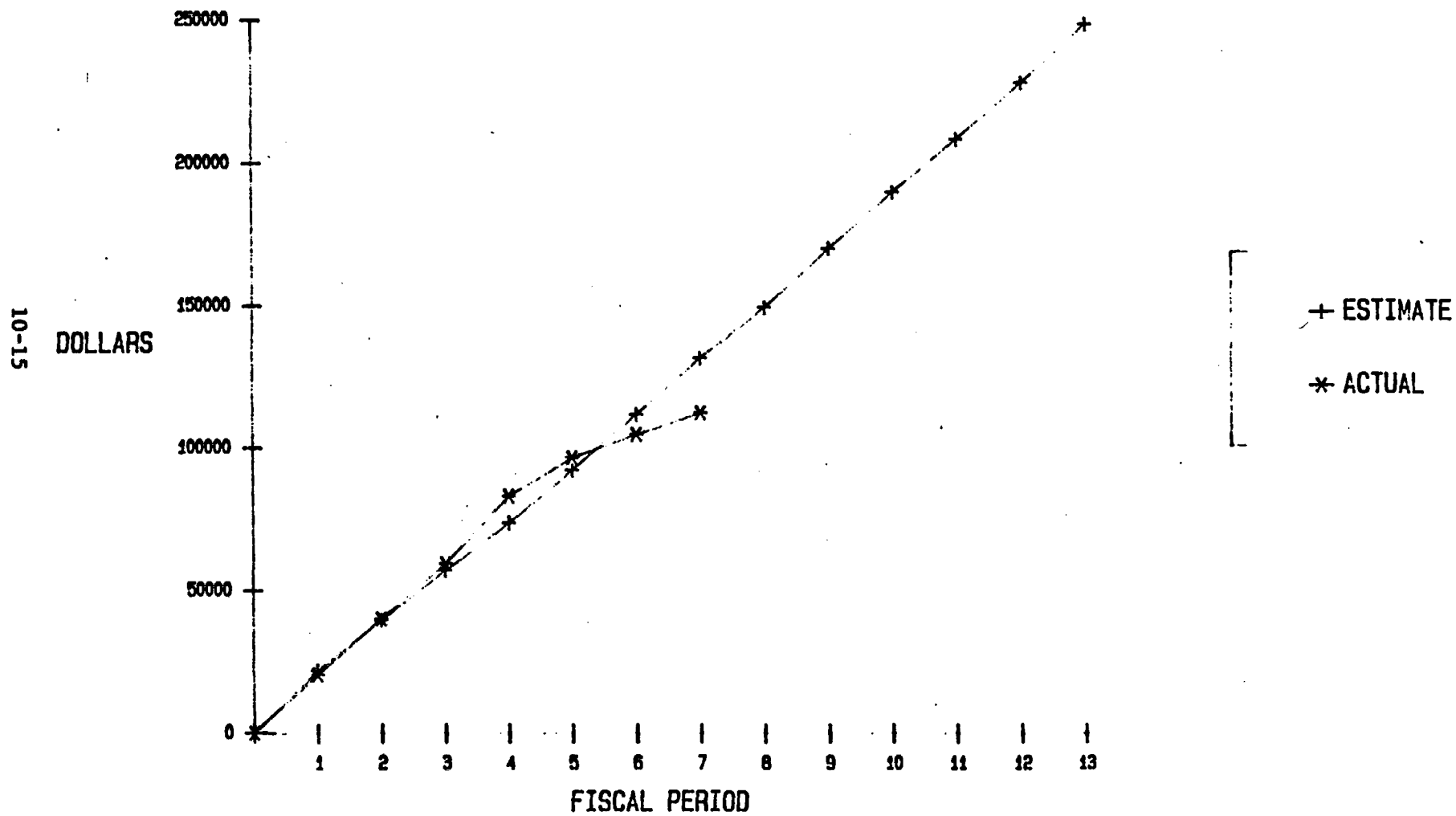
| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| EST PERIOD COST | 21922 | 17846 | 17390 | 16689 | 18432 | 19665 | 19799 | 17816 | 20549 | 19799 | 18640 | 19754 | 20569 | 131743 |
| ACT. PERIOD COST | 20509 | 19661 | 19305 | 23727 | 13462 | 8229 | 7585 | 0 | 0 | 0 | 0 | 0 | 0 | 112479 |
| VARIANCE, \$ | 1413 | -1815 | -1915 | -7038 | 4970 | 11436 | 12214 | 0 | 0 | 0 | 0 | 0 | 0 | 19264 |
| VARIANCE, % | 6.4 | -10.2 | -11.0 | -42.2 | 27.0 | 58.2 | 61.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14.6 |
| EST. FY CUMUL | 21922 | 39768 | 57158 | 73847 | 92279 | 111944 | 131743 | 149559 | 170108 | 189907 | 208547 | 228301 | 248870 | |
| ACTUAL FY CUMUL | 20509 | 40170 | 59475 | 83202 | 96664 | 104894 | 112479 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.082 | 0.161 | 0.239 | 0.334 | 0.388 | 0.421 | 0.452 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | 1413 | -402 | -2317 | -9355 | -4385 | 7050 | 19264 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | 6.4 | -1.0 | -4.1 | -12.7 | -4.8 | 6.3 | 14.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3704-010 GEOCHEM - FY 91

