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

FOR THE FISCAL REPORTING PERIOD—

February 16, 1991 - March 15, 1991

PMPR No. 91-06

March 29, 1991

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**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

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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: 02/16/91 - 03/15/91

1. SUMMARY

1.1 Technical Status

NMSS Element 1 - CNWRA Operations

Center and NRC management staff briefed the Commission at the end of this fiscal period. The briefing focused on the status of the overall high-level nuclear waste management program, including progress on establishing and staffing the Center, and on accomplishments that have been achieved during the past 12 months. Examples of joint NRC/CNWRA projects and coauthored papers were highlighted.

NRC and Center management held 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. Particular management attention was directed toward critical WSE&I milestones and cost variances being experienced in several of the Program Elements and Projects. Electronic time-keeping was implemented this period as a Center management initiative to provide more timely accounting of labor expenditures on the various tasks, projects, and elements of work.

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 revised Staffing Plan is approved. 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. At least one interview is planned for next period.

The active participation by each of the Element Managers and Directors of the Center led to the completion and transmittal of the Center Five-Year Plan on March 15, 1991. An integrated approach to program identification was pursued in the development of this Plan, consistent with information obtained via Systematic Regulatory Analysis (SRA). The revised Center Management Plan was transmitted in final form February 26, 1991.

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), review of technical operating procedures and development of quality assurance procedures, and QA indoctrination and training.

NMSS Element - 2 Waste Systems Engineering and Integration

Work on the Repository Functional Analysis (RFA) culminated in the completion and transmittal of this important milestone report on February 28, 1991 (Section 3). This work was completed consistent with the agreement that resulted from interactions between WSE&I and RDCO staffs of the NRC and CNWRA. Extensive technical and management reviews

were conducted on the materials resulting from the analysis.

Plans were made to host a second two-day course on Systems Engineering at the NRC facilities, as well as an abbreviated version of the same course at the Center offices in San Antonio. This training will be conducted by consultant experts in the systems area. Follow-on training in Systematic Regulatory Analysis was also planned.

Center staff continued support to the NRC task team which is charged with selecting general approaches to the reduction of regulatory and institutional uncertainties that were identified in CNWRA 90-003. Review comments were provided February 19, 1991, on the results of the task team work that will form the appendix of the report. Comments on the main body of the report are due next period.

The Regulatory Requirements (RR) and Regulatory Elements of Proof (REOP) analysis was completed and the report was transmitted to NRC February 28, 1991. In addition to Program Architecture Review Committee (PARC) reviews, which reviewed these materials against criteria established in TOP-001-03, extensive technical and management reviews were also conducted.

As work progresses in the areas noted above, appropriate modifications are being made to PASS Version 2.0 to improve processing speed and functionality. Significant improvements in input and retrieval speed and efficiency have been achieved. Development of a specification for enhancements to PASS began during this period, taking into consideration the lessons learned to date. Work continues on implementation of software quality assurance and configuration control aspects of Center activities.

Under the day-to-day direction of the technical program Element Managers, extensive SRA activity continued on the thermal loads, retrievability, mining regulations, and coordination of ESF design with repository design topics. The SRA work on retrievability continued to be PARC'd and entered into the database, 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 receipt of NRC comments and direction.

NMSS Element 3 - External Quality Assurance

Staff participated in the NRC Audit Observation team at REEC Co February 25 through March 1, 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 Los Alamos National Laboratory Observation Audit.

NMSS Element 4 - Geologic Setting

In addition to participation in routine NRC meetings, GS Element staff and management participated in the DOE/NRC technical exchange on the NRC seismic hazard staff positions on February 20, 1991 (Section 5). A Center consultant provided a briefing to the NRC staff on the topic "Volcanic Stratigraphy of Yucca Mountain."

Interactions continued on the development of a work plan on Probabilistic Seismic Hazard Analysis. The results of the above-mentioned meeting will require changes in the approach originally planned.

SRA work on the Ground Water Travel Time (GWTT) study continued this period, as did technical interactions. The focus of effort was technical and regulatory alternatives to the current subsystem requirement.

In addition, 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 was done 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

Staff presented a paper titled "Degradation Modes of Nuclear Reactor Fuel Cladding" and chaired two sessions at CORROSION'91, a conference sponsored by the National Association of Corrosion Engineers.

A presentation was made by NRC and Center staffs on the Substantially Complete Containment (SCC) Feasibility Study (Section 6). A meeting was held at the Center on March 6, 1991, to discuss follow-on studies that are needed to complete the SCC evaluation effort.

Activities related to the performance of the engineered barrier subsystem continued with a focus on development of the Watson crevice corrosion model. Using Watson's room-temperature results for 316L stainless steel as the initial test case, preliminary results suggest good agreement with one of two cases but not with the other. Evaluation of these results continues.

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 began preparations associated with the review of DOE responses to Site Characterization Analysis comments (Section 7). In addition, Center staff completed a trip report documenting its observations of the NRC/DOE technical exchange meeting on the ESF Alternatives Study and Calico Hills Cost-Benefit Analysis.

Planning activities continued regarding development of compliance determination methods for coordinating the ESF and repository designs. Comment resolution activities related to the public comment draft of the NRC Technical Position on Thermal Loads were completed and transmitted to NRC. 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. The required effort is proving to be significantly greater than anticipated when the Operations Plans were developed. Comment resolution began on the two previously submitted intermediate milestone reports on acceptance criteria for the report on RFA review and development of repository operational criteria. These are being incorporated in the revised documents. In-depth analysis of ROC topics continued, in support of preparation of the first report under this task.

NMSS Element 7 - Performance Assessment

A draft report on the SRA of 40 CFR Part 191, comprising Regulatory Requirements and Regulatory Elements of Proofs (REOPs) for the total system performance objective, was completed and transmitted (Section 8). Preliminary work continued on development of a Compliance Determination Strategy for the total system performance objective.

Extensive planning and reprogramming of activities took place this period. Included were the first management teleconference on the Iterative Performance Assessment and several teleconferences at the team-leader level.

Total System Code development work continued. Development of the 'executive module' continued with a planned completion of early April. Upon completion of this early version, it will be distributed (together with brief instructions on its use) to NRC and Center users.

Work on the source term module continued, including activities related to modification of the PHREEQE geochemistry code and its coupling to a version of GLASSOL. The latter code was obtained to support source term studies related to glass leaching.

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.

Staff completed their input to the report on 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.

The draft first Research Annual Report was completed and transmitted to NRC February 27, 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. Initial experimental conditions, which were selected based on EQ3/6 modeling results, include sodium chloride and sodium bicarbonate and various solid-mass/solution ratios. The UV-Visible spectrophotometry analytical technique is being used for the analysis of Al and Si.

Implementation of the EQ3/6 software which was recently obtained from Lawrence Livermore National Laboratory continued.

Research Project 3 - Thermohydrology

Evaluations continued on the 'draft' version of the TOUGH2 code which was received from Lawrence Berkeley National Laboratory. Problems encountered are being reported to the code author. The previous version of TOUGH continues to be used for data analysis and interpretation until a reliable version of the revised code can be obtained.

The dimensionless pi terms continue to be evaluated. It appears prudent to limit early studies to six of the 22 terms that have been identified; these terms seem to be most important, based on analyses to date.

Preparations were made for relocating the experimental apparatus to Building 57 to obtain better temperature and humidity controls for the future 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. Plans are being made to remotely acquire all of the data except the closure measurements (which are manually read).

Uniaxial compression and Brazilian tensile laboratory tests were completed this period. Preparation of shear test specimens was also completed.

The paper "Experimental Determination of Properties of Natural Rock Joints in a Welded Tuff" is being prepared for presentation at the 1991 ASME Geomechanics Symposium which will be held June 16-19, 1991, in Columbus, Ohio.

Research Project 5 - Integrated Waste Package Experiments

A review of the literature on localized corrosion, with a focus on test methodologies and the effects of environmental variables, continues. A report will be prepared to document the results of the review.

Studies on alloy 825 examined the effects of bicarbonate concentration and pH on localized corrosion. Early results indicate no inhibiting effect of bicarbonate in the range of 85 to 2000 ppm. There is some indication that sulfate may act as an inhibitor, but only at very high concentrations.

NRC approved three previously submitted test plans.

Staff attended CORROSION'91, where G. Cragolino presented the paper "Localized Corrosion of a Candidate Container Material for High Level Nuclear Waste Disposal," which was coauthored with N. Sridhar.

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 continued and are approaching completion. Results of the literature review are being compiled and summarized, in preparation for an April 1, 1991, delivery of the draft report.

To accommodate use of CRAY-2 time under a NASA grant, the work on Task 1 described above has been delayed somewhat. Work in this area has produced a 20-fold increase in computational speed.

Research Project 7 - Geochemical Analogs

The draft Natural Analog Literature Review Report continued to be revised to accommodate NRC comments, in preparation for submittal as a final document.

Activities in this project focused on the field site investigations at Peña Blanca. Three key Project participants from the Center visited the candidate field site the week of February 24, 1991. Preliminary information from this investigation is anticipated to be presented at a meeting of the Nuclear Waste Technical Review Board (NWTRB) April 16-17, 1991, in Reno, NV.

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. In particular, experimental and modeling studies related to uranium sorption on geologic media were reviewed. A work plan for experimental studies in this area has been drafted and is undergoing internal technical and management reviews in preparation for transmittal to the NRC.

Research Project 10 - Performance Assessment

Coding for modifying PORFLO-3 continued this period. The first test problem for the SNL code DCM-3 was selected.

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 will be summarized for presentation at the upcoming INTRAVAL meeting in Seattle. In addition, computations of equilibrium radioelement solubilities continued, using the EQ3 program. The literature review on carbon-14 retardation mechanisms commenced.

LSSA Support - Development of Access Protocols for Technical Data

Two deliverables were completed and transmitted as a single report February 28, 1991 (Section 11). This report addressed definitions of technical data and the infrastructure of the organizations which are anticipated to provide input to the LSS. The State of Nevada infrastructure and data handling procedures were reviewed in a visit to their Reno facilities.

Waste Solidification Systems

Approval is awaited on an Operations Plan for the Waste Solidification Systems (WSS) Program Element which was transmitted to NRC February 15, 1991 (Section 12). Preliminary information-gathering activities continued on the vitrification off-gas task. Substantive work on the sludge mobilization and mixing task continued to be delayed pending receipt of the DOE Safety Analysis Report (SAR). In the meantime, staff continued review of background materials so that the Safety Evaluation Report can be prepared as expeditiously as possible after receipt of the SAR.

1.2 Major Problems

Substantial cost variances have occurred in several of the Elements and Projects. Evaluations and intensive interactions with NRC management are ongoing concerning the root causes of these variances and tentative decisions have been made regarding control measures and project baseline revisions that are appropriate to remedy the variances.

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) resolution of cost variances, including 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.

Development of the Program Architecture and PASS will continue with an emphasis on Systematic Regulatory Analysis. Preparation of the final report on the Repository Functional Analysis will commence, pending receipt of comments. Briefings will be provided to the NRC staff on both the RFA report and the Regulatory Requirement and Regulatory Element of Proof report. 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. The Configuration Management and Control Manual for CNWRA computer systems will continue to be implemented. Effort will also be devoted to revisions of both the LARS Recommendation Report and the associated CDS development procedure, 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 Los Alamos National Laboratory 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, as requested.

The EBS Element will develop work plans for continued work on the technical feasibility 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. Review of DOE responses to the SCA comments should begin next period. Work on the ROC will continue in accordance with the approved work plan.

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 revision to the RR/REOP hierarchy.

The draft first Annual Research Report will be revised, pending receipt of NRC comments, in preparation for publication as a NUREG/CR. 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 complete a report addressing technical data header information in support of the LSSA. The previously submitted report will be revised, based on NRC comments.

Work will focus on activities in Tasks 1 and 2 of the WSS Program Element. Task 3 may also be initiated, upon approval of the WSS Operations Plan.

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 \$287,157. 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)	\$11,804,801
FY91 Funds Costed to Date (b)	\$ 4,736,880
FY91 Funds Uncosted (c)	\$ 7,067,921
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 (3/15/91)

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 GEOCHEMISTY	
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 (3/15/91)

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 GEOCHEMISTRY (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.

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

Staffing Summary

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

3700-000

CENTER COMPOSITE

Element Status Cost Report

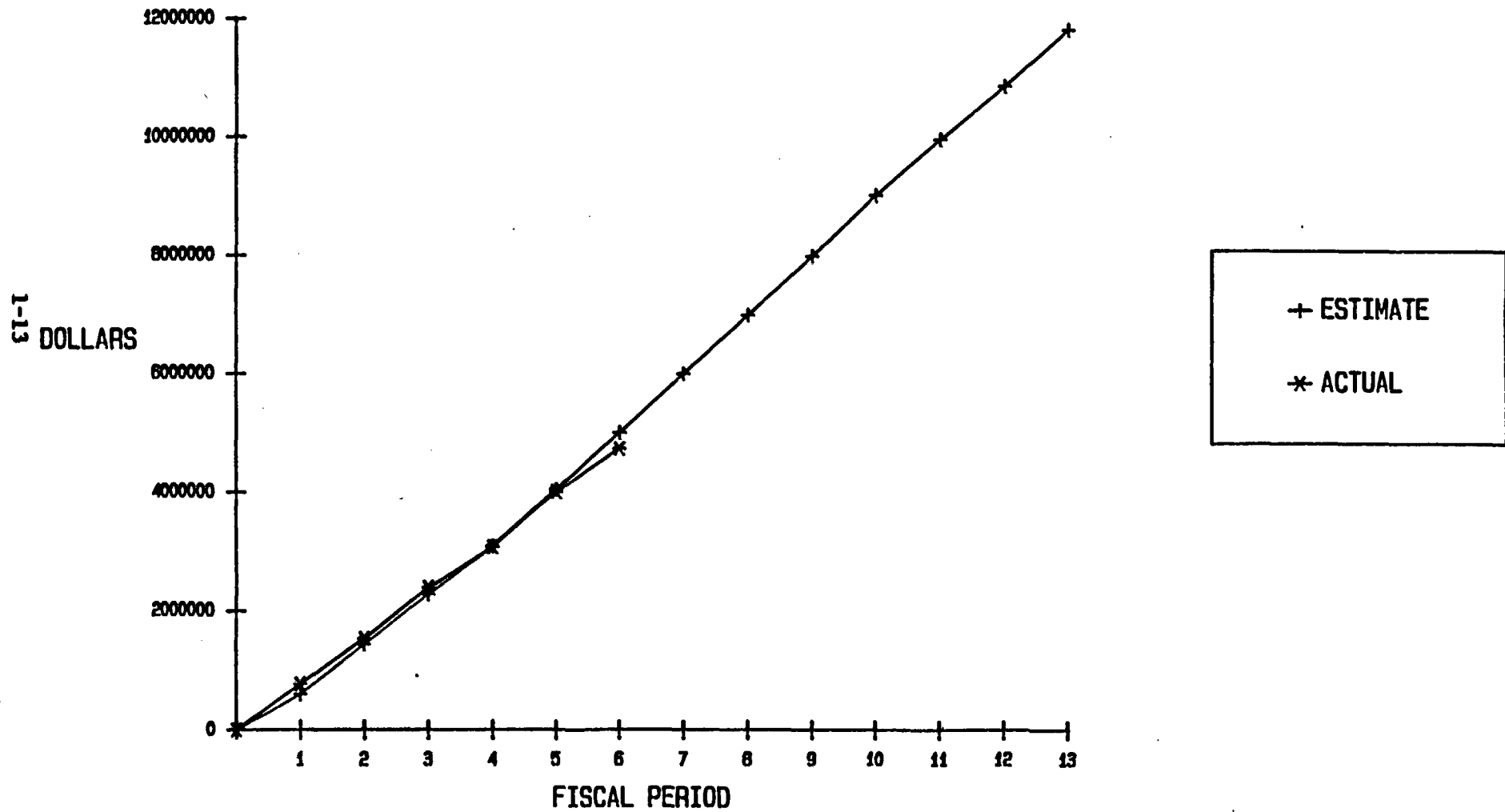
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	801629	833898	850755	810485	950280	964105	993523	993474	1000443	1029787	949340	900259	959150	5011153
ACT. PERIOD COST	770452	763102	864860	679889	893163	765415	0	0	0	0	0	0	0	4736881
VARIANCE, \$	-168823	70796	-14105	130596	57117	198690	0	0	0	0	0	0	0	274271
VARIANCE, %	-28.1	8.5	-1.7	16.1	6.0	20.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5
EST. FY CUMUL	801629	1435527	2286283	3096767	4047048	5011153	6004675	6998149	7998592	9028380	9977719	10877978	11837128	
ACTUAL FY CUMUL	770452	1533555	2398415	3078304	3971467	4736881	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.065	0.130	0.203	0.260	0.336	0.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-168823	-98027	-112132	18464	75581	274271	0	0	0	0	0	0	0	
VARIANCE, %	-28.1	-6.8	-4.9	0.6	1.9	5.5	0.0	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	589722	589578	557304	712291	713304	752978	759847	721049	753000	864750	594681	659282	3537568
ACT. PERIOD COST	581733	574543	638506	488580	646698	582490	0	0	0	0	0	0	0	3492530
VARIANCE, \$	-176364	-4821	-38928	68744	65593	130814	0	0	0	0	0	0	0	45038
VARIANCE, %	-45.8	-0.8	-6.5	12.3	9.2	18.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
EST. FY CUMUL	385369	955091	1554869	2111973	2824264	3537568	4290546	5050393	5771442	6524442	7189192	7783853	8443136	
ACTUAL FY CUMUL	581733	1136276	1774781	2263342	2910040	3492530	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.067	0.135	0.210	0.268	0.345	0.414	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-176364	-181185	-220113	-151369	-85776	45038	0	0	0	0	0	0	0	
VARIANCE, %	-45.8	-19.0	-14.2	-7.2	-3.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

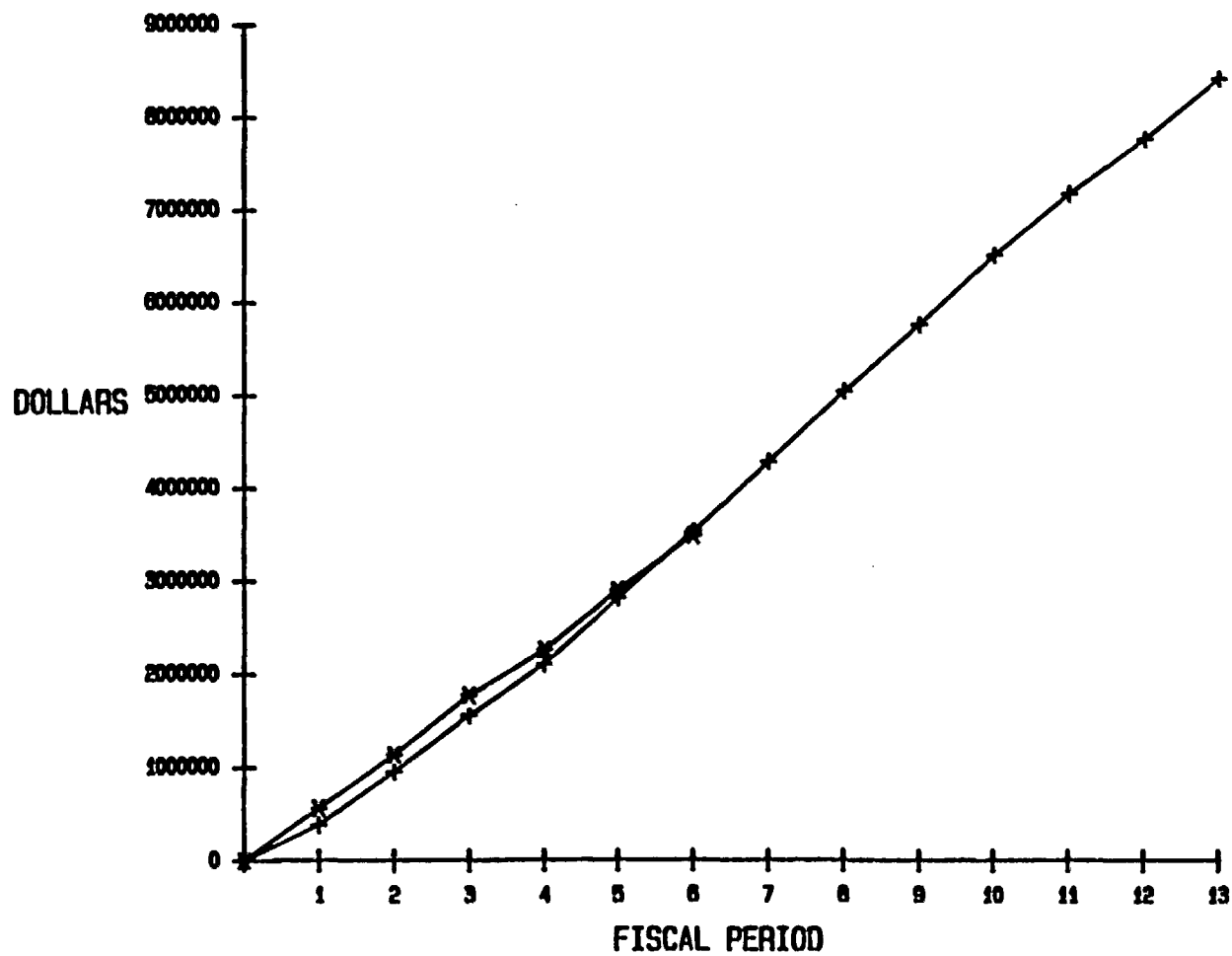
NOTES:

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.

1-15

3702 HIGH LEVEL WASTE - FY 91

Estimate vs. Actual



+ ESTIMATE

* 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	1358488
ACT. PERIOD COST	189342	172182	208364	176210	232994	158052	0	0	0	0	0	0	0	1137144
VARIANCE, \$	-1216	64313	31395	71553	-15935	71233	0	0	0	0	0	0	0	221344
VARIANCE, %	-0.6	27.2	13.1	28.9	-7.3	31.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.3
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	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.061	0.116	0.183	0.240	0.314	0.365	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-1216	63097	94492	166046	150111	221344	0	0	0	0	0	0	0	
VARIANCE, %	-0.6	14.9	14.2	18.2	13.3	16.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

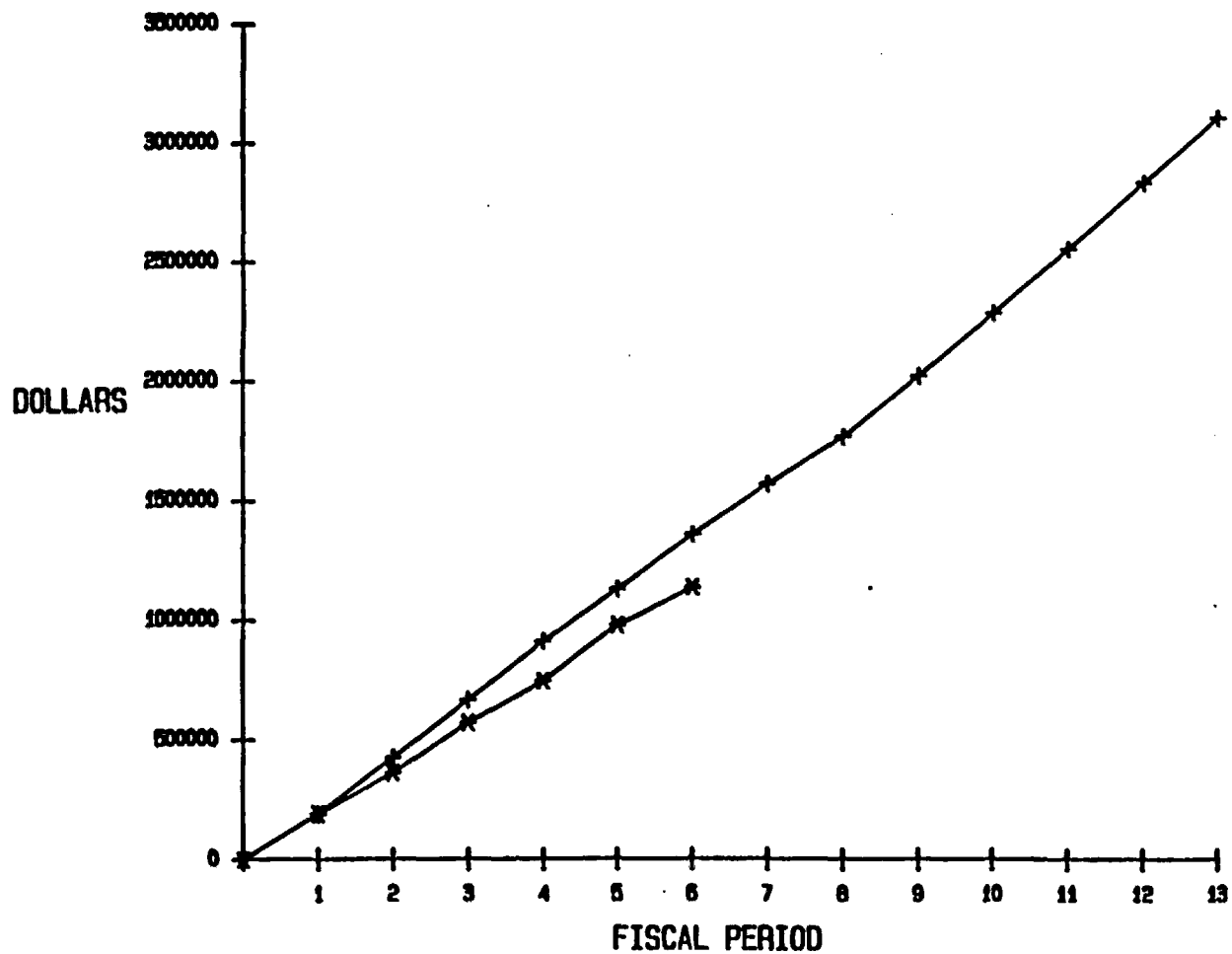
91-1

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



+ ESTIMATE

* 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
Consultant: A. Greenberg

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 NRC Commission Briefing, Center/NRC Periodic Management 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. Center management is evaluating the impact resulting from the temporary reorganization of Center on the operating groups and their pursuit of the delivery schedules for various existing and revised major and intermediate milestones. Sustained submission of supporting information relative to the NRC budget for the Center in FY92 and beyond coupled with renewed examination of near-term and subsequent fiscal year's Operations/Project Plan cost, scope and schedule was characteristic of much Center activity in this task. Implementation of the interim procedure for changing or modifying Operations/Project Plan cost, scope and schedule in response to ad hoc requests for same will commence following the delivery of the revised Operations/Project Plans. In addition, the Center introduced Electronic Time-Keeping and Cost-Sheet capabilities to facilitate both element and project management.

Task 2 - Develop and Sustain Technical and Analytical Capabilities

The Center is continuing input of various documents to the Technical Document Index (TDI). The Correspondence Control Log has been made operational. 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 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 continued. Drs. J. Russell and B. Sagar were advised of potential funding constraints that may impact their pursuit of such candidates.

Task 4 - Operations Plans and Five Year Plan Development

The draft version of the Center Five-Year Plan was delivered. The Center continued its involvement in the activities associated with the revision of Operations and Project Plans. The Center awaits a response to the ADP Plan comments 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 new Quality Assurance Procedures (QAPs), surveillance of Center 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.

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 await the NRC response to the draft version of its Five-Year Plan. 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 seventh period of FY91. Attendance at professional development events and participation in professional/technical society activities will be encouraged. Work will continue on the

Technical Document and Correspondence Control Indexes.

The CQAM will continue to be implemented, along with actions to respond to the Corrective Action Request. Areas within the CQAM are being reviewed to ensure they reflect current Center policy and fully meet 10 CFR Part 50 Appendix B and the NRC Review Plan for HLW QA Program Descriptions. It is expected that a change to the CQAM will be issued in May of 1991, reflecting the above criteria and lessons learned at the Center.

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 \$5,299. 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)	\$ 965,927
FY91 Funds Uncosted (c)	\$1,224,712
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	1030591
ACT. PERIOD COST	154970	171371	169190	111360	182216	176821	0	0	0	0	0	0	0	965927
VARIANCE, \$	-71222	17455	39203	51077	16545	11605	0	0	0	0	0	0	0	64664
VARIANCE, %	-85.0	9.2	18.8	31.4	8.3	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3
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	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.070	0.148	0.225	0.275	0.358	0.438	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-71222	-53767	-14563	36513	53058	64664	0	0	0	0	0	0	0	
VARIANCE, %	-85.0	-19.7	-3.0	5.7	6.3	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

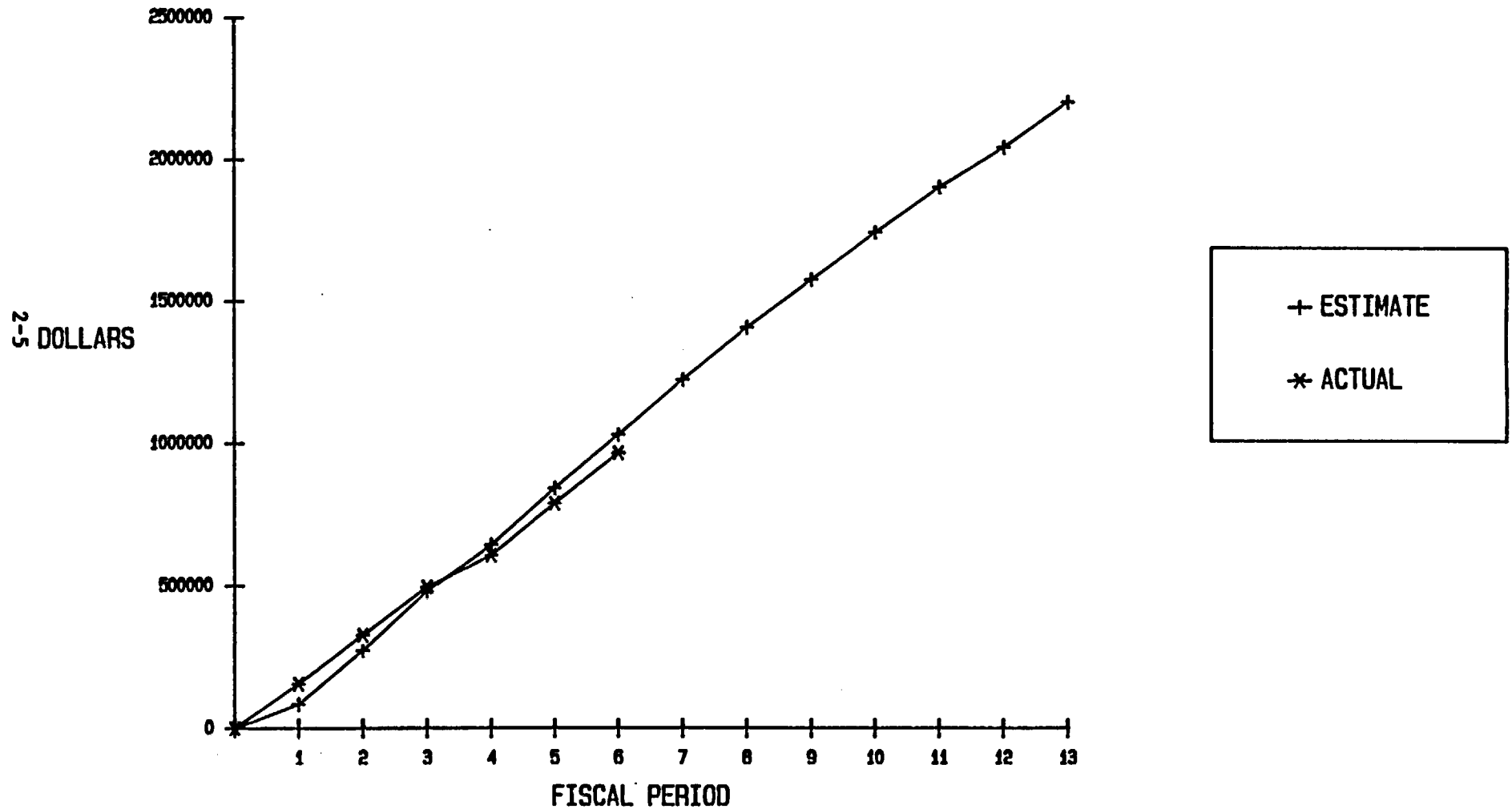
2-4

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, 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 the Center involved the development of the Repository Functional Analysis (RFA) (Draft Report delivered to NRC on February 28, 1991) and continuing Systematic Regulatory Analysis (SRA) efforts related to Technical Positions on Thermal Loads, Retrievability, and Mining Regulations, as well as work 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) loading into the PADB of reviewed and approved information in support of the Regulatory Requirement/Regulatory Elements of Proof (RR/REOP) Report (delivered March 15, 1991); (4) limited participation in the NRC uncertainty reduction method task activity; (5) preliminary discussions on LARS Recommendation Report comments; and (6) optimizing and extending features of PASS V2.0 based on lessons learned.

Task 1 - Statutory and Regulatory Analysis

During this period, the Repository Functional Analysis (RFA) draft report (WSE&I Intermediate Milestone 3702-031-102-001) was completed and delivered to the NRC on February 28, 1991 (Reference letter from A. Whiting to P. Altomare on February 28, 1991). This report was completed consistent with guidance received during the teleconference between the NRC and CNWRA on January 3, 1991, and subsequent communiques, specifically that: (1) the WSE&I element would provide a draft report on the functional analysis results through the development of the sufficiency categories as an Intermediate Milestone (3702-031-102-001); (2) pre-closure uncertainties and supporting rationale related to the "sufficiency" of 10 CFR Part 60 that are to supplement the CNWRA 90-003 report would be developed and reported as part of the Repository Operational Criteria Activities 1.4 and 3.2; and (3) the development and reporting of post-closure uncertainties and supporting rationale related to the "sufficiency" of 10 CFR Part 60 that are to supplement the CNWRA 90-003 report would become the WSE&I Major Milestone 3702-031-102-000 to be accomplished on a scope and schedule yet to be worked out between the Center and NRC.