Estimate vs. Actual



3704-020

THERMO

Element Status Cost Report

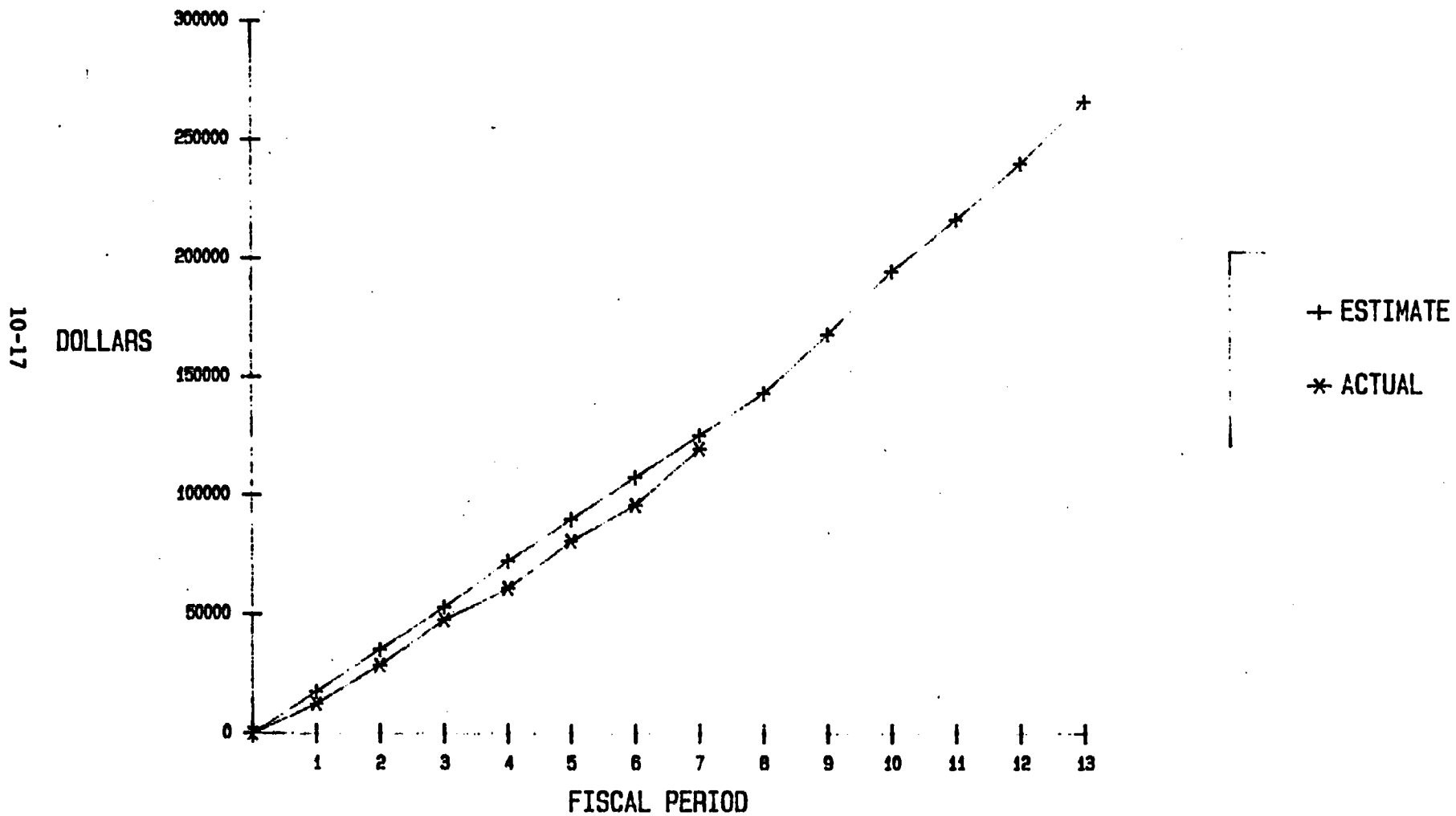
| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| EST. PERIOD COST | 17358 | 17697 | 17936 | 19294 | 17435 | 17622 | 17707 | 18042 | 24718 | 26642 | 21829 | 23621 | 26378 | 125049 |
| ACT. PERIOD COST | 12308 | 16186 | 19105 | 13328 | 19636 | 15115 | 23681 | 0 | 0 | 0 | 0 | 0 | 0 | 119357 |
| VARIANCE, \$ | 5050 | 1511 | -1169 | 5968 | -2202 | 2507 | -5974 | 0 | 0 | 0 | 0 | 0 | 0 | 5692 |
| VARIANCE, % | 29.1 | 8.5 | -6.5 | 30.9 | -12.6 | 14.2 | -33.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.6 |
| EST. FY CUMUL | 17358 | 35055 | 52992 | 72286 | 89720 | 107342 | 125049 | 143091 | 167810 | 194452 | 216281 | 239902 | 266280 | |
| ACTUAL FY CUMUL | 12308 | 28494 | 47599 | 60925 | 80561 | 95676 | 119357 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.046 | 0.107 | 0.179 | 0.229 | 0.303 | 0.359 | 0.448 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | 5050 | 6561 | 5392 | 11361 | 9159 | 11666 | 5692 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | 29.1 | 18.7 | 10.2 | 15.7 | 10.2 | 10.9 | 4.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3704-020 THERMO - FY 91

Estimate vs. Actual



3704-030

SEISMIC

Element Status Cost Report

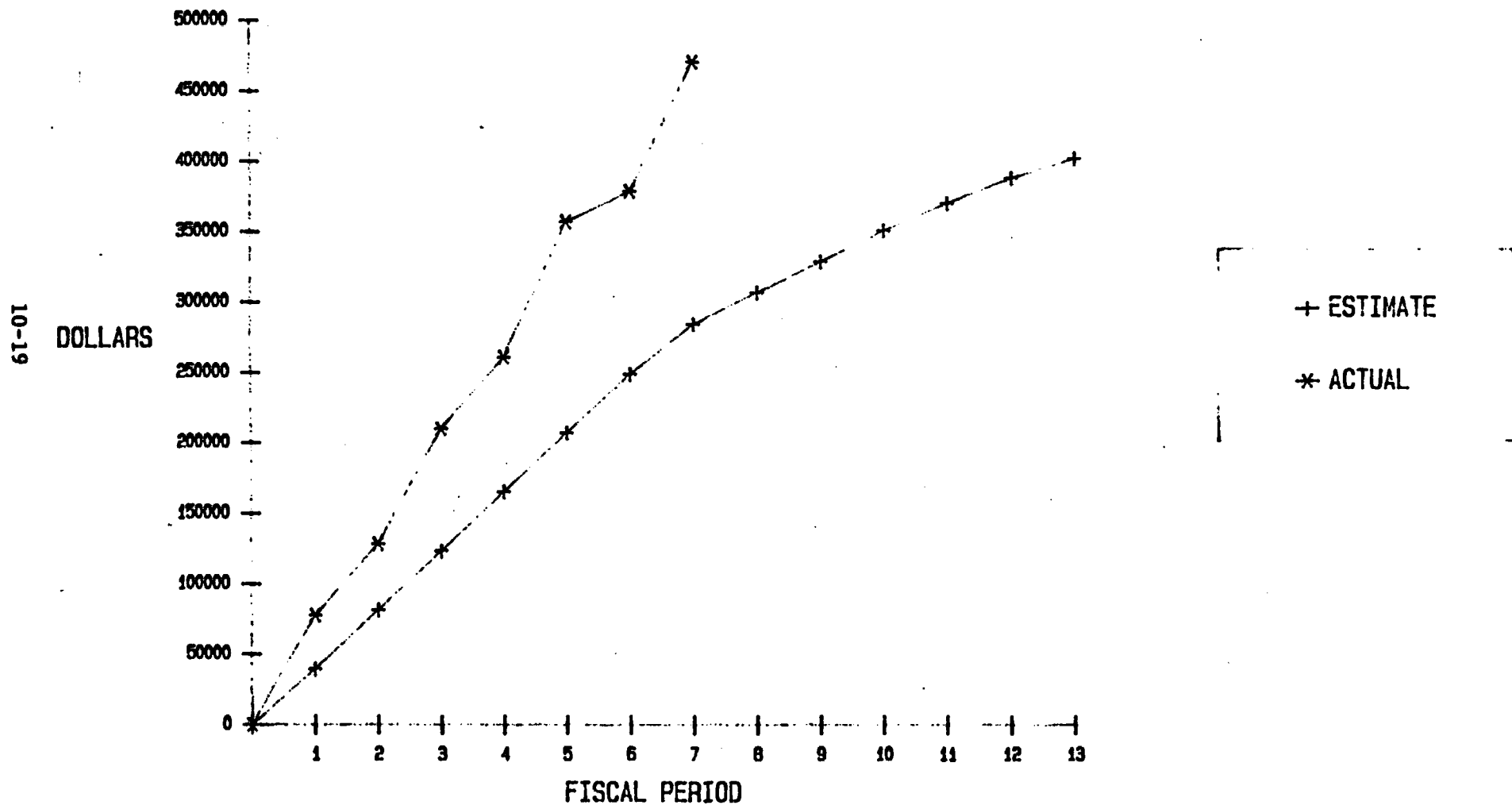
| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|--------|--------|--------|--------|---------|---------|---------|--------|--------|--------|--------|--------|--------|---------|
| EST PERIOD COST | 39355 | 42191 | 42080 | 41570 | 41705 | 41769 | 35581 | 22527 | 22027 | 22034 | 19694 | 17907 | 13903 | 284251 |
| ACT. PERIOD COST | 77802 | 50665 | 81510 | 50832 | 96173 | 21514 | 92278 | 0 | 0 | 0 | 0 | 0 | 0 | 470775 |
| VARIANCE, \$ | -38447 | -8474 | -39430 | -9263 | -54468 | 20255 | -56697 | 0 | 0 | 0 | 0 | 0 | 0 | -186524 |
| VARIANCE, % | -97.7 | -20.1 | -93.7 | -22.3 | -130.6 | 48.5 | -159.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -65.6 |
| EST. FY CUMUL | 39355 | 81546 | 123626 | 165196 | 206901 | 248670 | 284251 | 306778 | 328806 | 350840 | 370533 | 388440 | 402343 | |
| ACTUAL FY CUMUL | 77802 | 128467 | 209977 | 260809 | 356983 | 378497 | 470775 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.193 | 0.319 | 0.522 | 0.648 | 0.887 | 0.941 | 1.170 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | -38447 | -46921 | -86351 | -95614 | -150082 | -129827 | -186524 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | -97.7 | -57.5 | -69.8 | -57.9 | -72.5 | -52.2 | -65.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3704-030 SEISMIC - FY 91

Estimate vs. Actual



3704-040 INTEGR. WASTE PACKAGE E Element Status Cost Report

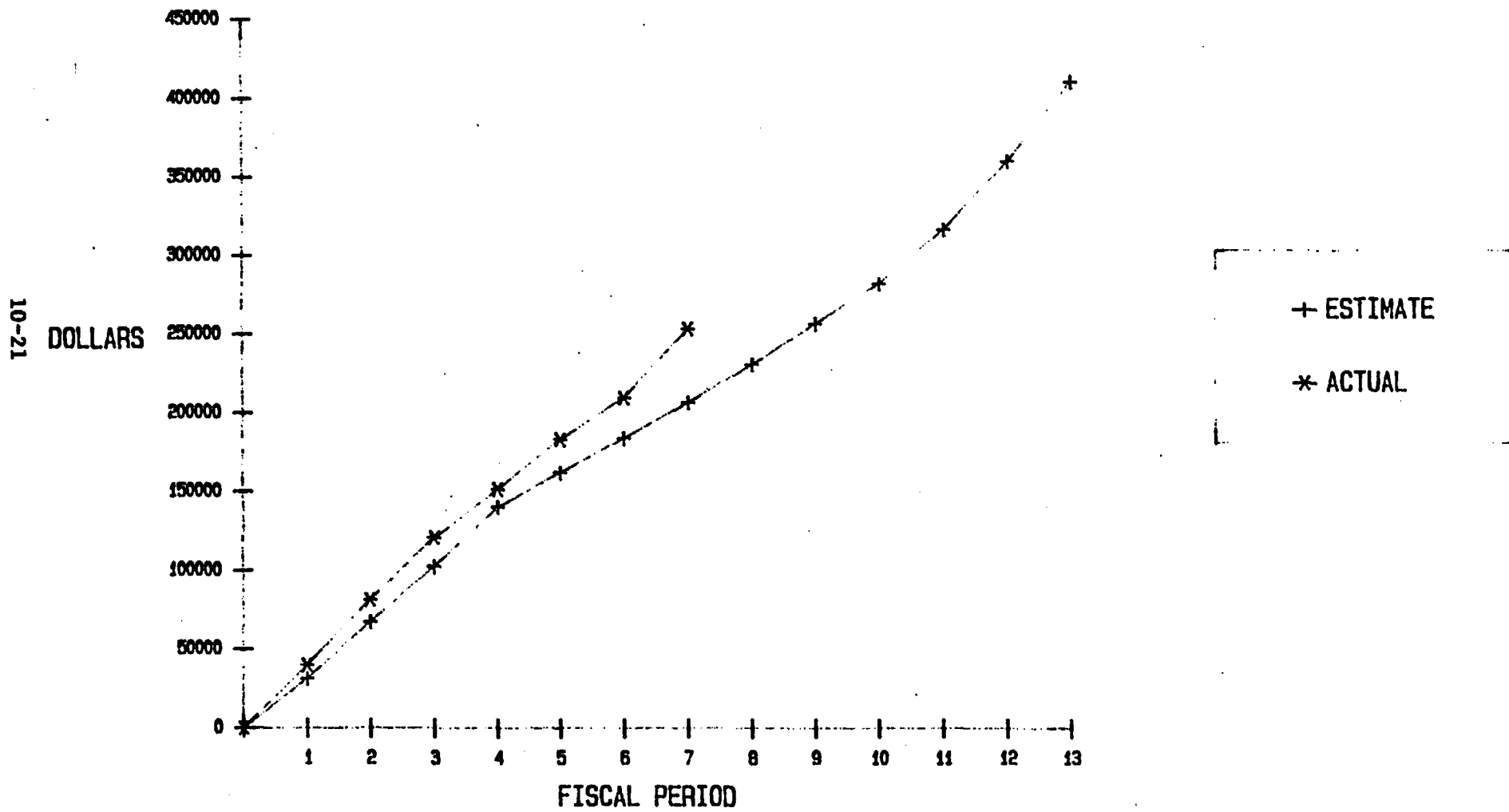
| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| EST PERIOD COST | 31303 | 36084 | 35181 | 37545 | 21894 | 21966 | 22807 | 24436 | 25687 | 25523 | 34680 | 43694 | 50953 | 206780 |
| ACT. PERIOD COST | 39685 | 41780 | 39362 | 30588 | 31659 | 26702 | 44003 | 0 | 0 | 0 | 0 | 0 | 0 | 253780 |
| VARIANCE, \$ | -8382 | -5696 | -4181 | 6957 | -9765 | -4736 | -21196 | 0 | 0 | 0 | 0 | 0 | 0 | -47000 |
| VARIANCE, % | -26.8 | -15.8 | -11.9 | 18.5 | -44.6 | -21.6 | -92.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -22.7 |
| EST. FY CUMUL | 31303 | 67387 | 102568 | 140113 | 162007 | 183973 | 206780 | 231216 | 256903 | 282426 | 317106 | 360800 | 411753 | |
| ACTUAL FY CUMUL | 39685 | 81465 | 120827 | 151415 | 183074 | 209776 | 253780 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.096 | 0.198 | 0.293 | 0.368 | 0.445 | 0.509 | 0.616 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | -8382 | -14078 | -18259 | -11302 | -21067 | -25803 | -47000 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | -26.8 | -20.9 | -17.8 | -8.1 | -13.0 | -14.0 | -22.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3704-040 WASTE PACKAGE - FY 91