CNWRA comments were formally submitted on the Appendix A portion of the uncertainty reduction draft report as WSE&I Intermediate Milestone 3702-031-121-001

(reference letter from A. Whiting to P. Altomare on February 19 , 1991). Advisory support was provided to the NRC task team on uncertainty reduction for the selection of the general approaches to the reduction of uncertainties identified in CNWRA 90-003. Just as this period ended, the CNWRA received a draft copy of the remainder of the uncertainty reduction task team report for official comments which will be provided early during the next reporting period.

A CNWRA procedure (TOP-001-06) "Procedure for Regulatory Requirement Categorization and Compliance Determination Strategy Development," consistent with the LARS and the CNWRA Recommendation Report for the LARS remained on hold pending further guidance forthcoming on the LARS from the NRC.

Several meetings were held among the Center and the NRC staff and management on schedules and NRC staff involvement in the SRA process and various activities, and other items related to SRA and Program Architecture in general.

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, Program Architecture Review Committee (PARC) reviews of SRA analyses in the Regulatory Requirement Synopsis format continued in preparation for loading into the PADB. S. Spector and P. LaPlante from the Washington office are playing key roles in this effort. Conversion of this SRA information to the DW4 forms and loading of the PASS mainframe continued. Also during this period, Analysts and Element Managers continued the development and review of the Regulatory Requirement Synopses with priority being placed on the RR and REOP rationales and associated logic diagrams of the RRs that the DOE must meet that are in 10 CFR Part 60. This was done in support of the RR/REOP Intermediate Milestone 3702-031-103 (delivered March 15, 1991). Additionally, on February 28, 1991, informal delivery of selected high priority RR/REOP packages was completed when RR2018 "Natural Resources" occurred. (Reference letter of February 28, 1991, from A. Whiting to P. Altomare.)

The RRs and REOPs, together with Regulatory Uncertainties, are being PARC'd and loaded into the database. 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 PASS Version 2.0. Changes based on feedback from Center users are being made to optimize and extend features of PASS V2.0 operations. A training outline and schedule is being prepared for new Center staff and the NRC staff.

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

The PASS Security Plan is being updated for delivery in the NRC requested format of OMB Bulletin No. 90-08.

Task 3 - HLWM Program Analysis and Integration

Updated DOE Project decision schedules and 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. A. Chowdhury and E. Tschoepe of CNWRA, and L. Lorig of Itasca, performed these activities. 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 and entered in the database during this reporting period.

In addition to the SRA work described under this task, A. Chowdhury carried out SRA activities of WSE&I Task 1 for more than 20 other regulatory requirements relevant to RDCO.

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

D. Turner worked on the SRA of the regulatory requirements dealing with the potentially adverse conditions (RR2002 through RR2025) by assisting in the review and appropriate correction of input into the PASS Version 2.0 database. M. Miklas accomplished similar work for RR2001(the favorable conditions) and RR2000(groundwater travel time). Entry of RR/REOP information to the PASS Version 2.0 database was completed.

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

There was no reportable activity this period under this task.

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 CNWRA and NRC staff.

3.2 Major Problems

Previously identified problems (PMPR Period 4 Report) are being addressed in a thorough manner.

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 outcome of several CNWRA/NRC Management Meetings, and updating the Operations Plans accordingly.
- Conducting an April 2, 1991, briefing for NRC staff on the content and purpose of the RR/REOP Report (WSE&I Intermediate Milestone 3702-031-103-000) delivered March 15, 1991.
- Conducting and April 2, 1991, briefing for NRC staff on the first draft report of on the conduct and results of the RFA and the 10 CFR Part 60 sufficiency test (WSE&I Intermediate Milestone 3702-031-102-001 delivered February 28, 1991.) A second WSE&I report (Major Milestone 3702-031-102-000) Final Report on RFA, yet to be defined and scheduled, will be discussed during the next reporting period.
- 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 V2.0 User's Guide and a specification for interactive input of data.
- Continued optimization and extension of feature in PASS V2.0
- Continued implementation of the Configuration Management and Control Manual procedure and tracking systems.
- Delivery of updated PASS Security Plan.
- Continued limited participation in the NRC task activity of developing URM's for the Regulatory and Institutional Uncertainties in 10 CFR Part 60 and completing the

review of the NRC draft report on Uncertainty Reduction Methods by March 22, 1991.

- Anticipating receipt of NRC annotated outline of LARS Document to initiate CNWRA participation in Task Force on said subject.
- Assist NRC in developing 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 do a preliminary Compliance Determination Strategy for RR0002 Retrievability.
- Continued preparation for repeat of Systems Engineering Course to be presented to NRC (May 15-16, 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 \$64,525. 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 nearly 25% over planned expenditures. This is due to historical schedule variances caused by: (a) delayed guidance, underestimation of effort needed and over-commitment of certain key staff, (b) changing expectations and priorities, (c) conflicting assignments of key technical staff on multiple deliverables in WSE&I, (d) underestimated level of effort to prepare RR/REOP data and load into PASS Version 2.0 and (e) acceptance of additional work without changing other scheduled deliverables. It is anticipated that these cost variances will be remedied when the operations plans are revised and work efforts are focussed and rescheduled consistent with guidance on activity prioritization and resource availability anticipated to be completed during the next reporting period.

Table 1. Financial Status	
FY91 Funds Authorized (a)	\$2,329,667
FY91 Funds Costed to Date (b)	\$1,136,853
FY91 Funds Uncosted (c)	\$1,192,814
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

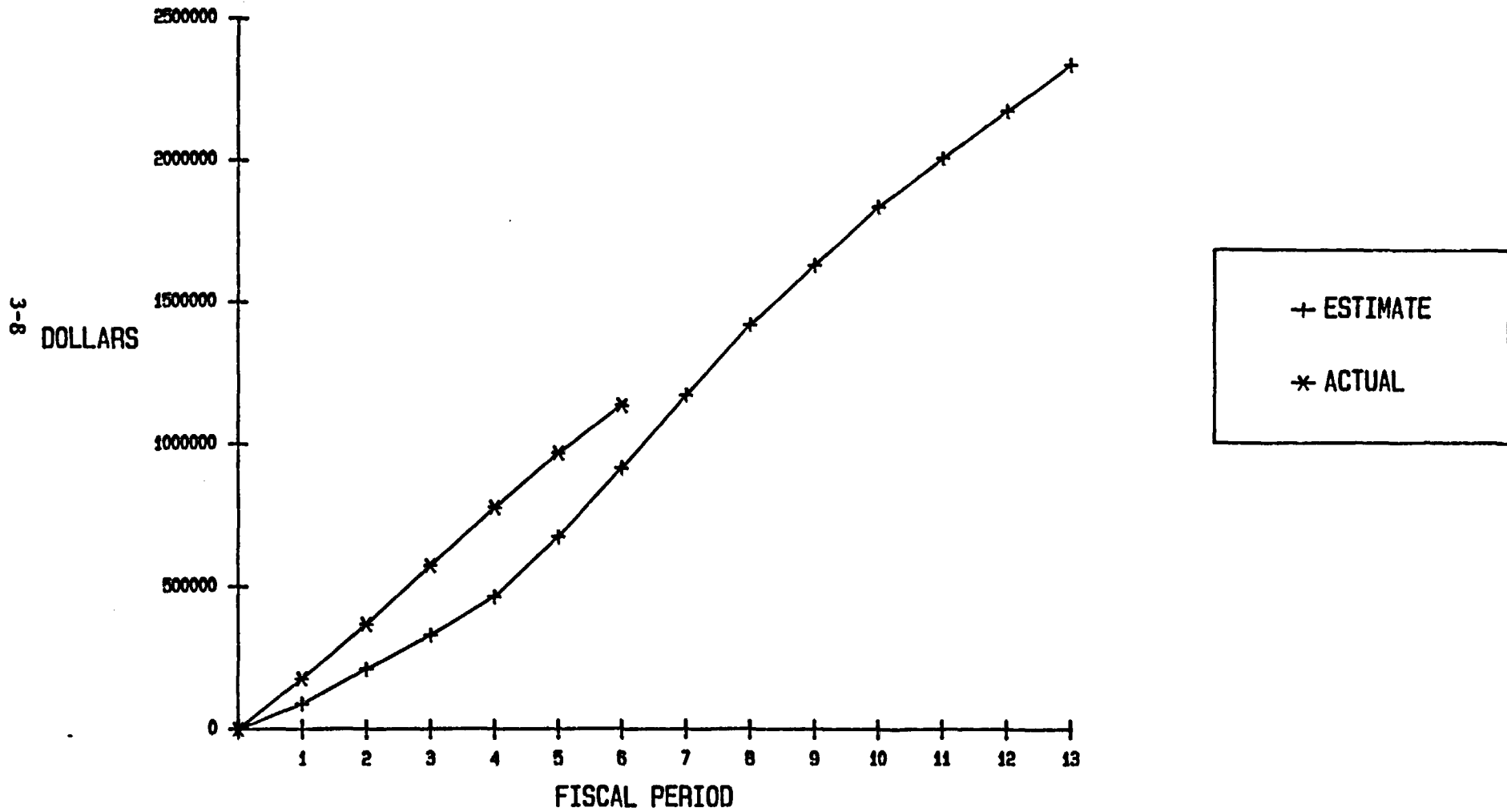
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	88130	121982	119294	134867	211174	239971	257346	247080	210701	205460	172290	166842	163199	915418
ACT. PERIOD COST	175483	191583	207239	203017	190578	168953	0	0	0	0	0	0	0	1136853
VARIANCE, \$	-87353	-69601	-87945	-68150	20596	71018	0	0	0	0	0	0	0	-221435
VARIANCE, %	-99.1	-57.1	-73.7	-50.5	9.8	29.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-24.2
EST. FY CUMUL	88130	210112	329406	464273	675447	915418	1172764	1419843	1630544	1836004	2008294	2175136	2338395	
ACTUAL FY CUMUL	175483	367066	574305	777322	967900	1136853	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.075	0.157	0.246	0.332	0.414	0.486	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-87353	-156954	-244900	-313049	-292454	-221435	0	0	0	0	0	0	0	
VARIANCE, %	-99.1	-74.7	-74.3	-67.4	-43.3	-24.2	0.0	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 REECOA Audit Observation Team (AOT) which conducted its work February 25-March 1, 1991, in the Las Vegas, NV area and contributed to the AOT report. Participation on these NRC teams allows the Center QA staff to learn about and maintain knowledge of the DOE HLW schedules and activities which are often similar to the Center work, and both require a rigorous QA system. Also during the period, preparation for the Los Alamos Audit Observation Team work in New Mexico took place with review of the DOE audit checklist and planning with the cognizant NRC QA staff person.

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

During this period Center QA personnel regularly interfaced with NRC QA staff by telephone and written communications and kept each other informed on developments in the HLW field. Additionally, plans were made to attend the American Society for Quality Control Second International Waste Management Conference in Nevada.

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 will include work with the NRC AOT for the Los Alamos participant organization and possibly QA reviews of DOE documents associated with the site characterization program. As a follow

up to the Los Alamos audit observation team activity, a report will be submitted to the cognizant NRC QA staff member for review and possible modification, and inclusion into the final NRC report.

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)	\$ 33,806
FY91 Funds Uncosted (c)	\$ 137,786
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	10167	9150	8984	10264	12175	13060	15397	21392	30707	79747
ACT. PERIOD COST	7162	9534	3322	2382	4809	6597	0	0	0	0	0	0	0	33806
VARIANCE, \$	13304	4777	9380	10549	5378	2553	0	0	0	0	0	0	0	45941
VARIANCE, %	65.0	33.4	73.8	81.6	52.8	27.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.6
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	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.037	0.087	0.104	0.117	0.142	0.176	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	13304	18081	27461	38011	43389	45941	0	0	0	0	0	0	0	
VARIANCE, %	65.0	52.0	57.8	62.9	61.5	57.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

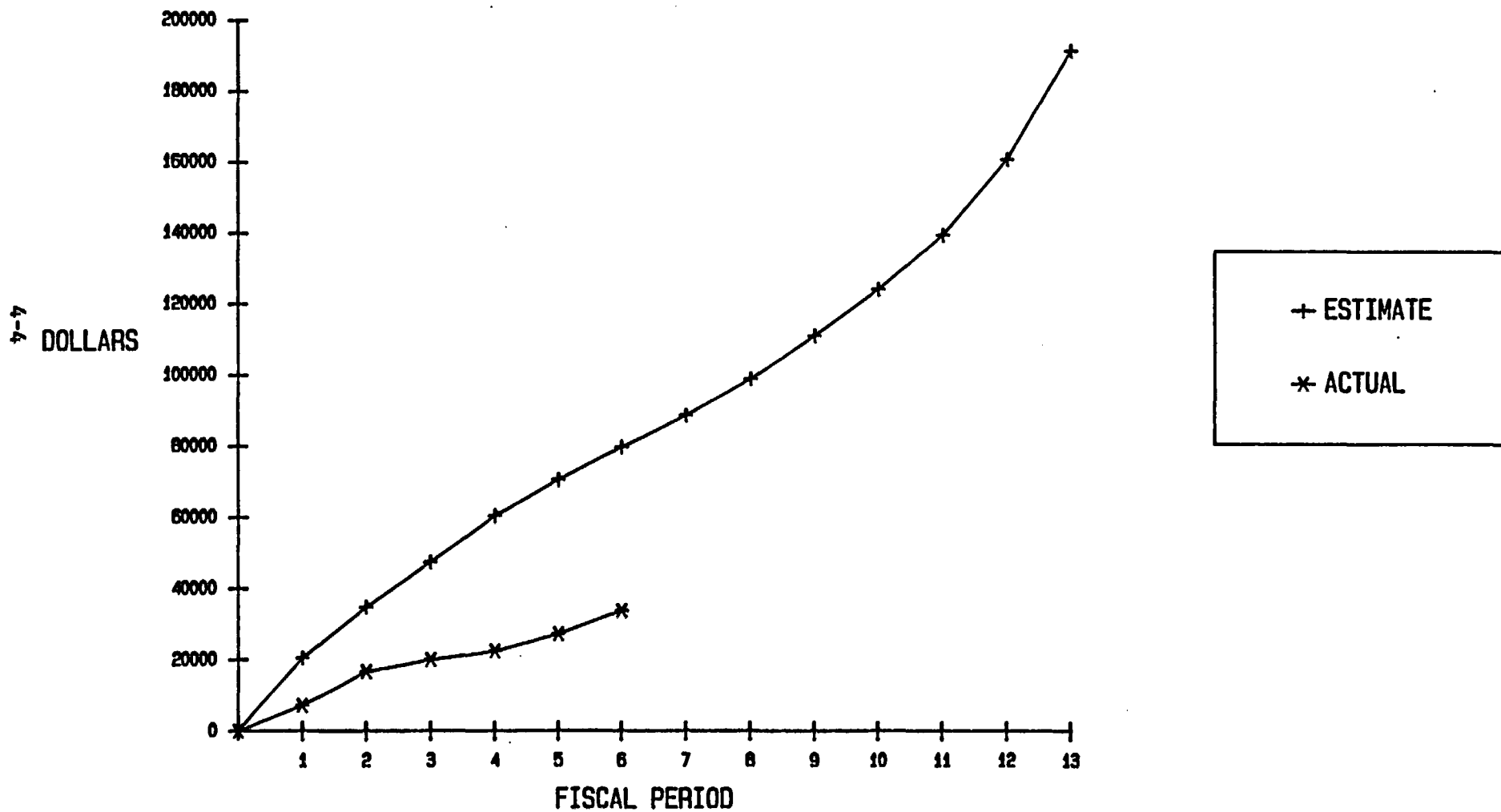
4-3

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 February 27 and March 13 and other NRC meetings at Rockville, Maryland pertinent to the Center's Geologic Setting Program Element (GSPE) technical activities. G. Stirewalt attended a NWTRB meeting on "Volcanic Hazards" held March 1 in Tucson, Az. D. Turner attended, as a professional development activity, a National Water Well Association Short Course on Applications of Environmental Isotopes.

Geologic Setting Program Element Interfaces With Other Center Activities

Center geoscientists conducted work for the Performance Assessment, WSE&I, and Repository Design and Construction 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

Two Center technical staff members participated in the DOE/NRC Technical Exchange on the NRC's Seismic Hazard Staff Positions and the Tectonics Guidance Strategy on February 20, 1991. Center consultant Dr. L. McKague presented a discussion on February 19 to assembled White Flint NRC staff entitled "Volcanic Stratigraphy of Yucca Mountain."

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 the preparation of a work plan for Center activities on Probabilistic Seismic Hazard Analysis. The Center technical leader for this Subtask meet with NRC staff during the repository period to discuss proposed activities.

Definition of the scope (and therefore cost and schedule) of the Center's continuing work in this area is being revised by the Center. The scope is being adjusted based upon the outcome of the February 20, 1991, DOE/NRC technical exchange on the NRC's seismic hazard staff positions and the tectonics guidance strategy and upon the decision at the NRC and CNWRA management meeting of February 20 and 21, 1991. The latter decision was to defer the development of SRA in the Subtask and to emphasize technical support of a staff technical position on Probabilistic Faulting and Seismic Hazard Analysis.

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 6. 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.

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 6. 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 drilling 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 6.