Estimate vs. Actual



3704-050

STOCH MODELING

Element Status Cost Report

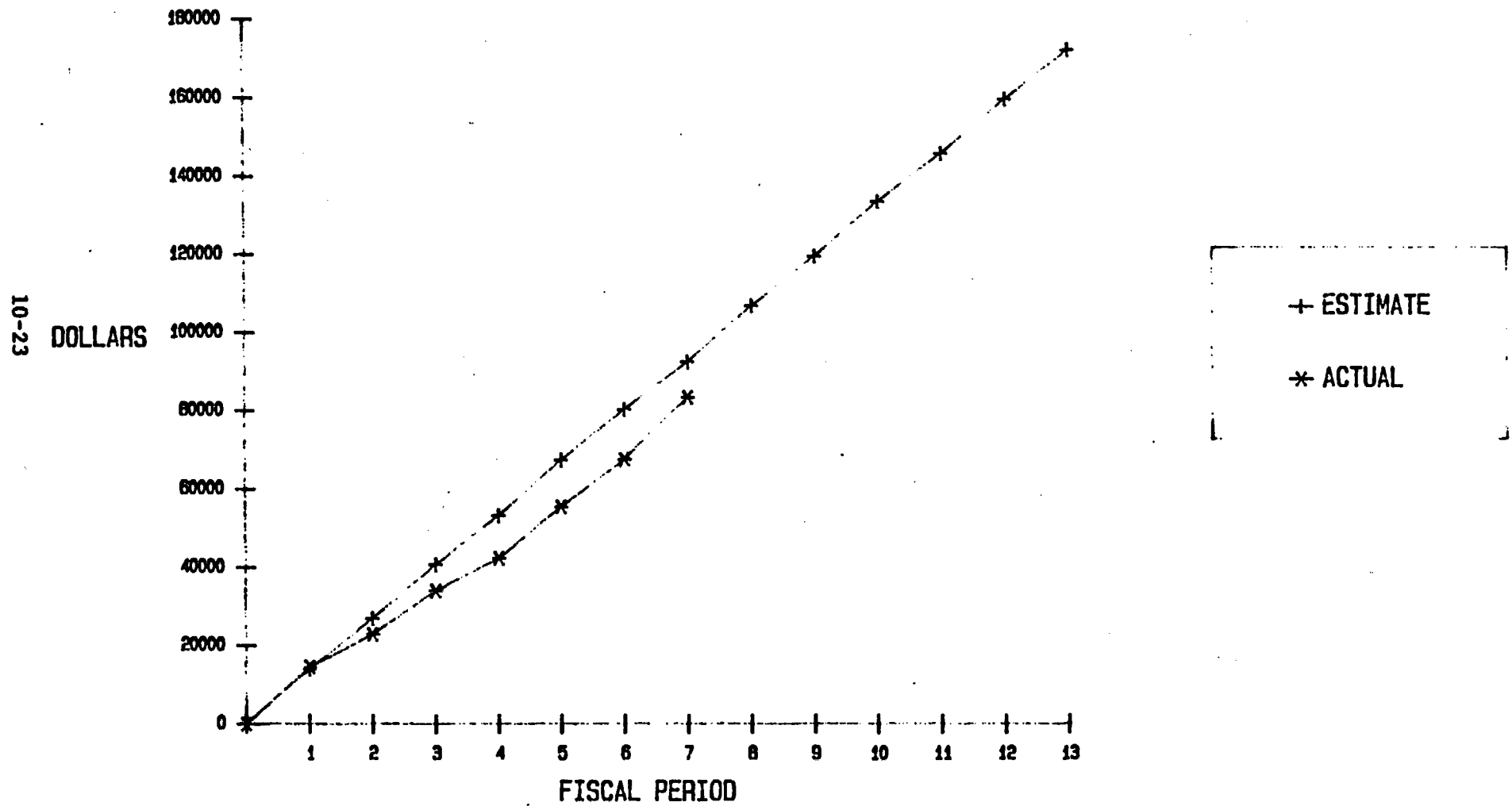
| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|-------|
| EST PERIOD COST | 13964 | 12927 | 13860 | 12505 | 14002 | 12960 | 12310 | 14194 | 12675 | 14192 | 12338 | 13835 | 12504 | 92528 |
| ACT. PERIOD COST | 14481 | 8372 | 11191 | 8291 | 13113 | 11982 | 16445 | 0 | 0 | 0 | 0 | 0 | 0 | 83875 |
| VARIANCE, \$ | -517 | 4555 | 2669 | 4214 | 889 | 978 | -4135 | 0 | 0 | 0 | 0 | 0 | 0 | 8653 |
| VARIANCE, % | -3.7 | 35.2 | 19.3 | 33.7 | 6.3 | 7.5 | -33.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.4 |
| EST. FY CUMUL | 13964 | 26891 | 40751 | 53256 | 67258 | 80218 | 92528 | 106722 | 119397 | 133589 | 145927 | 159762 | 172266 | |
| ACTUAL FY CUMUL | 14481 | 22853 | 34043 | 42335 | 55448 | 67430 | 83875 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.084 | 0.133 | 0.198 | 0.246 | 0.322 | 0.391 | 0.487 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | -517 | 4038 | 6708 | 10921 | 11810 | 12788 | 8653 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | -3.7 | 15.0 | 16.5 | 20.5 | 17.6 | 15.9 | 9.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3704-050 STOCH MODELING - FY 91