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. 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. Staff will work, as appropriate, with the NRC on the "example" regulatory requirements RR2018 - Naturally Occurring Materials, and RR2003 - Flooding, which are being worked within the SRA process by a joint NRC/Center team. Period 7 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 \$15,329. 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 \$21,447 for Period 6. 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)	\$ 330,400
FY91 Funds Uncosted (c)	\$ 396,955
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	77842	80525	82622	76926	73250	123288	242483
ACT. PERIOD COST	85455	57066	83661	29088	49284	25869	0	0	0	0	0	0	0	330400
VARIANCE, \$	-73433	-24952	-40956	20122	9854	21447	0	0	0	0	0	0	0	-87918
VARIANCE, %	-610.8	-77.7	-95.9	40.9	16.7	45.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-36.3
EST. FY CUMUL	12022	44135	86841	138029	195167	242483	289973	367818	448140	530763	607689	680939	804207	
ACTUAL FY CUMUL	85455	142521	226182	255248	304531	330400	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.106	0.177	0.261	0.317	0.379	0.411	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-73433	-98385	-139341	-119219	-109364	-87918	0	0	0	0	0	0	0	
VARIANCE, %	-610.8	-222.9	-160.5	-87.6	-56.0	-36.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

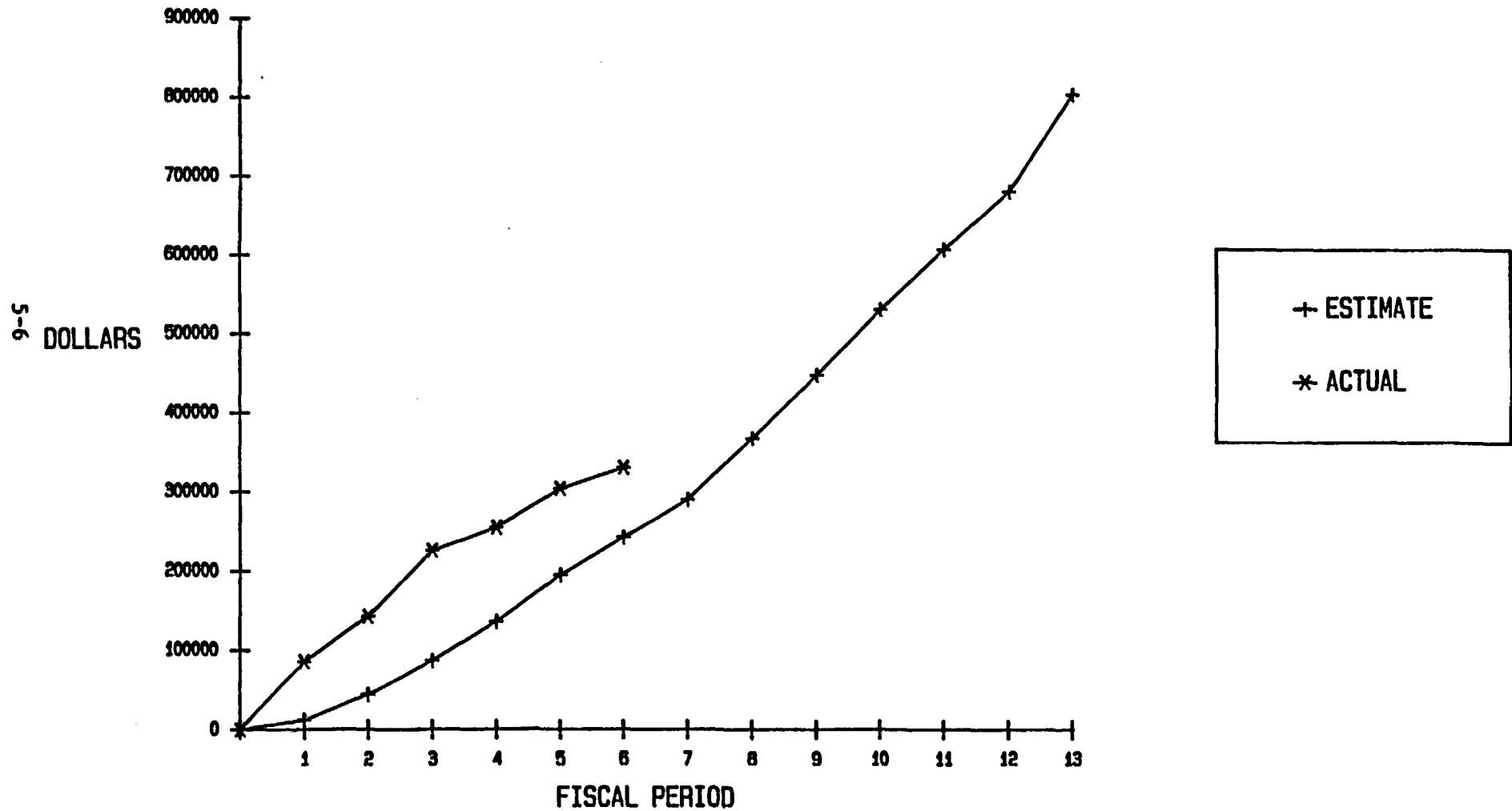
5-5

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 support of the iterative PA activities.

Professional Activities

- H. Manaktala, G. Cragnolino, and N. Sridhar attended the National Association of Corrosion Engineers (NACE) sponsored CORROSION'91 Conference in Cincinnati, Ohio, March 11-15, 1991. H. Manaktala presented a paper titled, "Degradation Modes of Nuclear Reactor Fuel Cladding". Participation activities of G. Cragnolino and N. Sridhar at the conference are described under the Integrated Waste Package Experiments Research section of this periodic report. H. Manaktala also co-chaired two sessions on "Corrosion of Materials in Nuclear Systems" at the conference.
- H. Manaktala has been named the organizer and chairman for the Unit Committee T-2A sponsored symposium "Corrosion of Materials in Nuclear Systems", and N. Sridhar has been named co-chairman for the Unit Committee T-3E sponsored symposium, "Stress Corrosion Cracking and Corrosion Fatigue", at the CORROSION'92 Conference to be held in Nashville, Tennessee, April 27-May 01, 1992. H. Manaktala has also been appointed the official technical reviewer of papers relating to the back-end of the nuclear fuel cycle for CORROSION'92 Conference.

A trip report related to the attendance at the CORROSION'91 Conference will be prepared.

Task 1 - Prelicensing Activities

No planned activity

Task 2 - Regulatory and Technical Guidance Development

A presentation on the SCC Technical Feasibility Study was made to the Advisory Committee on Nuclear Waste on February 21, 1991, at the NRC offices in Bethesda, Maryland. The presenters were P. Nair, H. Manaktala, and Y. Wu from CNWRA/SwRI, and J. Bunting, C. Interrante, and L. Abramson from the NRC.

A meeting was held at the Center on March 6, 1991, to review concepts for developing an example problem to demonstrate the quantitative framework developed for evaluating the SCC condition for waste packages. The meeting was attended by J. Bunting and J. Pearring from the NRC, and the EBS staff from the Center. An approach based on a fault-tree analysis and the adaptation of a version of EBSPAC was discussed and found reasonable.

Task 3 - Analysis Codes and Methods

During period 6, the primary EBSPAC activities dealt with testing the basic crevice corrosion model and initiating the design of the EBSPAC driver for the material degradation module.

In testing the basic crevice corrosion model, two test cases have been run for the 316L stainless steel alloy. One test case has a crevice depth of 0.0001 cm. and the other case has a crevice depth of 2.5 cm. Both cases have a constant crevice gap of 0.0001 cm. and an initial crevice pH of 7. The bulk solution is 0.5M NaCl with a passive current of 0.000002 amps. per sq. cm. In the test case for the shallow crevice, the crevice pH drops initially and flattens out above the critical crevice pH. Consequently, the crevice remains passive. However, the Watson results show the crevice pH dropping continuously until the critical crevice solution (chemical composition where crevice corrosion takes place) is reached after ten hours of simulated time. The discrepancies between these two results are being investigated. The test case results for the 2.5 cm. crevice depth does show the crevice developing the critical crevice solution. This is due to the increased crevice depth providing more crevice metal surface for metal ion production. The comparison of the results from the two test cases highlight the importance of crevice depth in determining if the crevice will remain passive or become active.

Also this period, work has begun 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.

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

Work plans will be developed 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 \$ 5,454. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Expenditures for this program element are about 35% 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)	\$ 257,053
FY91 Funds Uncosted (c)	\$ 300,695
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

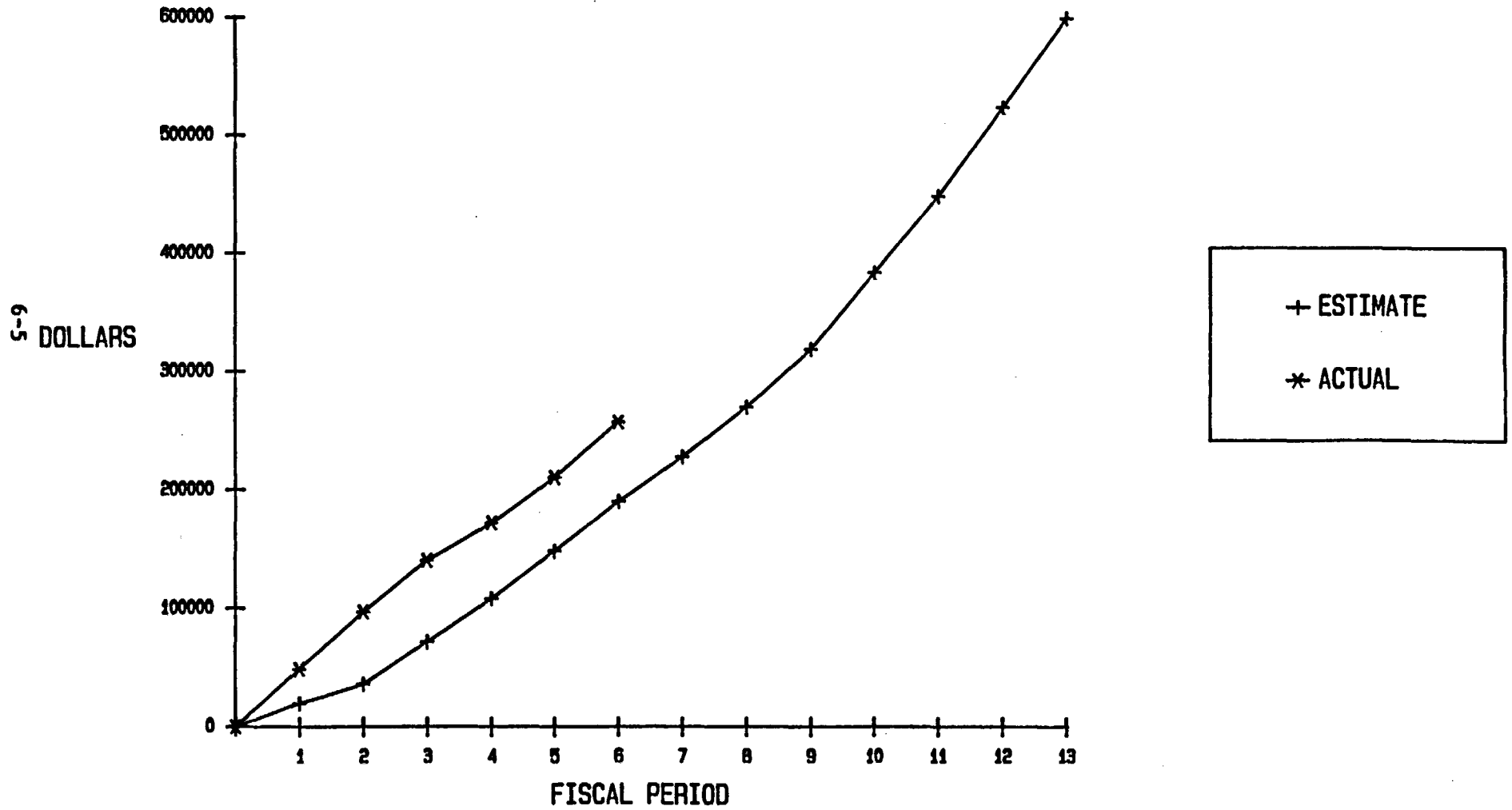
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	19874	18136	35642	36443	40255	41668	37578	42311	48931	64746	65277	75320	75495	190019
ACT. PERIOD COST	48573	48246	43728	31568	38172	46765	0	0	0	0	0	0	0	257053
VARIANCE, \$	-28699	-32110	-8086	4875	2083	-5097	0	0	0	0	0	0	0	-67034
VARIANCE, %	-144.4	-199.0	-22.7	13.4	5.2	-12.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-35.3
EST. FY CUMUL	19874	38010	71652	108096	148351	190019	227597	269908	318838	383584	448861	524181	599676	
ACTUAL FY CUMUL	48573	96820	140548	172116	210288	257053	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.081	0.161	0.234	0.287	0.351	0.429	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-28699	-60809	-68896	-64020	-61937	-67034	0	0	0	0	0	0	0	
VARIANCE, %	-144.4	-168.9	-96.2	-59.2	-41.8	-35.3	0.0	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.

Task 1 - Prelicensing Activities

The planning activities were carried out during this period to review DOE's responses to NRC Site Characterization Analysis (SCA). One objection, twenty-five comments, and thirty-one questions in the SCA are relevant to RDCO. These comments, questions, and objection will be reviewed during the next reporting period by S. Hsiung, L. Lorig, J. Daemen, and A. Chowdhury.

A trip report on the NRC-DOE Technical Exchange Meeting on the ESF Alternatives Study and Calico Hills Cost-Benefit Analysis that took place at Washington, DC on January 29-31, 1991 has been submitted to NRC on February 22, 1991. S. Hsiung, M. Ahola, and L. Lorig attended this NRC-DOE Technical Exchange Meeting.

Task 2 - Regulatory and Technical Guidance Development

The resolution of CNWRA comments on the NRC public comment draft of the technical position on repository design -- thermal loads dated August 1990 was completed during this period and was submitted to NRC as Intermediate Milestone No. 20-3702-022-085-002. A. Chowdhury, W. Patrick, and B. Sagar participated in this resolution activity.

Planning activities continued for the development of the compliance determination method(s) for coordinating the ESF design with the repository design.

Task 3 - Analysis Codes and Methods

Not funded in FY91.

Task 6 - Repository Operational Criteria Feasibility Studies

Activity 1 of the Repository Operational Criteria (ROC) Feasibility Studies continued during this period. A NRC-CNWRA meeting took place at CNWRA on March 4-6, 1991, to discuss, as per ROC Subactivity 1.1.2, the cost, schedule, and progress of ROC Feasibility Studies Activity 1. The level of effort needed for in-depth analysis of the ROC Topics was found to be higher than that assumed at the time of preparing the CNWRA FY91-92 Operations Plan, because at that time, there was insufficient information regarding the potential details of work within the scope of ROC Activity 1. Some work of ROC Activity 2 was done during this period for inclusion in the Report #1 (NUREG/CR#1) of ROC Activity 1. This is because most of the ROC Topics needed integration to a large extent for the preparation of Report #1 of ROC Activity 1. J. Hageman, S. Hsiung, H. Karimi, M. Ahola, E. Tschoepe, R. Field, J. Burkes, R. Hofmann, G. Stirewalt, A. Chowdhury, S. Spector, L. Lorig, and J. Daemen performed ROC activities.

7.2 Major Problems

Costs attendant to the ROC studies are anticipated to be higher than originally estimated. CNWRA and NRC management met to address this matter. An official letter containing revised costs and schedule is in preparation to send to NRC.

7.3 Forecast for Next Period

Work on the review of DOE's 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 will continue during the next reporting 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 \$62,808. The attached figure displays the estimated cumulative spending plan and the reported actual cumulative costs to date.

Costs incurred to date are slightly less than planned. Because of the higher costs for ROC Studies (RDCO Task 6) than originally estimated and because of higher priority of ROC Studies compared to some prelicensing activities (RDCO Task 1), it is proposed that the continuation of ROC studies be accommodated by reducing comparable amount of work from RDCO Task 1.