Estimate vs. Actual



3704-060 GEOCHEMICAL ANALOGS Element Status Cost Report

| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|-------|-------|-------|-------|-------|--------|-------|-------|--------|--------|--------|--------|--------|-------|
| EST PERIOD COST | 14907 | 8102 | 10135 | 10062 | 9943 | 10258 | 9966 | 14269 | 56195 | 59317 | 50920 | 50944 | 50831 | 73373 |
| ACT. PERIOD COST | 6316 | 4767 | 4008 | 5982 | 9627 | 20988 | 16965 | 0 | 0 | 0 | 0 | 0 | 0 | 68650 |
| VARIANCE, \$ | 8592 | 3334 | 6129 | 4081 | 316 | -10730 | -6999 | 0 | 0 | 0 | 0 | 0 | 0 | 4723 |
| VARIANCE, % | 57.6 | 41.2 | 60.5 | 40.8 | 3.2 | -104.6 | -70.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.4 |
| EST. FY CUMUL | 14907 | 23009 | 33144 | 43207 | 53149 | 63407 | 73373 | 87642 | 143836 | 203153 | 254072 | 305016 | 355847 | |
| ACTUAL FY CUMUL | 6316 | 11083 | 15089 | 21071 | 30697 | 51686 | 68650 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.018 | 0.031 | 0.042 | 0.059 | 0.086 | 0.145 | 0.193 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | 8592 | 11926 | 18056 | 22136 | 22452 | 11721 | 4723 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | 57.6 | 51.8 | 54.5 | 51.2 | 42.2 | 18.5 | 6.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

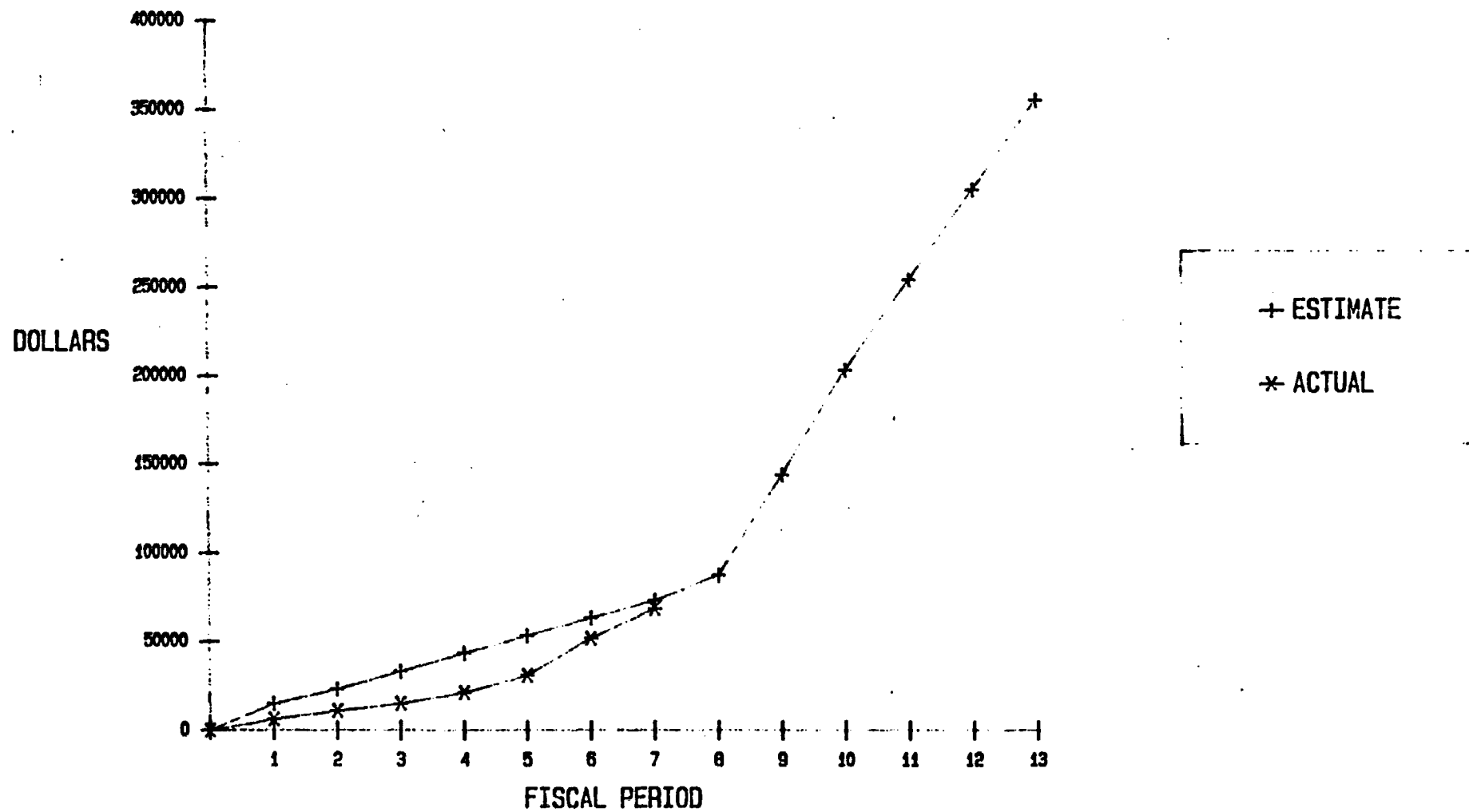
NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3704-060 GEOCHEMICAL ANALOGS - FY 91