Table 1. Financial Status	
FY91 Funds Authorized (a)	\$ 876,445
FY91 Funds Costed to Date (b)	\$ 420,666
FY91 Funds Uncosted (c)	\$ 455,779
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

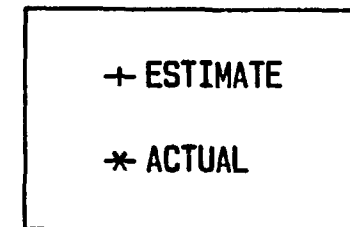
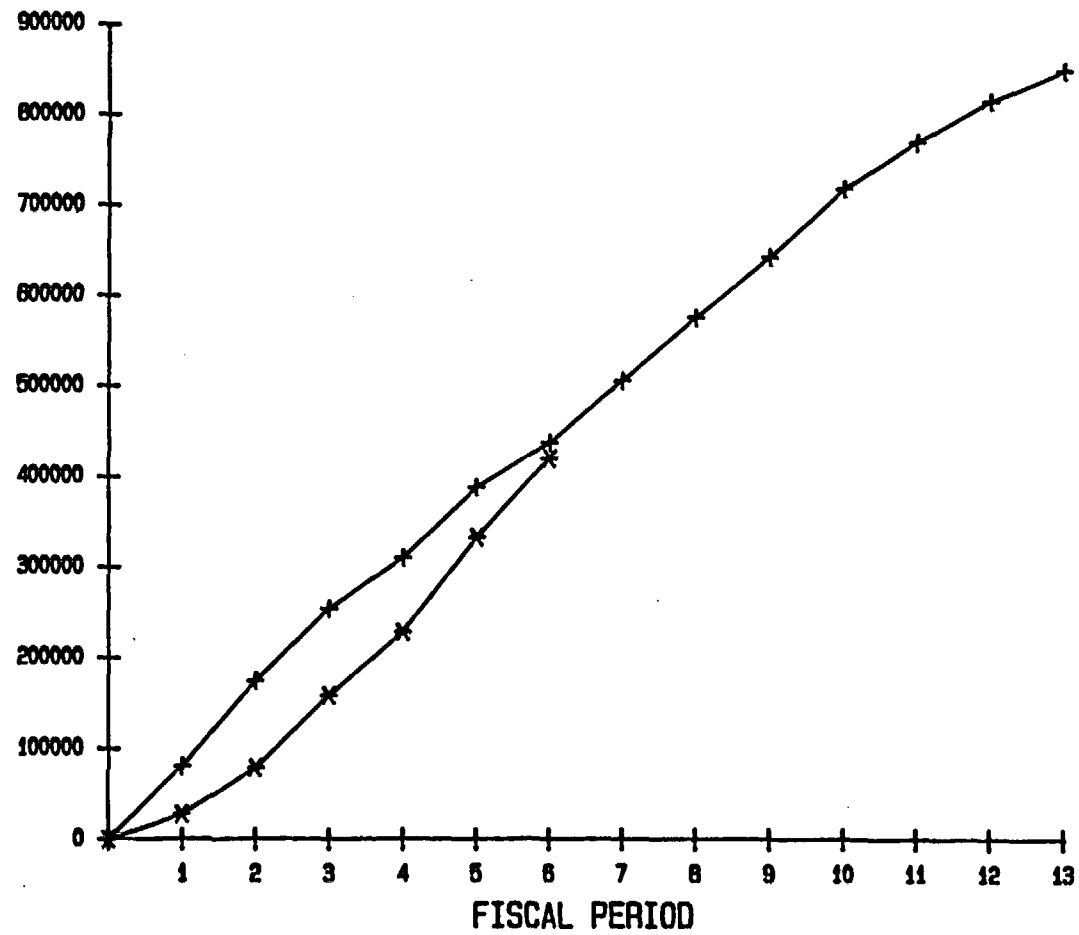
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	80330	94490	79409	56263	78162	49304	68363	70499	66805	75618	51651	45657	33677	437957
ACT. PERIOD COST	27495	50848	80077	70259	104466	87520	0	0	0	0	0	0	0	420666
VARIANCE, \$	52835	43641	-868	-13996	-26305	-38216	0	0	0	0	0	0	0	17291
VARIANCE, %	65.8	46.2	-0.8	-24.9	-33.7	-77.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9
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	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.032	0.092	0.186	0.269	0.392	0.495	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	52835	96477	95808	81812	55508	17291	0	0	0	0	0	0	0	
VARIANCE, %	65.8	55.2	37.7	26.3	14.3	3.9	0.0	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: Tasks 1- 4, P. Brooks
Task 5, N. Eisenberg

CNWRA Element Manager: Budhi Sagar

Key Personnel: R. Ababou, R. Green, A. Gureghian, R. Janetzke, H. Manaktala, W. Murphy,
W. Murphy, R. Pablan, 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 has been started. The Performance Assessment Strategy developed earlier under Task 5 will provide the basis for the CDS.

Subtask 2.2 - Implementing the EPA HLW Standard

A draft report on the Regulatory Requirements (RR) and the associated Regulatory Elements Of Proof (REOPs) associated with the EPA rule was submitted to NRC for review.

Task 5 - Iterative Performance Assessment

W. Patrick, B. Sagar, and H. Manaktala from the Center participated in the first management teleconference on February 27, 1991, of the Iterative Performance Assessment Task. The teleconference was chaired by M. Delligatti who has already circulated the minutes. Following the decision in the meeting to revise the program plan, B. Sagar and H. Manaktala coordinated comments on their subtasks and submitted these to various subtask leaders and to M. Delligatti.

B. Sagar participated in a teleconference with M. Delligatti, N. Eisenberg, and J. Randall on March 19, 1991 to consider all the comments received on the work plan. It was agreed to discuss with team leaders certain suggested changes to the program plan. Also, the milestones to be tracked by the NRC were decided upon.

Work on the development of the Source Term Module of the Total System Code continued during this reporting period. E. Percy and H. Manaktala have started a review of literature on modeling of spent fuel. Work on modifying PHREEQE and coupling it to GLASSOL also continued. Discussions also occurred about the structure of other parts of the source-term module.

The Executive Module of the Total System Code continued to be developed. We expect to deliver the first version of the code to various team leaders of the Iterative Performance Assessment in April, along with instructions for use. After some experience with the code, we expect that modifications will be made. Formal documentation will be purposely delayed to accommodate these changes. Further modifications to the code will be deferred to later iterations.

NRC comments on the paper titled "Issues in Modeling Source-Term From Vitriified High-Level Wasteforms" authored by H. Manaktala and B. Sagar were received. Due to current NRC restrictions on foreign travel, H. Manaktala will not be able to present the paper as planned.

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)	\$ 329,689
FY91 Funds Uncosted (c)	\$1,152,819
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

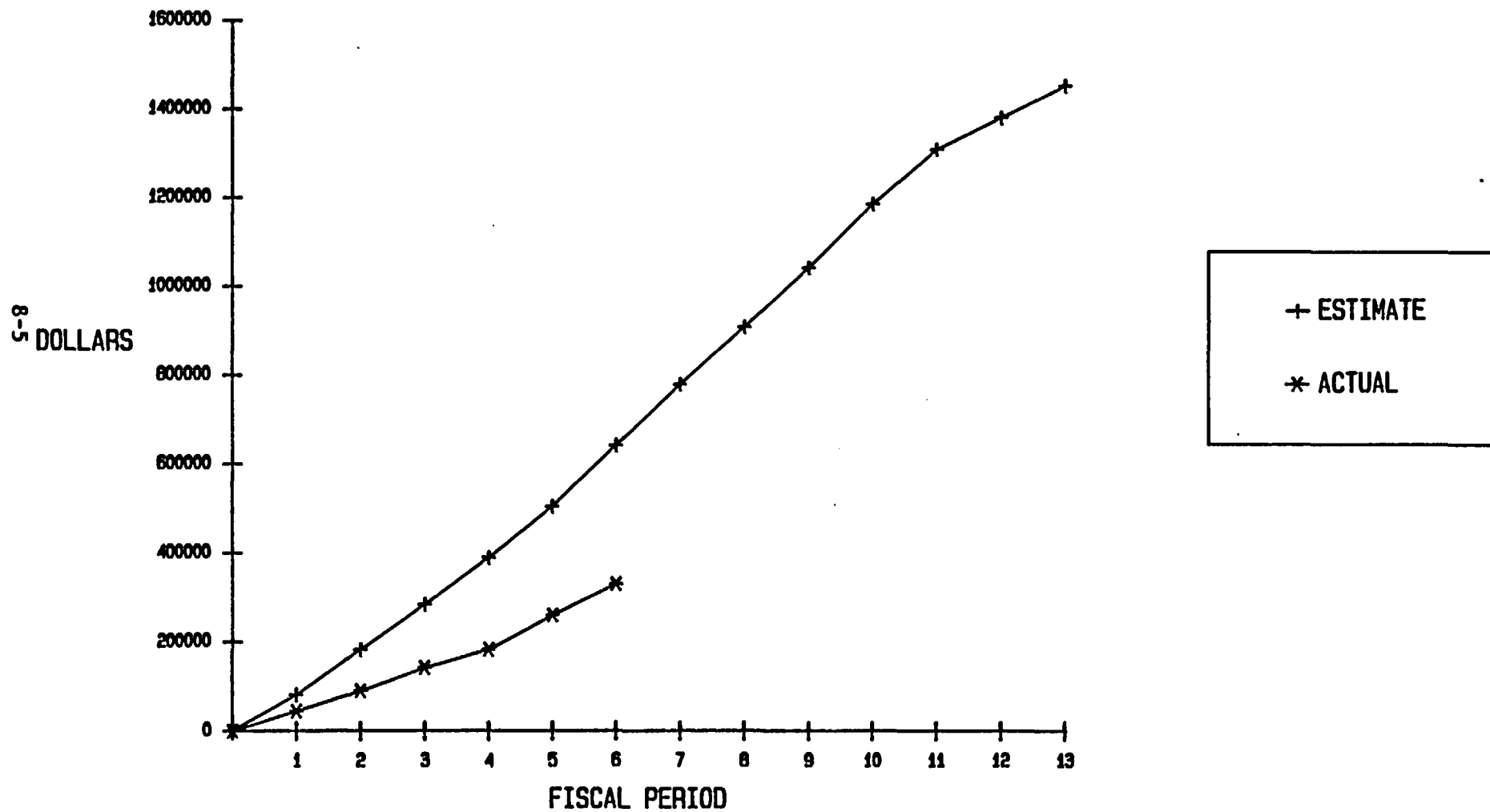
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	80799	101863	101433	105175	114614	137469	138048	129256	133670	144137	123577	71955	72373	641353
ACT. PERIOD COST	44461	45894	51289	40908	77173	69965	0	0	0	0	0	0	0	329689
VARIANCE, \$	36339	55969	50144	64266	37441	67504	0	0	0	0	0	0	0	311663
VARIANCE, %	45.0	54.9	49.4	61.1	32.7	49.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.6
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	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.031	0.062	0.097	0.126	0.179	0.227	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	36339	92308	142452	206718	244159	311663	0	0	0	0	0	0	0	
VARIANCE, %	45.0	50.5	50.1	53.1	48.5	48.6	0.0	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 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. Cragolino, 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 CNWRA. 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 by the end of February 1991.

Research Project 1 - Overall Research Plan

Major effort was directed toward preparation of the first Annual Research Report which was submitted to the NRC on February 27, 1991.

Center personnel continue 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.

In the reporting period, Center staff assigned to developing a Natural Analogs Workshop met with L. Kovach to discuss the workshop agenda and list of potential participants, including invited speakers. DOE comments on a preliminary agenda were discussed and a revised agenda was prepared and submitted to the NRC.

The status of the Research Project Plans, identified in the Overall Research Project Plan, as of March 15, 1991, 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

Research Project 2 - Geochemistry

Experiments to study the kinetics of analcime dissolution continued. Initial starting solutions of 0.1 M NaCl-0.01 M NaHCO₃ were preequilibrated with atmospheric CO₂(g) over several days until the equilibrium pH was attained. Solid-mass/solution ratio was varied by reacting 0.1, 0.5, and 1.0 g of analcime powder (230-325 mesh size range; surface area = 1800 cm²/gm). Aliquots of aqueous solutions reacting with analcime

powder were taken on a periodic basis for chemical analysis of Si, Al, and Na. The aqueous samples were analyzed for Si and Al using UV-Visible spectrophotometry. Na was analyzed using an ion-selective electrode. Results from the first set of experiments indicated problems with Si contamination from glassware used in the sampling and chemical analysis. This problem was eliminated in the next set of experiments by avoiding the use of glassware.

W. Murphy continued to implement the updated EQ3/6 software recently received from Lawrence Livermore Laboratory with identification of bugs and new capabilities.

Research Project 3 - Thermohydrology

A copy of TOUGH2 was received from K. Pruess of LBL. TOUGH2 is an updated version of the TOUGH code, which provides a numerical solution to two-phase flow through partially-saturated media. TOUGH2 has not completed the internal LBL review process and draft copies of the code have been released to provide broader review of the code. Initial efforts to install the code on either a VAX or Cray mainframe or the Center's Iris work station have not been successful. Difficulties encountered with implementing the code have been documented and are being transmitted to K. Pruess for his review. Until the difficulties in employing TOUGH2 are resolved, the original TOUGH code will be run on the SwRI VAX to perform the numerical simulations.

The dimensionless pi terms have been further evaluated. Using reasonable values, sixteen of the twenty-two pi terms associated with the geometry, property ratios and physical effects of the two-dimensional system investigated in the lab have been identified as not important for further study at this time. The remaining six pi terms are being evaluated to determine their sensitivity to changes in values assigned to the parameters contained in those pi terms.

The lab equipment is being prepared for removal from Building 262 and installation at Building 57, the Center's laboratory. Building 57 will provide a more amenable environment, particularly in terms of humidity and temperature control.

Research Project 4 - Seismic Rock Mechanics Studies

The collection of instrumented field studies data from the Lucky Friday Mine, Mullan, Idaho, continued during this period. This includes displacement response of rock from 50 extensometers, deformation response of two tunnel openings, rockburst velocity data from two velocity gauges, geohydrologic response from four piezometers, and rockburst data from one hydrophone. 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. Planning is being done 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 uniaxial and triaxial compression tests and Brazilian disk tension tests as well as the

preparation of specimens for direct shear tests were completed during this period.

The full-length paper entitled "Experimental Determination of Properties of Natural Rock Joints in a Welded Tuff" continued to be 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. This paper will also be published in the Symposium Proceedings as a Special Publication.

Research Project 5 - Integrated Waste Package Experiments

A review on localized corrosion of the candidate container materials is being prepared as an intermediate milestone report for Task 1.1. The review is mainly focused in a critical discussion of experimental methods for the study of localized corrosion and the effect of environmental variables on pitting and crevice corrosion as related to the Yucca Mountain repository conditions.

The effects of bicarbonate concentration and pH on the localized corrosion of alloy 825 are being examined at 95°C using the cyclic potentiodynamic polarization technique. Tests were conducted in solutions containing 1000 ppm chloride, 20 ppm sulfate, 10 ppm nitrate, 2 ppm fluoride, with sodium as a single cation. It was found that bicarbonate, within the concentration range of 85 to 2000 ppm (at a constant pH of 8.4), is not an inhibitor of localized corrosion. On the other hand, sulfate may act as an inhibitor but only at very high concentration ratios. Tests conducted in solutions of similar composition to that above indicate that complete inhibition of pitting was only observed at 20,000 ppm sulfate. The effect of pH is currently being studied at a fixed bicarbonate concentration varying the concentration of CO₂.

Remodeling of the Center laboratory has been completed. The experimental set-up for pitting protection potential experiments (Subtask 1.1.3.4) and crevice corrosion experiments (Subtask 1.1.3.3) has been prepared.

NRC-RES approvals of the following IWPE test plans were received during the reporting period: (i) Test Plan for Subtask 3.1: Long-Term Materials Stability of HLW Container and Waste Package Materials (Austenitic Alloys), (ii) Test Plan for Subtask 3.2: Growth Kinetics and Stability of Thick-Oxide Film Formation in Candidate Copper and Copper-Based Alloys for HLW Containers, and (iii) Test Plan for Subtask 2.2: Slow Strain Rate Tests.

H. Manaktala, N. Sridhar and G. Cragolino attended the National Association of Corrosion Engineers-sponsored CORROSION'91 Conference held in Cincinnati, Ohio, on March 11 - 15, 1991. G. Cragolino presented a paper coauthored with N. Sridhar and titled "Localized Corrosion of a Candidate Container Material for High Level Nuclear Waste Disposal" in the session on Corrosion of Materials in Nuclear Systems. A modified version of this paper has been accepted for publication in Corrosion Journal. A trip report is being prepared.

N. Sridhar has been named co-chairman for the Unit Committee T-3E sponsored

symposium on Stress Corrosion Cracking and Corrosion Fatigue as part of the CORROSION'92 conference. H. Manaktala has been named organizer and chairman for the Unit Committee T-2A sponsored symposium on Corrosion of Materials in Nuclear Systems for the CORROSION'92 conference.

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

During this period, the project has been advancing Task 2 computational activities and completing the Task 1 literature review activity. The final report for Task 1 has been recently granted a time extension to allow acceleration of computational work in Task 2 activities which requires the utilization of Cray-2 supercomputer time which the Center has 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 is being completed and will be delivered on April 1, 1991. The final report is due on May 1, 1991.

Research Project 7 - Geochemical Analogs

E.C. Percy, R.T. Green and W.M. Murphy performed field research of the Peña Blanca, Mexico uranium deposits which occur approximately 50km north of Chihuahua, Mexico. The Center researchers examined the geology, geochemistry, and hydrology of this potential geochemical analog research site. This trip was conducted as part of Task 2 of the Geochemical Analog Research Project - Site Identification and Development of Workplan. The trip report contains the details of the trip. It is anticipated that Center researchers will present preliminary information on the Peña Blanca site in Reno, Nevada, at a meeting of the NWTRB on April 16-17, 1991.

TOP-016 Field Collection of Geologic Samples was prepared and used in collecting rock and mineral samples during the Peña Blanca field research. Arrangements were made for storage and handling of the radioactive samples from Peña Blanca at the Center's facilities. Discussions were begun on methods of radioactive sample preparation.

Uranium deposits at McDermitt Caldera will be investigated in Period 7 to determine their suitability as geochemical analog research sites.

Work continued on the Final Draft of the Natural Analogs Literature Review Report to address NRC and internal comments and to incorporate newly published information.

E.C. Percy and W.M. Murphy met with L. Kovach at the Center to discuss the results of the Peña Blanca trip and to make plans for a trip to the McDermitt Caldera, on the Nevada-Oregon border.

Research Project 9 - Sorption Modeling

The literature review of Task 1 continued. All references acquired for this review are being input into a PROCITE bibliographic database.

A review of experimental and modeling studies of uranium sorption on geologic media was conducted by R. Pabalan. On the basis of this review, a workplan for experimental studies on uranium sorption on zeolites and other geologic materials was developed. The workplan is under technical and management review at the Center, and will be submitted for NRC's review and approval during the next reporting period.

Development of laboratory facilities in Building 57 and acquisition of equipment to support sorption experiments occurred in this reporting period. This included acquisition of a glove box, alpha spectrometer system, polarograph, and associated equipment.

Research Project 10 - Performance Assessment

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

Task 2: Two-Phase Flow and Transport. The coding for modifying PORFLO-3 continued during this reporting period.

Task 3: Evaluation and Modification of SNL Technology. We have selected the first problem for testing DCM-3. It is a saturated flow problem in a fractured porous medium which formed part of the INTRACON problems.

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. The second experiment at the Las Cruces trench experiment has been simulated with PORFLO-3, Version 1.1 at the Los Alamos Cray. Earlier efforts to perform a fine-scale (300,000 nodes) at the NASA Cray proved to be unsuccessful because of the difficulty in accessing the machine in an interactive mode required for initial testing. Both the fluid flow and the mass transport aspects were included in the simulation on Los Alamos Cray. The aim was to use the data as measured, i.e., all the 180 sampling points were used to generate a two-dimensional, 30,000 node grid. The results are currently being plotted. Preliminary results will be discussed at the forthcoming INTRAVAL meeting at Seattle. We intend to investigate why the bromide pulse tends to move faster than the tritium pulse.

W. Murphy directed computations of equilibrium radioelement solubilities using the updated EQ3 program and associated database. He also conducted literature review and analysis of carbon-14 retardation mechanisms.

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 \$132,543. 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 the two 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 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 CNWRA 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 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)	\$ 51,303
FY91 Funds Uncosted (c)	\$ 105,699
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)	\$ 104,894
FY91 Funds Uncosted (c)	\$ 163,437
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)	\$ 95,676
FY91 Funds Uncosted (c)	\$ 190,995
Recommended Adjustment to Complete (+/-)	\$ -0-
See the enclosed Element Status Cost Report	

Selsmic Rock Mechanics

Table 4. Financial Status	
FY91 Funds Authorized (a)	\$ 433,591
FY91 Funds Costed to Date (b)	\$ 378,497
FY91 Funds Uncosted (c)	\$ 55,094
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)	\$ 209,776
FY91 Funds Uncosted (c)	\$ 234,083
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)	\$ 67,430
FY91 Funds Uncosted (c)	\$ 118,307
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)	\$ 51,686
FY91 Funds Uncosted (c)	\$ 449,746
Recommended Adjustment to Complete (+/-)	\$ -0-
See the enclosed Element Status Cost Report	

Performance Assessment

Table 8. Financial Status	
FY91 Funds Authorized (a)	\$ 545,470
FY91 Funds Costed to Date (b)	\$ 102,238
FY91 Funds Uncosted (c)	\$ 443,232
Recommended Adjustment to Complete (+/-)	\$ -0-
See the enclosed Element Status Cost Report	

Sorption

Table 9. Financial Status	
FY91 Funds Authorized (a)	\$ 366,716
FY91 Funds Costed to Date (b)	\$ 75,645
FY91 Funds Uncosted (c)	\$ 291,071
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

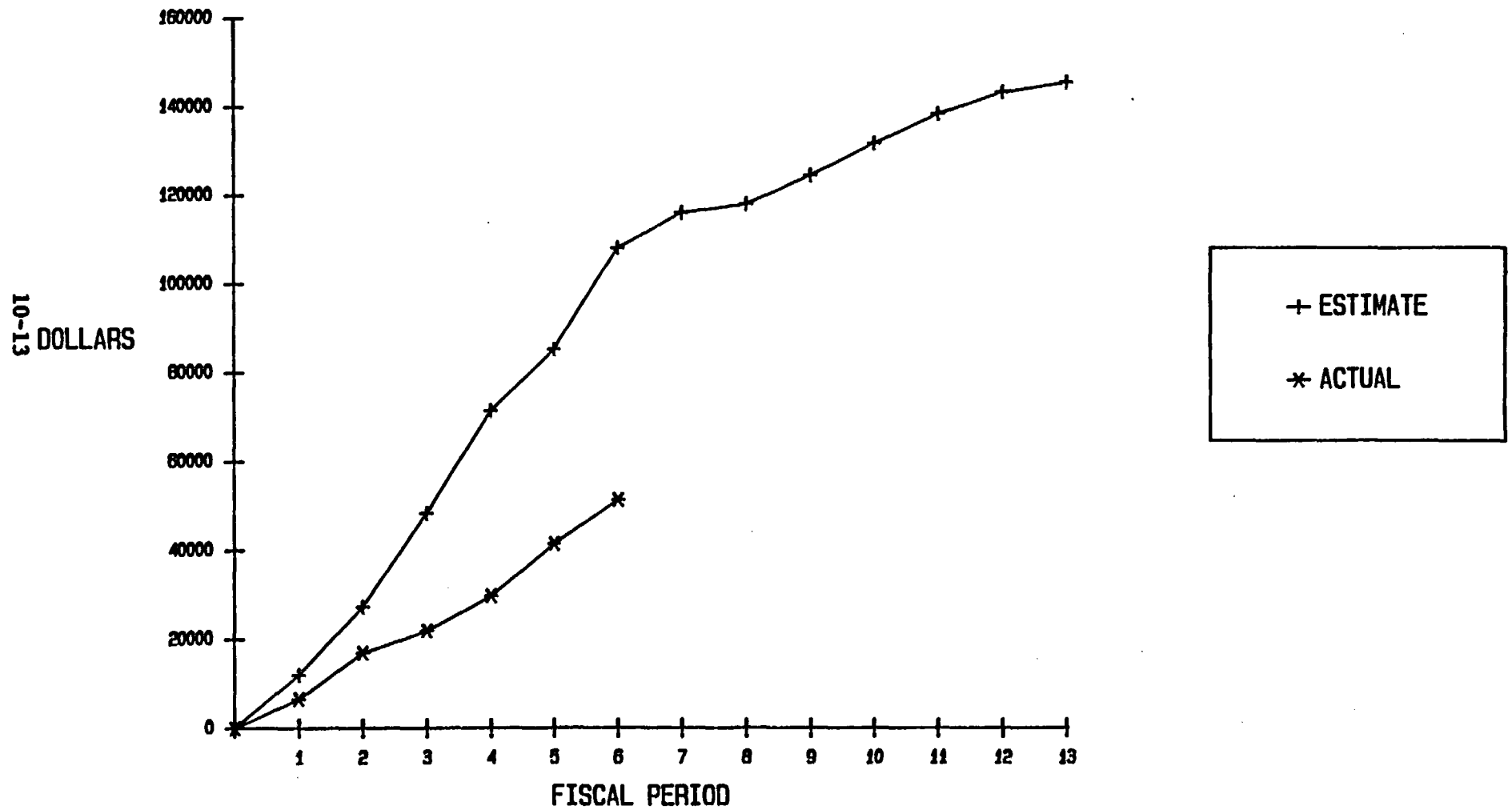
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	11937	15330	21023	23146	13828	22883	7990	1941	6456	7244	6643	4918	2219	108147
ACT. PERIOD COST	6531	10352	4930	7918	11720	9852	0	0	0	0	0	0	0	51303
VARIANCE, \$	5406	4978	16094	15228	2108	13031	0	0	0	0	0	0	0	56845
VARIANCE, %	45.3	32.5	76.6	65.8	15.2	56.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52.6
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	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.045	0.116	0.150	0.204	0.285	0.352	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	5406	10384	26477	41705	43813	56845	0	0	0	0	0	0	0	
VARIANCE, %	45.3	38.1	54.8	58.4	51.4	52.6	0.0	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

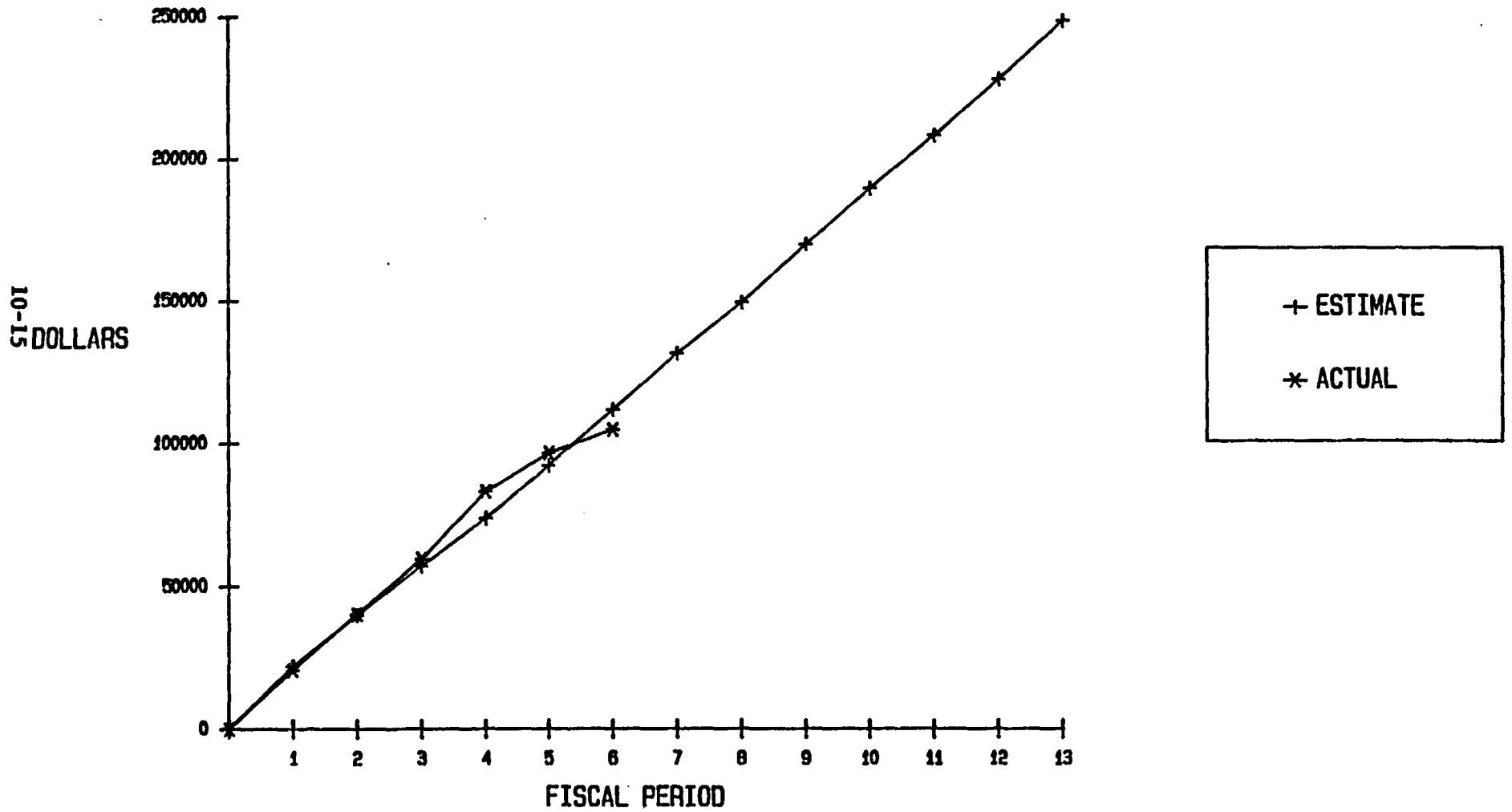
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	21922	17846	17390	16689	18432	19665	19799	17816	20549	19799	18640	19754	20569	111944
ACT. PERIOD COST	20509	19661	19305	23727	13462	8229	0	0	0	0	0	0	0	104894
VARIANCE, \$	1413	-1815	-1915	-7038	4970	11436	0	0	0	0	0	0	0	7050
VARIANCE, %	6.4	-10.2	-11.0	-42.2	27.0	58.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3
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	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.082	0.161	0.239	0.334	0.388	0.421	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	1413	-402	-2317	-9355	-4385	7050	0	0	0	0	0	0	0	
VARIANCE, %	6.4	-1.0	-4.1	-12.7	-4.8	6.3	0.0	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

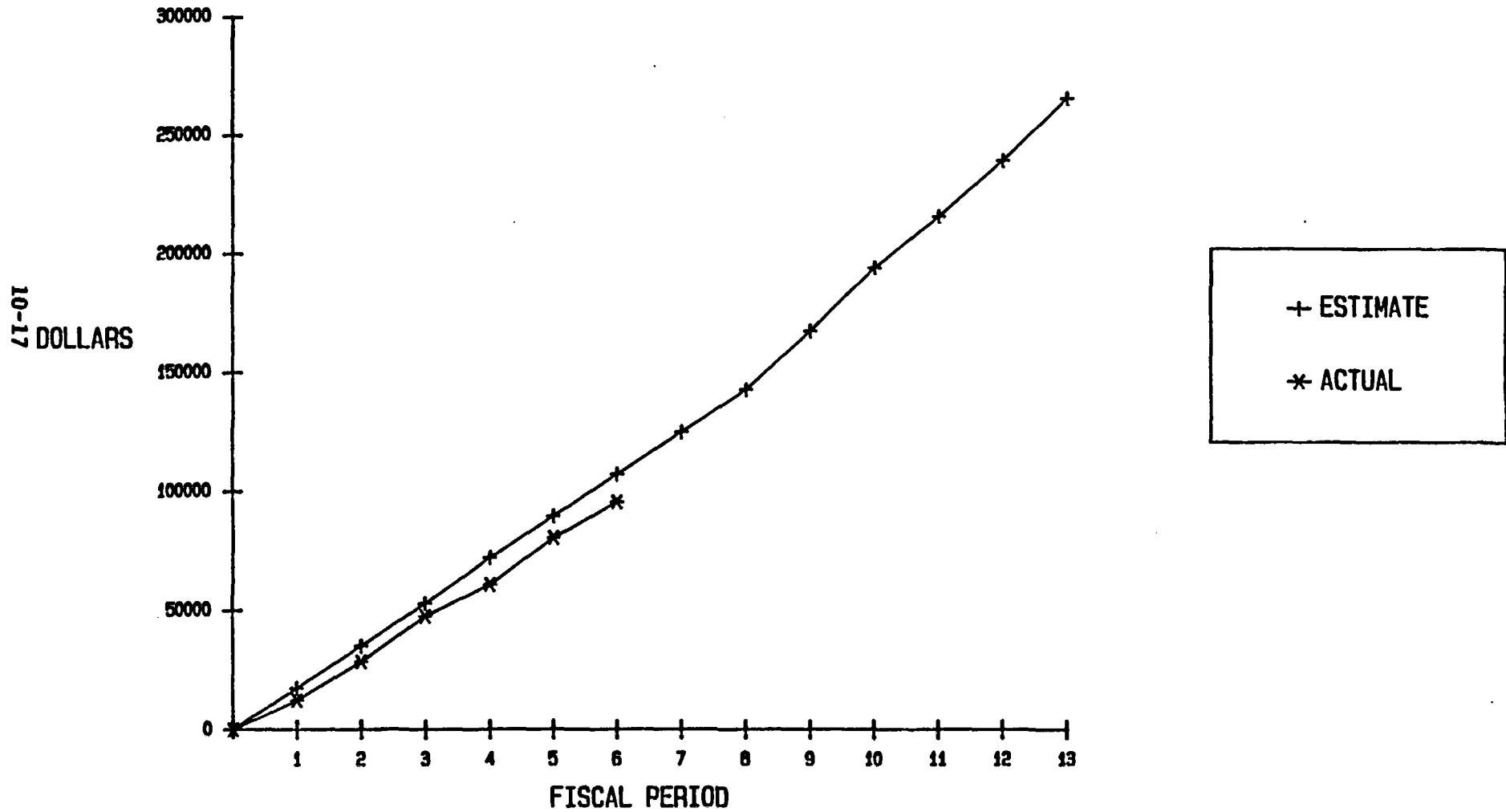
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	17358	17697	17936	19294	17435	17622	17707	18042	24718	26642	21829	23621	26378	107342
ACT. PERIOD COST	12308	16186	19105	13326	19636	15115	0	0	0	0	0	0	0	95676
VARIANCE, \$	5050	1511	-1169	5968	-2202	2507	0	0	0	0	0	0	0	11666
VARIANCE, %	29.1	8.5	-6.5	30.9	-12.6	14.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.9
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	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.046	0.107	0.179	0.229	0.303	0.359	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	5050	6561	5392	11361	9159	11666	0	0	0	0	0	0	0	
VARIANCE, %	29.1	18.7	10.2	15.7	10.2	10.9	0.0	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