Estimate vs. Actual

10-25



3704-070 SORPTION MECHANISMS Element Status Cost Report

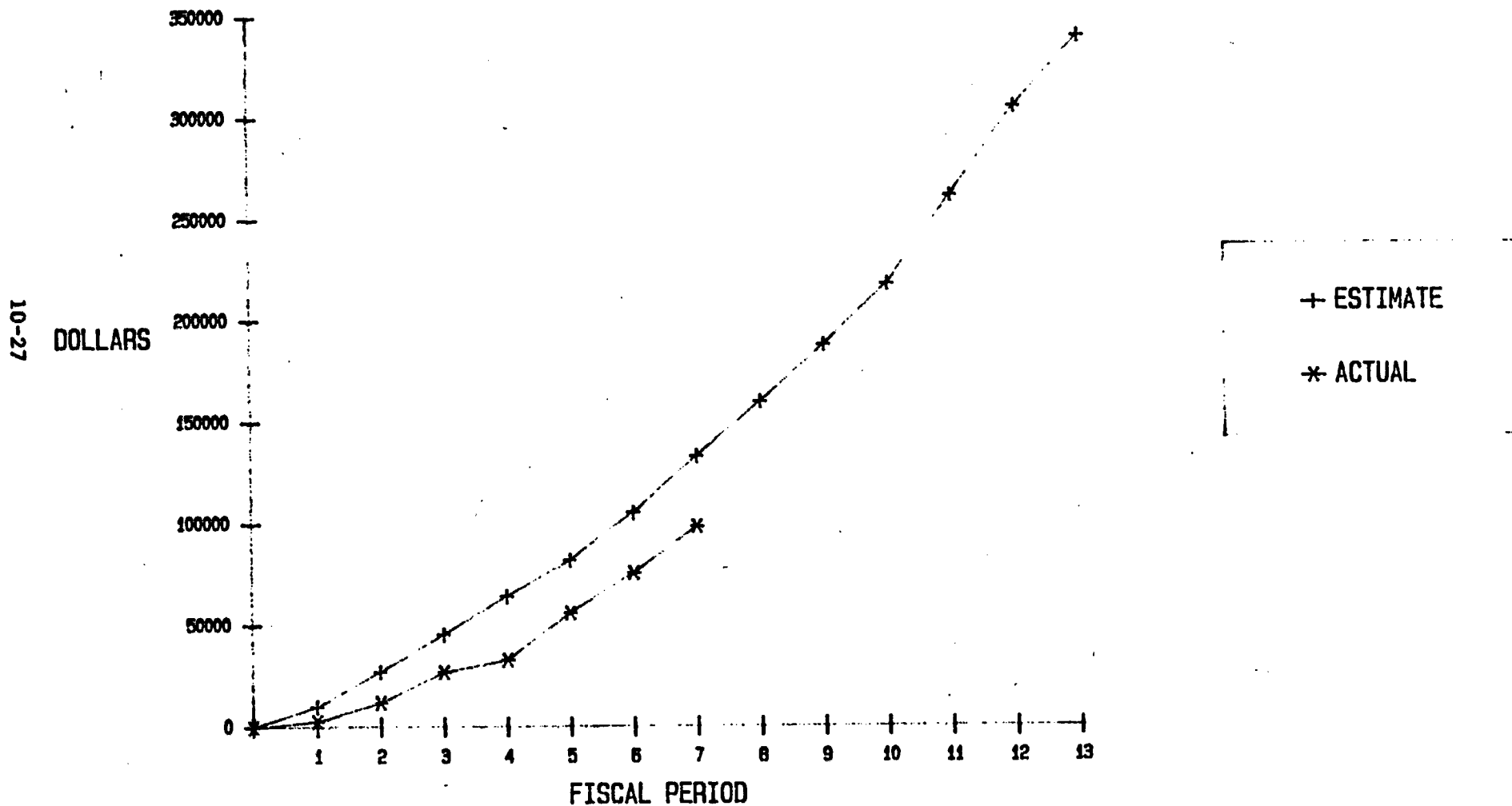
| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| EST PERIOD COST | 9907 | 17088 | 18400 | 18888 | 17619 | 23490 | 27379 | 27112 | 27828 | 29985 | 43899 | 43947 | 34650 | 132771 |
| ACT. PERIOD COST | 2830 | 9028 | 14847 | 5942 | 23268 | 19731 | 22760 | 0 | 0 | 0 | 0 | 0 | 0 | 98405 |
| VARIANCE, \$ | 7077 | 8060 | 3553 | 12946 | -5649 | 3759 | 4619 | 0 | 0 | 0 | 0 | 0 | 0 | 34366 |
| VARIANCE, % | 71.4 | 47.2 | 19.3 | 68.5 | -32.1 | 16.0 | 16.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.9 |
| EST. FY CUMUL | 9907 | 26995 | 45395 | 64283 | 81902 | 105392 | 132771 | 159883 | 187711 | 217696 | 261595 | 305542 | 340192 | |
| ACTUAL FY CUMUL | 2830 | 11858 | 26705 | 32647 | 55914 | 75645 | 98405 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.008 | 0.035 | 0.078 | 0.096 | 0.164 | 0.222 | 0.289 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | 7077 | 15137 | 18690 | 31636 | 25988 | 29747 | 34366 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | 71.4 | 56.1 | 41.2 | 49.2 | 31.7 | 28.2 | 25.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3704-070 SORPTION MECHANISMS - FY 91

Estimate vs. Actual



3704-110 PERFORMANCE ASSESSMENT Element Status Cost Report

| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| EST PERIOD COST | 26970 | 53360 | 41228 | 45845 | 39678 | 36175 | 37123 | 36201 | 36569 | 37107 | 37867 | 39513 | 38207 | 280379 |
| ACT. PERIOD COST | 8881 | 11369 | 14110 | 29603 | 14336 | 23938 | 21822 | 0 | 0 | 0 | 0 | 0 | 0 | 124060 |
| VARIANCE, \$ | 18089 | 41991 | 27118 | 16242 | 25342 | 12237 | 15301 | 0 | 0 | 0 | 0 | 0 | 0 | 156319 |
| VARIANCE, % | 67.1 | 78.7 | 65.8 | 35.4 | 63.9 | 33.8 | 41.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 55.8 |
| EST. FY CUMUL | 26970 | 80330 | 121558 | 167403 | 207081 | 243256 | 280379 | 316580 | 353149 | 390256 | 428123 | 467636 | 505843 | |
| ACTUAL FY CUMUL | 8881 | 20250 | 34360 | 63964 | 78300 | 102238 | 124060 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.018 | 0.040 | 0.068 | 0.126 | 0.155 | 0.202 | 0.245 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | 18089 | 60080 | 87198 | 103439 | 128781 | 141018 | 156319 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | 67.1 | 74.8 | 71.7 | 61.8 | 62.2 | 58.0 | 55.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

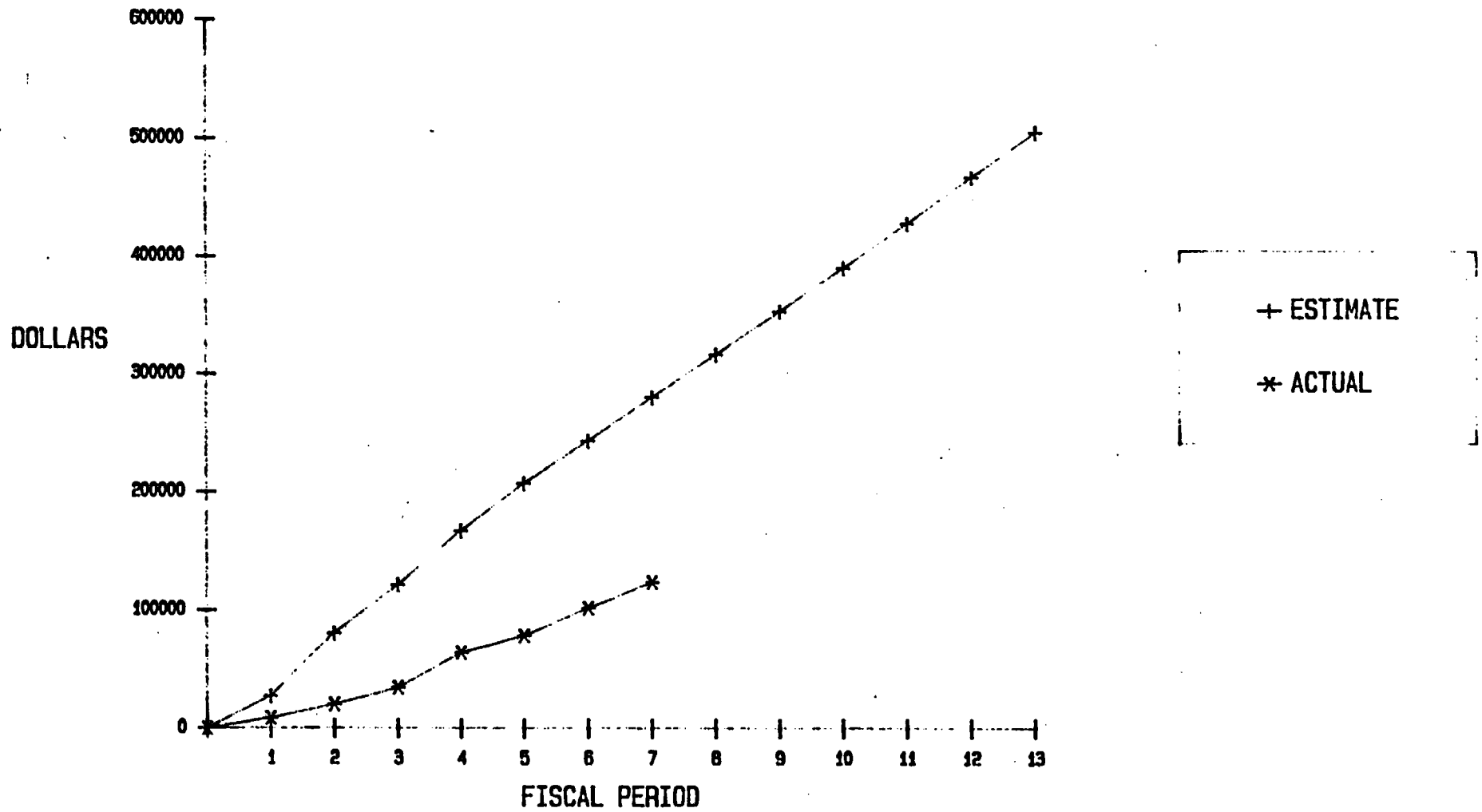
NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3704-110 RESEARCH PA - FY 91