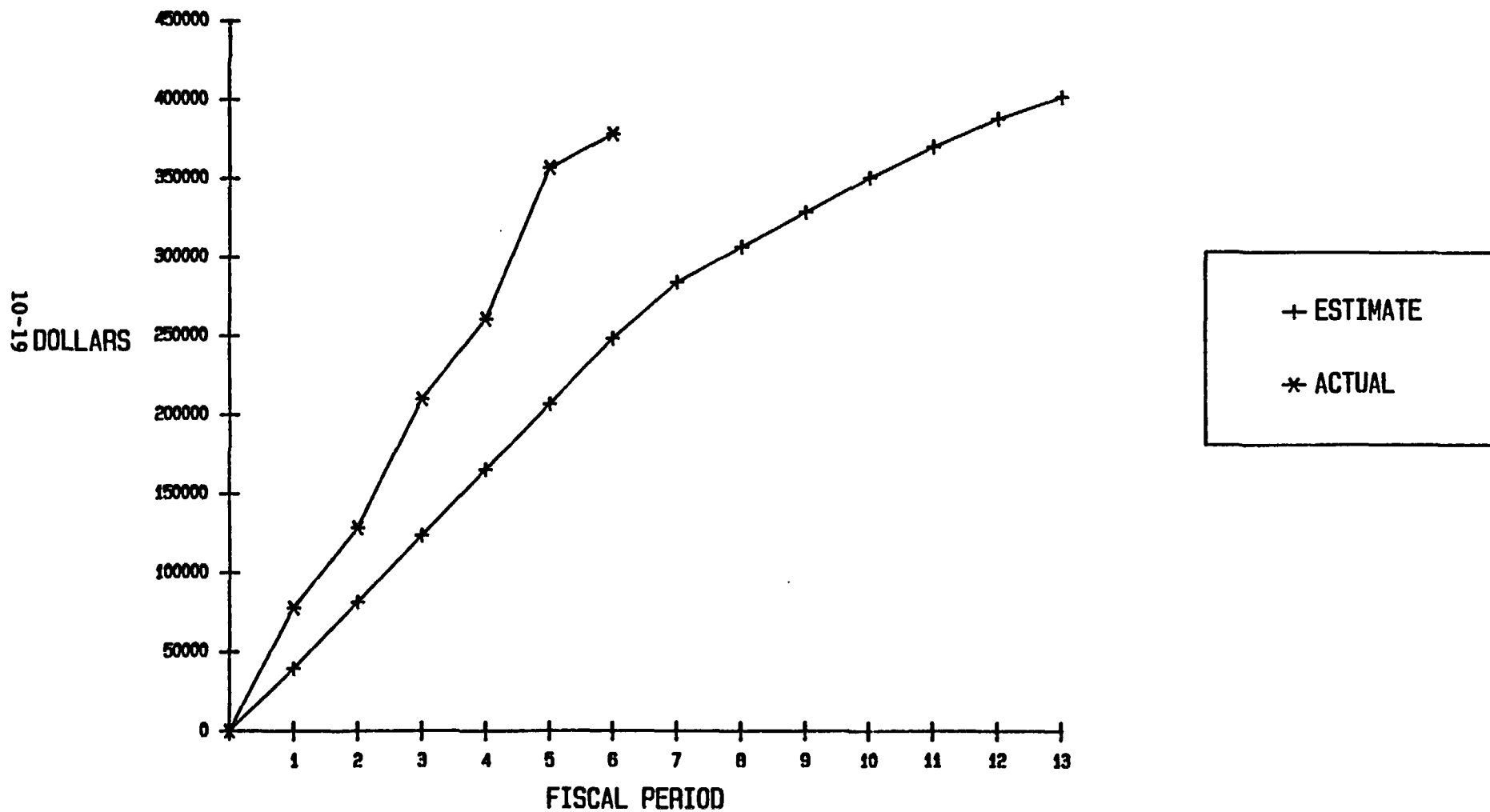
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	39355	42191	42080	41570	41705	41769	35581	22527	22027	22034	19694	17907	13903	248670
ACT. PERIOD COST	77802	50665	81510	50832	96173	21514	0	0	0	0	0	0	0	378497
VARIANCE, \$	-38447	-8474	-39430	-9263	-54468	20255	0	0	0	0	0	0	0	-129827
VARIANCE, %	-97.7	-20.1	-93.7	-22.3	-130.6	48.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-52.2
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	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.193	0.319	0.522	0.648	0.887	0.941	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-38447	-46921	-86351	-95614	-150082	-129827	0	0	0	0	0	0	0	
VARIANCE, %	-97.7	-57.5	-69.8	-57.9	-72.5	-52.2	0.0	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

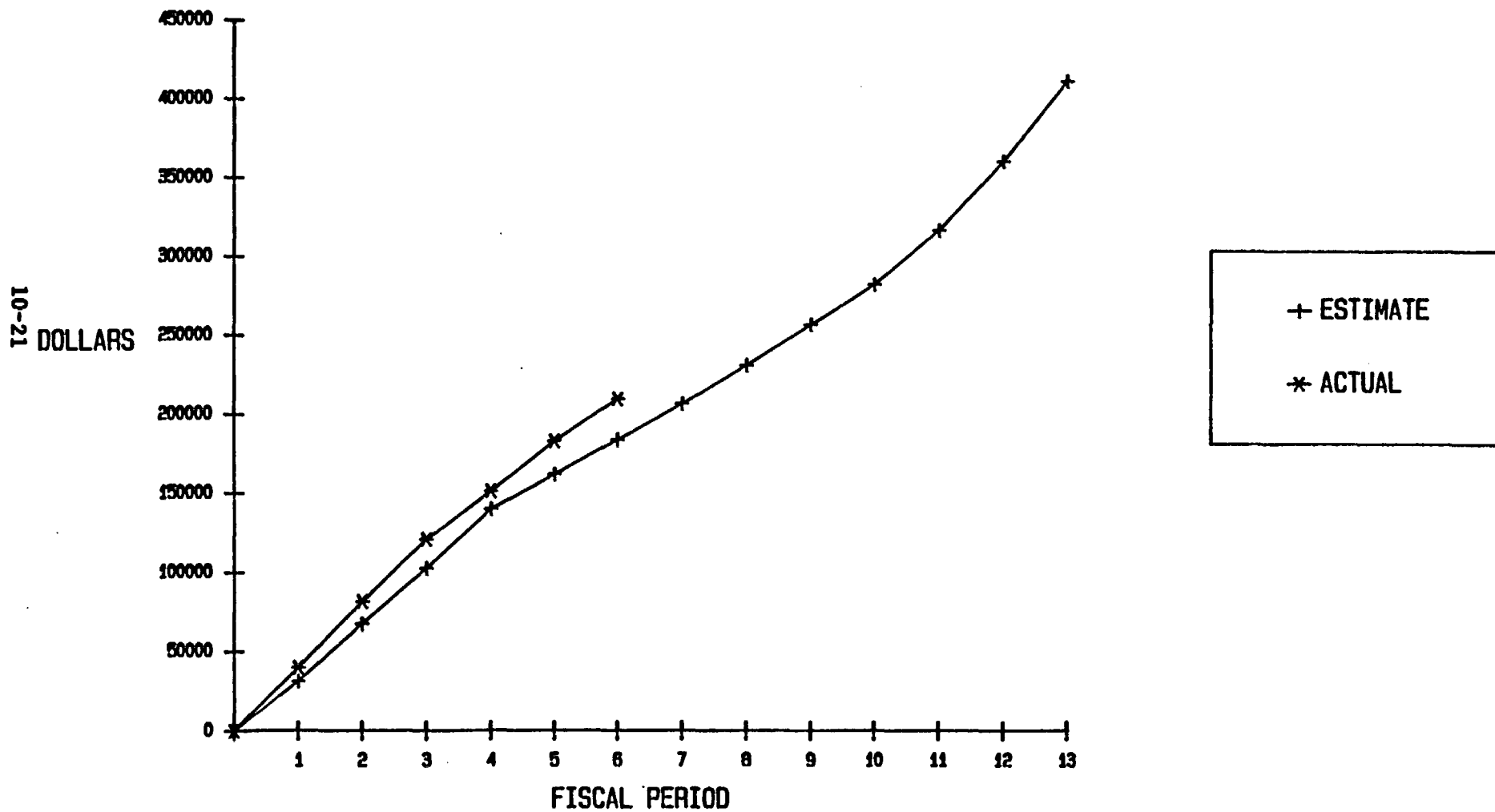
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	31303	36084	35181	37545	21894	21966	22807	24436	25687	25523	34680	43694	50953	183973
ACT. PERIOD COST	39685	41780	39362	30588	31659	26702	0	0	0	0	0	0	0	209776
VARIANCE, \$	-8382	-5696	-4181	6957	-9765	-4736	0	0	0	0	0	0	0	-25803
VARIANCE, %	-26.8	-15.8	-11.9	18.5	-44.6	-21.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-14.0
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	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.096	0.198	0.293	0.368	0.445	0.509	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-8382	-14078	-18259	-11302	-21067	-25803	0	0	0	0	0	0	0	
VARIANCE, %	-26.8	-20.9	-17.8	-8.1	-13.0	-14.0	0.0	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

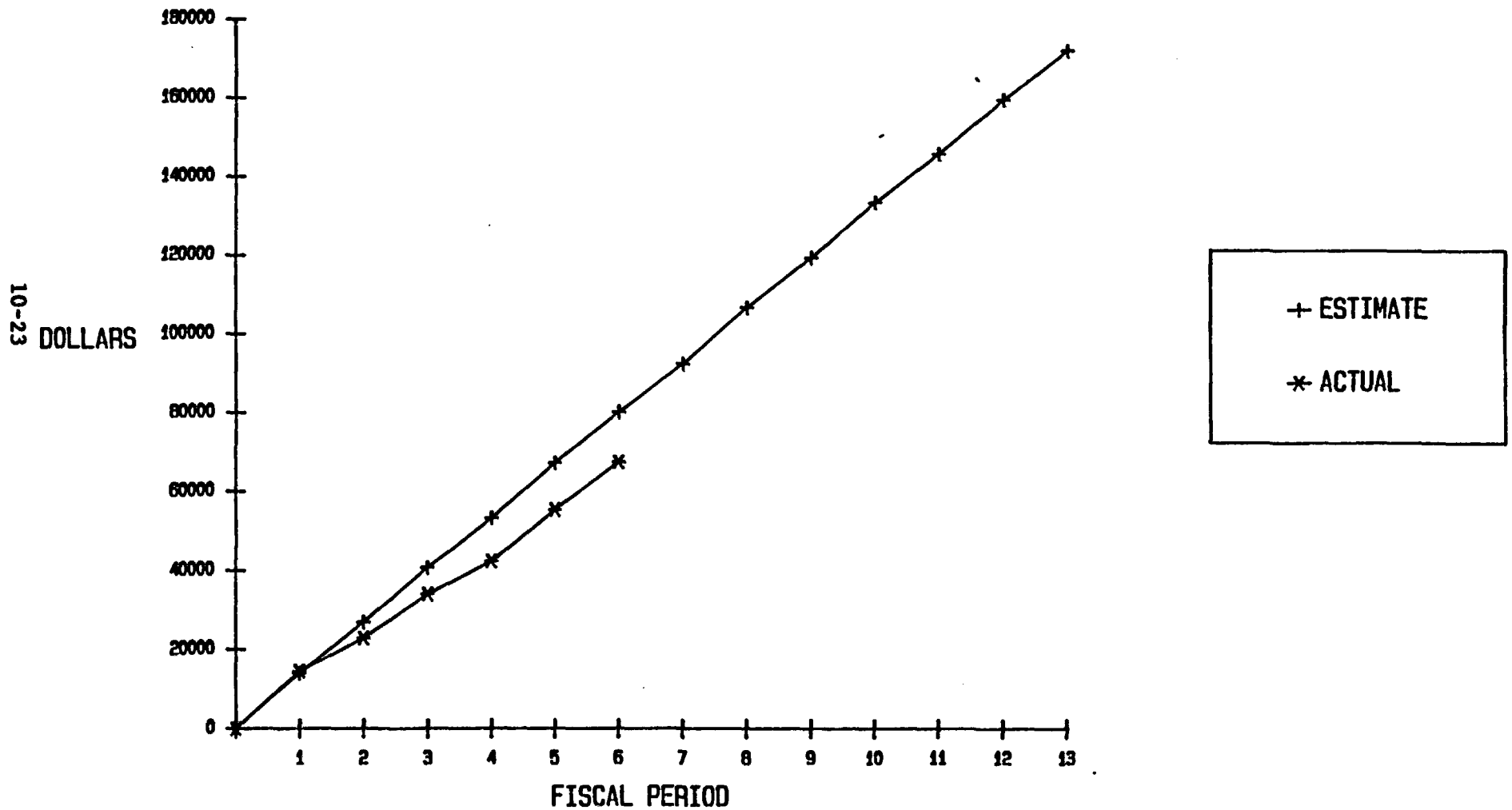
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	13964	12927	13860	12505	14002	12960	12310	14194	12675	14192	12338	13835	12504	80218
ACT. PERIOD COST	14481	8372	11191	8291	13113	11982	0	0	0	0	0	0	0	67430
VARIANCE, \$	-517	4555	2669	4214	889	978	0	0	0	0	0	0	0	12788
VARIANCE, %	-3.7	35.2	19.3	33.7	6.3	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.9
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	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.084	0.133	0.198	0.246	0.322	0.391	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-517	4038	6708	10921	11810	12788	0	0	0	0	0	0	0	
VARIANCE, %	-3.7	15.0	16.5	20.5	17.6	15.9	0.0	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



3704-080

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	63407
ACT. PERIOD COST	6316	4767	4006	5982	9627	20988	0	0	0	0	0	0	0	51686
VARIANCE, \$	8592	3334	6129	4081	316	-10730	0	0	0	0	0	0	0	11721
VARIANCE, %	57.6	41.2	60.5	40.6	3.2	-104.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.5
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	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.018	0.031	0.042	0.059	0.086	0.145	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	8592	11926	18056	22136	22452	11721	0	0	0	0	0	0	0	
VARIANCE, %	57.6	51.8	54.5	51.2	42.2	18.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

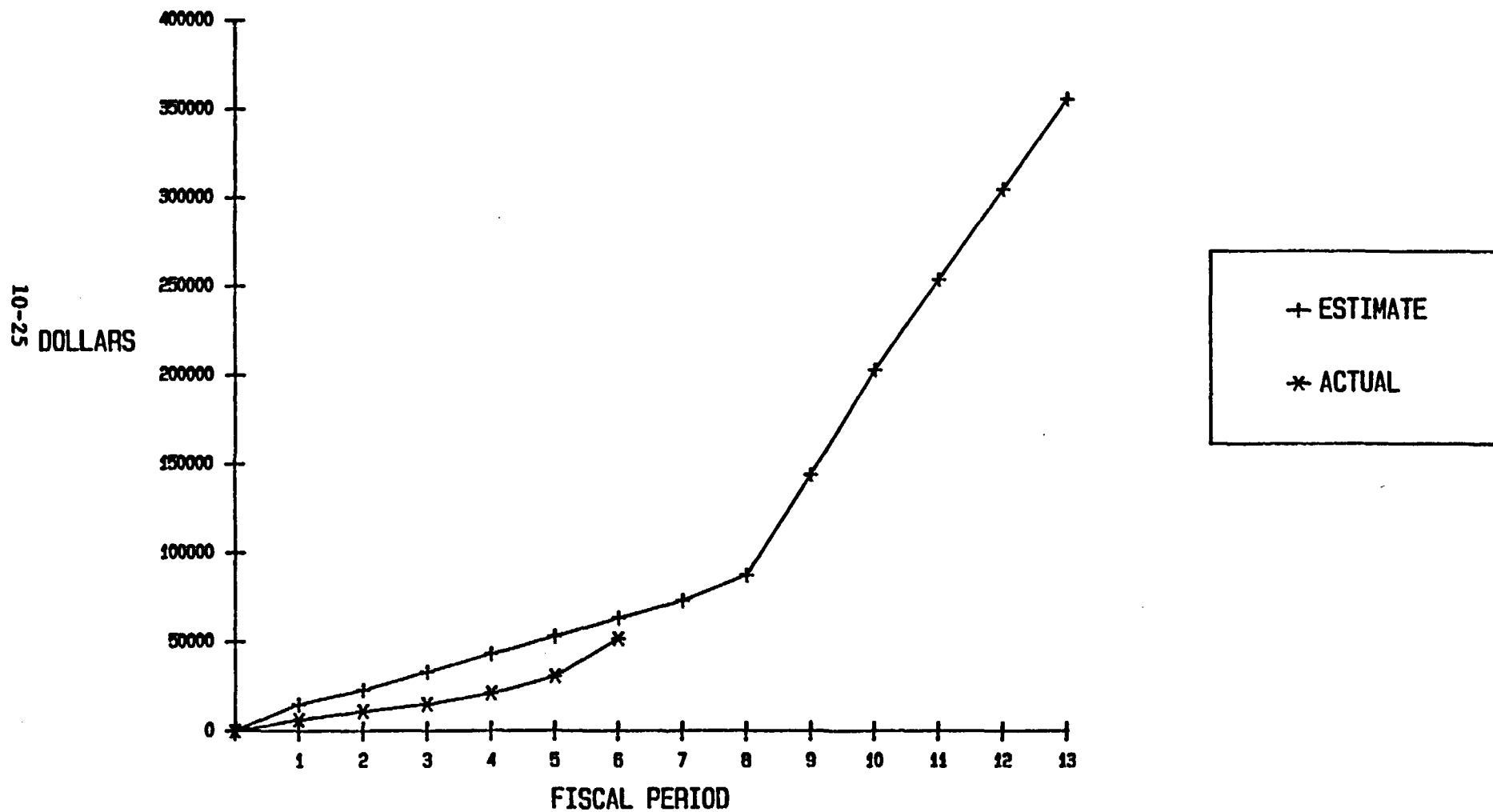
NOTES:

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.