Estimate vs. Actual

10-29



11. LICENSING SUPPORT SYSTEM ADMINISTRATOR

NRC Program Element Manager: Betsy Shelburne

CNWRA Element Manager: Rawley Johnson

Key Personnel: S. Young

Subcontractor/Consultant: C. Acree (P.I.)

11.1 Technical Status

Task 1 - Development of Access Protocols to LSS Technical Data

The trip report for the Center's visit to Carson City, Nevada on March 12, 1991, to review the State of Nevada's infrastructure and technical data handling procedures for the LSS was prepared and distributed. In addition the recommendation on Technical data Header fields was sent to the LSSA. Discussions were begun with the LSSA office following their review and comments on the Center's report on technical data definitions and the LSS participants' infrastructures.

11.2 Major Problems

None.

11.3 Forecast for Next Period

Staff will meet in May at the NRC offices to discuss and resolve the comments of the LSSA Office on the report. A strategy will be developed for resolving each issue. A plan for further work and investigations to complete the definition of technical data and identification of ambiguities in the participants' infrastructures will be developed together with the LSSA. The drafting of the plan for access protocols to LSS technical data will begin.

11.4 Element Financial Status

Table 1 below indicates the financial status of this Element in the context of "authorized" funds established by the NRC. Table 2 displays planned and actual costs without allowance for fee to date on both a per period and a cumulative basis. Variances are shown on both a dollar and percentage basis. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Costs incurred to date compare favorably with planned expenditures.

| Table 1. Financial Status | |
|---|------------|
| FY91 Funds Authorized (a) | \$ 180,037 |
| FY91 Funds Costed to Date (b) | \$ 83,495 |
| FY91 Funds Uncosted (c) | \$ 96,542 |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

NOTES: (a) Authorized funds remaining after FY90 actual expenditures with fee.
 (b) Actual expenditures FY91 YTD without fee.
 (c) Difference between (a) and (b).

3705

LSSA

Element Status Cost Report

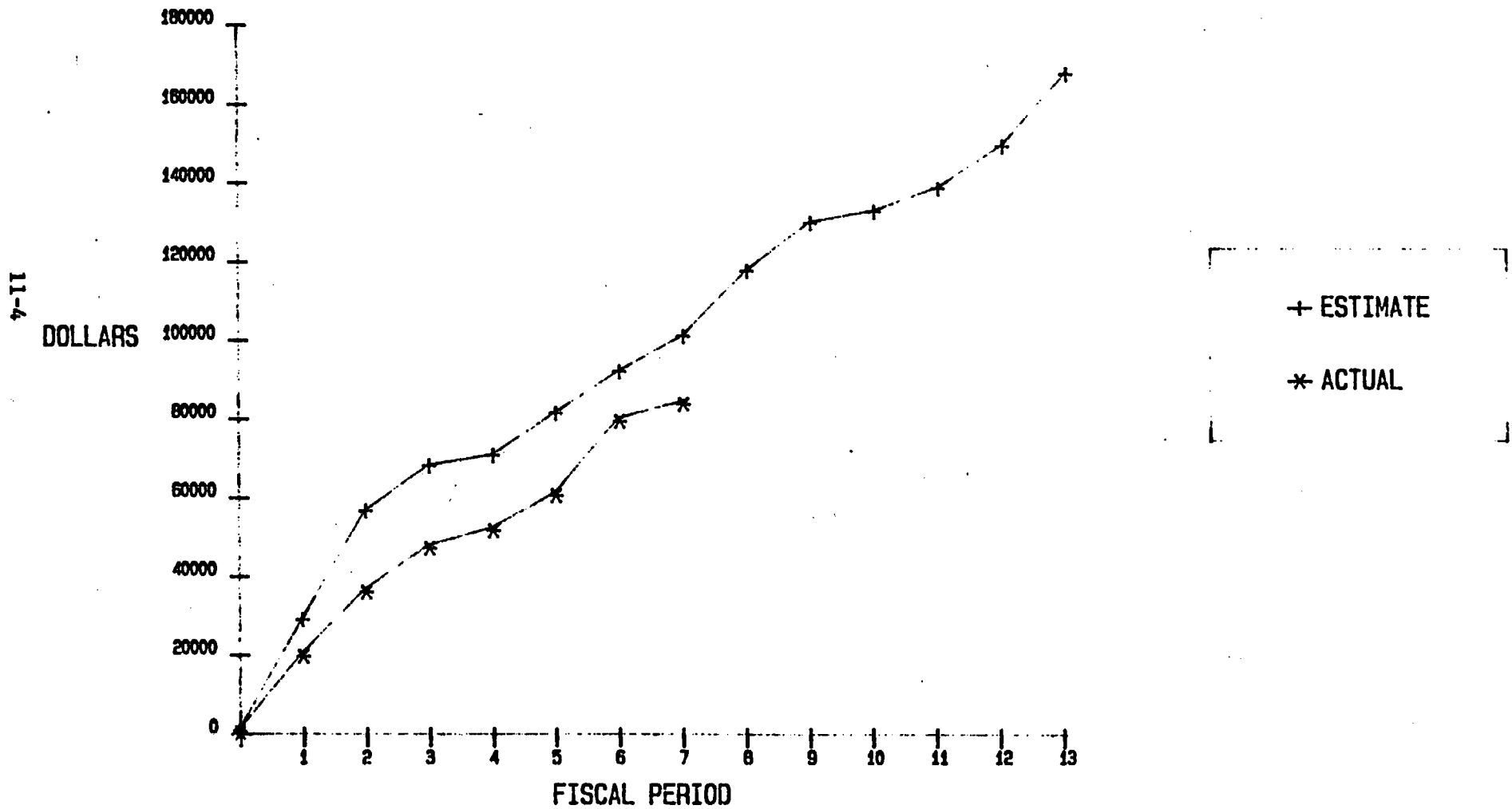
| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| EST PERIOD COST | 28134 | 27681 | 11418 | 2864 | 10661 | 10659 | 8958 | 16629 | 12192 | 2881 | 5989 | 10821 | 18488 | 100175 |
| ACT. PERIOD COST | 19377 | 16377 | 11153 | 4505 | 8896 | 18789 | 4397 | 0 | 0 | 0 | 0 | 0 | 0 | 83495 |
| VARIANCE, \$ | 8757 | 11304 | 265 | -1841 | 1765 | -8130 | 4562 | 0 | 0 | 0 | 0 | 0 | 0 | 16680 |
| VARIANCE, % | 31.1 | 40.8 | 2.3 | -69.1 | 16.6 | -76.3 | 50.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 16.7 |
| EST. FY CUMUL | 28134 | 55815 | 67233 | 69897 | 80558 | 91217 | 100175 | 116804 | 128996 | 131877 | 137866 | 148687 | 167175 | |
| ACTUAL FY CUMUL | 19377 | 35755 | 46908 | 51413 | 60309 | 79098 | 83495 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.116 | 0.214 | 0.281 | 0.308 | 0.361 | 0.473 | 0.499 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | 8757 | 20060 | 20325 | 18484 | 20249 | 12119 | 16680 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | 31.1 | 35.9 | 30.2 | 26.4 | 25.1 | 13.3 | 16.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3705-000 LSSA - FY 91

Estimate vs. Actual



12. WASTE SOLIDIFICATION SYSTEMS

NRC Program Element Manager: Davis Hurt

CNWRA Element Manager: Prasad Nair

Key Personnel: A. Chowdhury, H. Karimi, H. Manaktala, E. Tschoepe

Subcontractor/Consultant: G. Lamping

12.1 Technical Status

A Program Element Operations Plan for three tasks of the WSS Program Element was approved on April 8, 1991.

Task 1 - Assessment of Vitrification Off-Gas Generation and Treatment

Several documents and background reports supporting the task activities were obtained. Review of these materials is in progress. A visit to Commonwealth Edison facilities is planned to obtain information on performance and maintenance issues related to off-gas treatment systems currently in operation.

Task 2 - Sludge Mobilization and Mixing

P. Nair participated in a NRC-DOE/WVPD review meeting on April 2-4, 1991, on the subject of the Integrated Radwaste Treatment System (IRTS). The NRC was represented by R. D. Hurt, G. Comfort, T. Clark, J. Roth, and K. Abraham. The sludge washing activity is tied to the IRTS program. The IRTS process has been on standby since November 1990. This was done to investigate the change noticed in the inventory of fissile material in the HLW tank. WVPD has tentatively concluded that the fissile radionuclides are adhering to salt scales in the evaporator. The transportation of Pu and U from the 8D-2 tank has resulted in redefining the sludge washing program. The present plan is to integrate the supernatant and sludge wash processes into one, an approach identified as Waste Tank Farm Processing. The change is expected to impact minimally the sludge washing addendum to SAR. DOE's schedule now shows the completion of NRC's sludge washing SER activity by early October 1991. This assumes the availability of an early draft of the SAR and additional interactions among DOE/WVPD/NRC/CNWRA.

Task 3 - Seismic Analysis of the Vitrification Facility

No activity this reporting period.

12.2 Major Problems

None.

12.3 Forecast for Next Period

Work will be initiated on Tasks 3. Work will continue on Task 1 as planned. Task 2 activities will reflect the changes in the current DOE schedules.

12.4 Summary Financial Status

Table 1 below indicates the financial status of this Element in the context of authorized funds established by the NRC. Table 2 displays planned and actual costs, without allowance for fee, to date on both a per period and a cumulative basis. In addition, these data do not include commitments, and variances are shown on both a dollar and percentage basis. Commitments in the Element are \$1,895. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

| Table 1. Financial Status | |
|---|------------|
| FY91 Funds Authorized (a) | \$ 194,000 |
| FY91 Funds Costed to Date (b) | \$ 42,133 |
| FY91 Funds Uncosted (c) | \$ 151,867 |
| Recommended Adjustment to Complete (+/-) | \$ -0- |
| See the enclosed Element Status Cost Report | |

NOTES: (a) FY91 authorized funds.
(b) Actual expenditures FY91 YTD without fee.
(c) Difference between (a) and (b).

3706

WSS

Element Status Cost Report

| ITEM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | TOTAL |
|------------------|-------|-------|-------|--------|-------|-------|-------|-------|--------|--------|--------|--------|--------|-------|
| EST PERIOD COST | 0 | 0 | 0 | 3565 | 14279 | 17311 | 28878 | 28473 | 18396 | 14953 | 16031 | 23794 | 14900 | 64034 |
| ACT. PERIOD COST | 0 | 0 | 6837 | 10614 | 4574 | 6084 | 14024 | 0 | 0 | 0 | 0 | 0 | 0 | 42133 |
| VARIANCE, \$ | 0 | 0 | -6837 | -7048 | 9704 | 11227 | 14854 | 0 | 0 | 0 | 0 | 0 | 0 | 21901 |
| VARIANCE, % | 0.0 | 0.0 | 0.0 | -197.7 | 68.0 | 64.9 | 51.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 34.2 |
| EST. FY CUMUL | 0 | 0 | 0 | 3565 | 17844 | 35156 | 64034 | 92507 | 110903 | 125856 | 141887 | 165681 | 180582 | |
| ACTUAL FY CUMUL | 0 | 0 | 6837 | 17451 | 22025 | 28109 | 42133 | 0 | 0 | 0 | 0 | 0 | 0 | |
| PERCENT COMPLETE | 0.000 | 0.000 | 0.038 | 0.097 | 0.122 | 0.156 | 0.233 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| VARIANCE, \$ | 0 | 0 | -6837 | -13885 | -4181 | 7047 | 21901 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VARIANCE, % | 0.0 | 0.0 | 0.0 | -389.4 | -23.4 | 20.0 | 34.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

3706 WSS - FY 91

Estimate vs. Actual