10-24

3704-060 GEOCHEMICAL ANALOGS - FY 91

Estimate vs. Actual



3704-070

SORPTION MECHANISMS

Element Status Cost Report

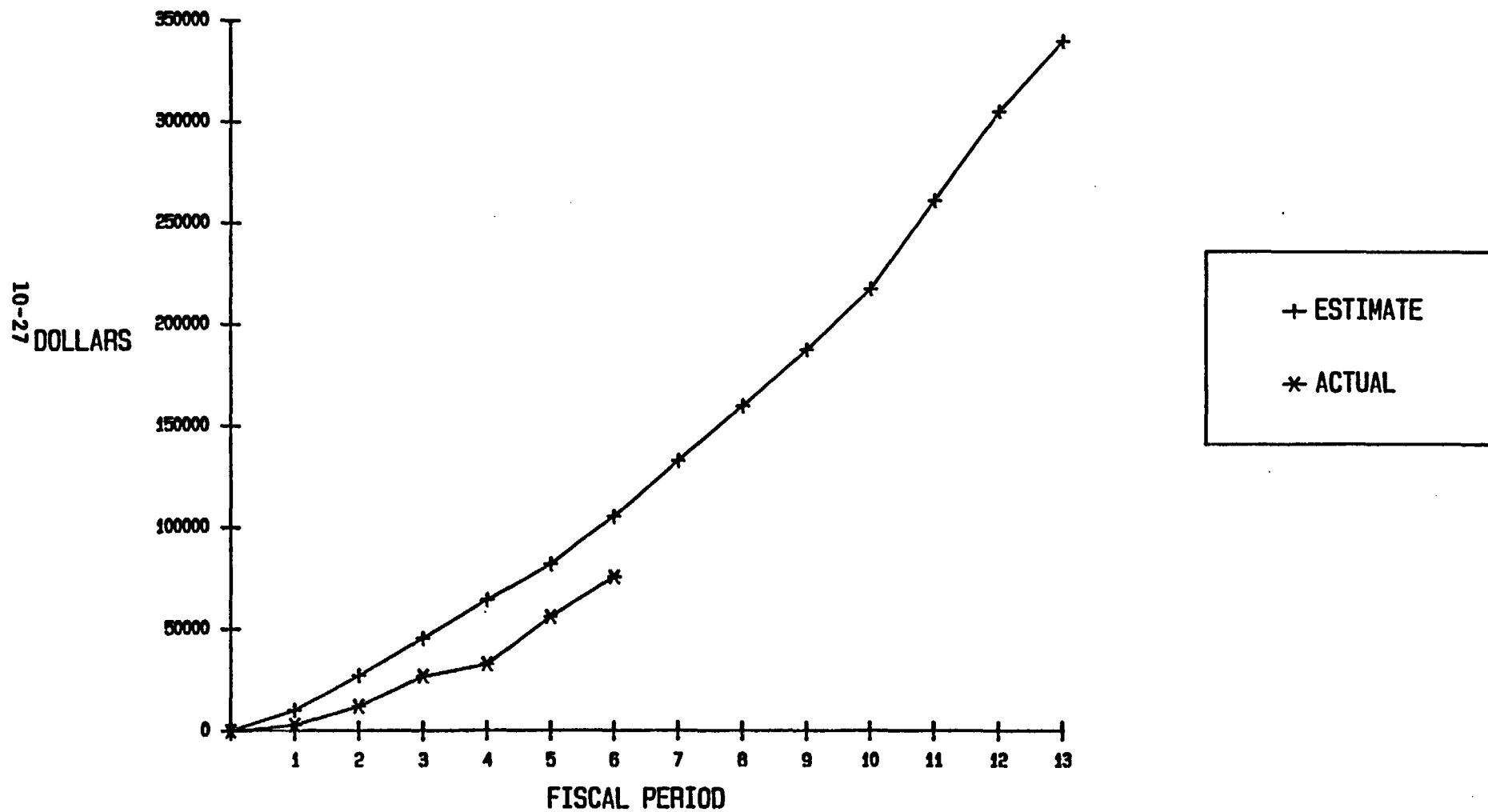
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	9907	17088	18400	18868	17619	23490	27379	27112	27828	29985	43899	43947	34650	105392
ACT. PERIOD COST	2830	9028	14847	5942	23268	19731	0	0	0	0	0	0	0	75645
VARIANCE, \$	7077	8060	3553	12946	-5649	3759	0	0	0	0	0	0	0	28747
VARIANCE, %	71.4	47.2	19.3	68.5	-32.1	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.2
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	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.008	0.035	0.078	0.096	0.164	0.222	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	7077	15137	18690	31636	25988	29747	0	0	0	0	0	0	0	
VARIANCE, %	71.4	56.1	41.2	49.2	31.7	28.2	0.0	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

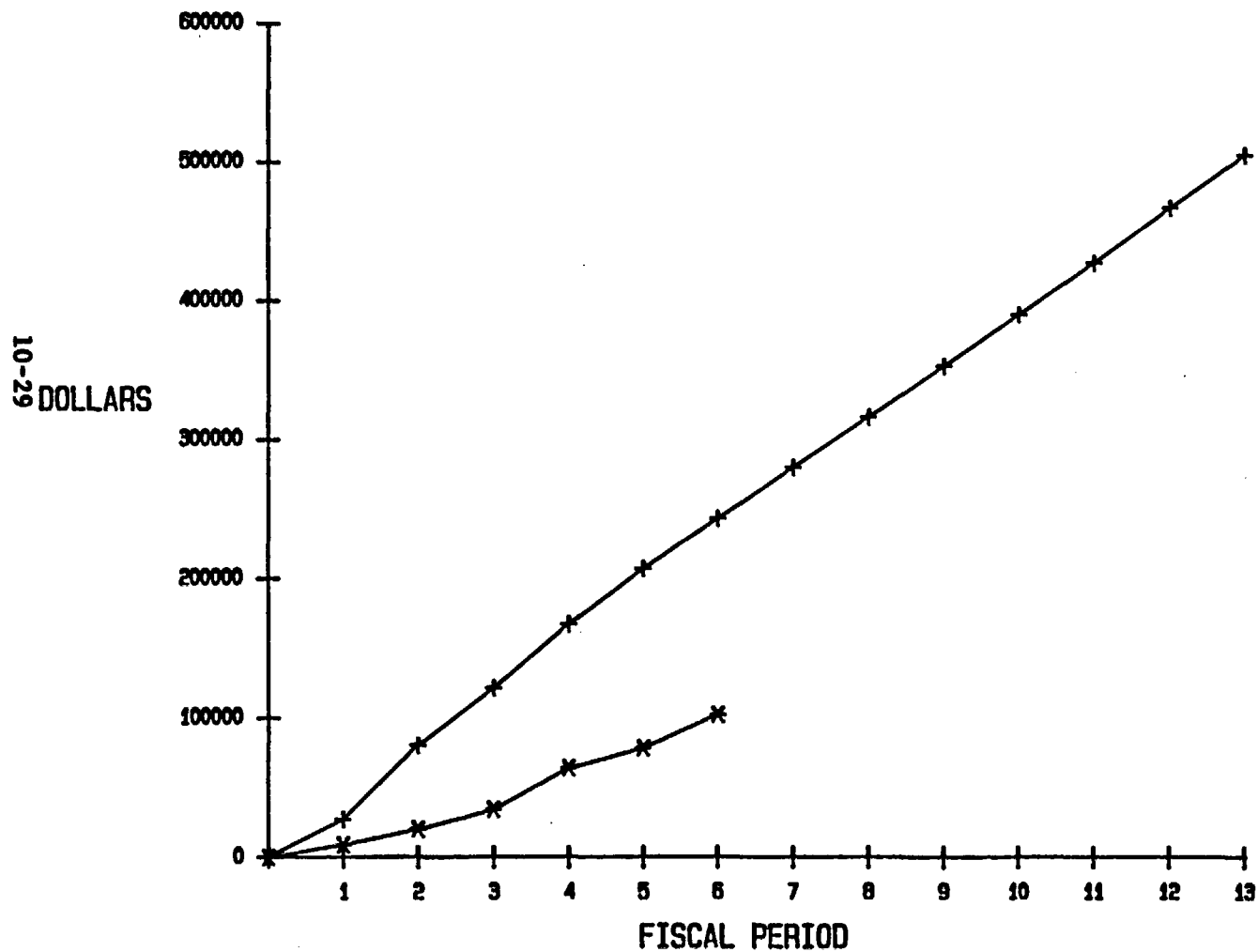
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	26970	53360	41228	45845	39678	36175	37123	36201	36569	37107	37867	39513	38207	243256
ACT. PERIOD COST	8881	11369	14110	29603	14336	23938	0	0	0	0	0	0	0	102238
VARIANCE, \$	18089	41991	27118	16242	25342	12237	0	0	0	0	0	0	0	141018
VARIANCE, %	67.1	78.7	65.8	35.4	63.9	33.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58.0
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	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.018	0.040	0.068	0.126	0.155	0.202	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	18089	60080	87198	103439	128781	141018	0	0	0	0	0	0	0	
VARIANCE, %	67.1	74.8	71.7	61.8	62.2	58.0	0.0	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



+ ESTIMATE

* ACTUAL

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

Two intermediate milestone reports regarding Technical Data Definition and Participants Infrastructure Organization, combined as one document, were delivered on schedule, February 28, 1991. A trip was made to Carson City, Nevada, on March 12, 1991, to review the State of Nevada infrastructure and technical data handling procedures for the LSS.

11.2 Major Problems

None.

11.3 Forecast for Next Period

The trip report for the visit to Carson City will be prepared and distributed. The Center recommendations on Technical Data Header Fields will be sent by April 1, 1991. Discussions of the issues and comments from the LSSA review of the report delivered last period will begin and the results will be factored into the drafting of the access plan for technical data.

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)	\$ 79,098
FY91 Funds Uncosted (c)	\$ 100,939
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

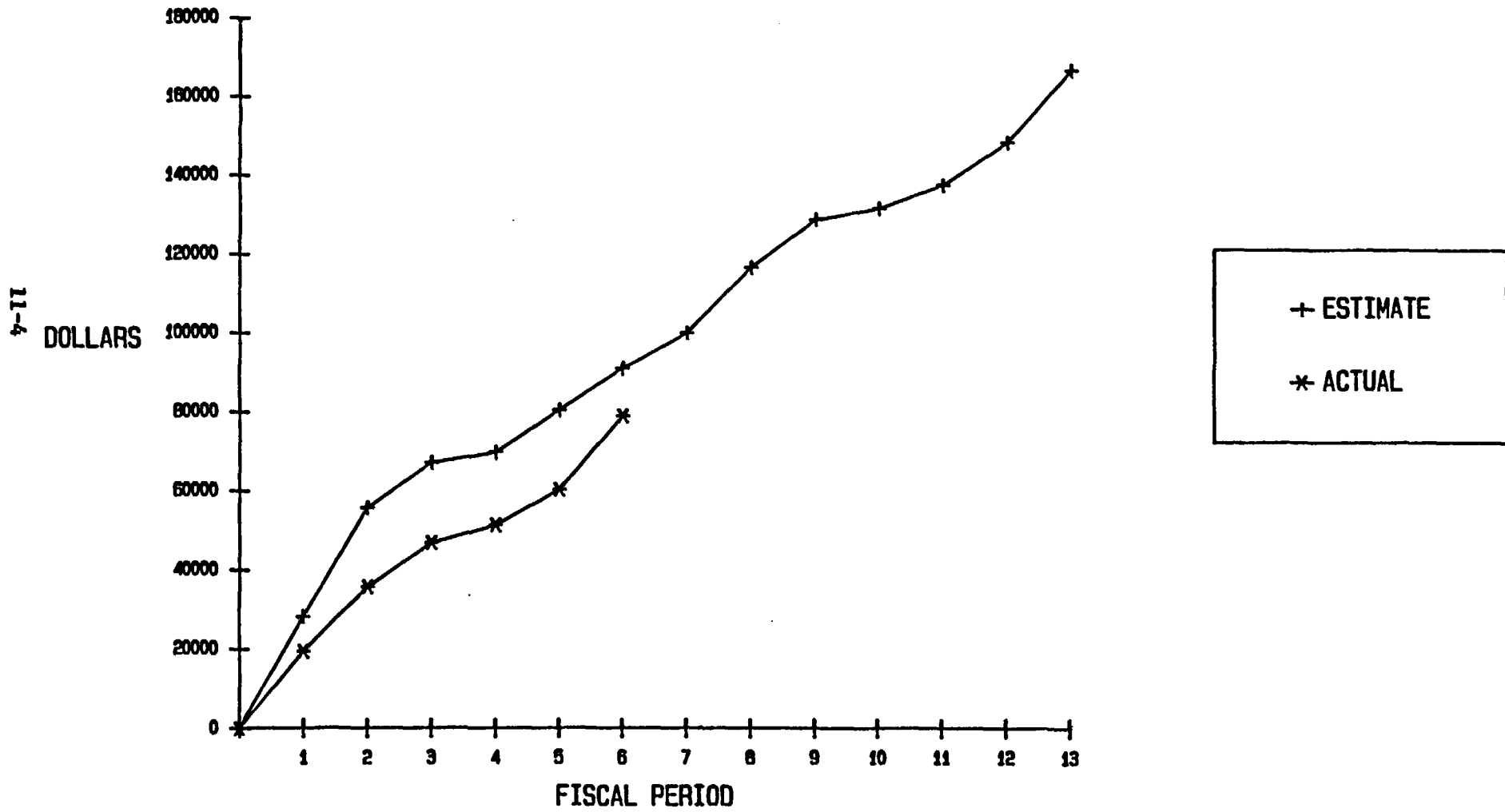
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	28134	27681	11418	2664	10661	10659	8958	16629	12192	2881	5989	10821	18488	91217
ACT. PERIOD COST	19377	16377	11153	4505	8898	18789	0	0	0	0	0	0	0	79098
VARIANCE, \$	8757	11304	265	-1841	1765	-8130	0	0	0	0	0	0	0	12119
VARIANCE, %	31.1	40.8	2.3	-69.1	16.6	-76.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.3
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	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.116	0.214	0.281	0.308	0.361	0.473	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	8757	20060	20325	18484	20249	12119	0	0	0	0	0	0	0	
VARIANCE, %	31.1	35.9	30.2	26.4	25.1	13.3	0.0	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 prepared and submitted to the NRC on February 15, 1991, in accordance with the NRC guidance provided to the CNWRA by the letters P. Edgeworth to J. Latz, dated December 12, 1990 and February 11, 1991. The Operations Plan approval from the NRC is awaited.

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. Preparations are being made visit sites/plants where off-gas treatment facilities are currently in operation. The purpose of these visits will be to obtain information on the performance of the off-gas treatment systems and the associated maintenance problems.

Task 2 - Sludge Mobilization and Mixing

The SAR on the sludge washing system was expected to be issued in February 1991. However, West Valley Demonstration Project (WVDP) has, to date, not transmitted the Safety Analysis Report (SAR) to the NRC. The schedule for completion of this task, based on the submitted Operations Plan, is for the Center's Safety Evaluation Report (SER) on the subject to be complete six weeks after receipt of the SAR by the Center. The review of background material provided by the NRC and WVDP on the sludge mobilization system is ongoing.

Task 3 - Seismic Analysis of the Vitrification Facility

No planned activity this reporting period.

12.2 Major Problems

None.

12.3 Forecast for Next Period

Work will be initiated on Tasks 3 after NRC approval of the Operations Plan. Work will continue on Tasks 1 and 2 as planned.

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. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Table 1. Financial Status	
FY91 Funds Authorized (a)	\$ 100,000
FY91 Funds Costed to Date (b)	\$ 28,109
FY91 Funds Uncosted (c)	\$ 71,891
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	2753	10269	10857	18059	17702	11855	9197	9370	13954	8300	23880
ACT. PERIOD COST	0	0	6837	10614	4574	6084	0	0	0	0	0	0	0	28109
VARIANCE, \$	0	0	-6837	-7861	5694	4774	0	0	0	0	0	0	0	-4229
VARIANCE, %	0.0	0.0	0.0	-285.5	55.5	44.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-17.7
EST. FY CUMUL	0	0	0	2753	13022	23880	41938	59640	71496	80693	90063	104017	112317	
ACTUAL FY CUMUL	0	0	6837	17451	22025	28109	0	0	0	0	0	0	0	
PERCENT COMPLETE	0.000	0.000	0.061	0.155	0.196	0.250	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	0	0	-6837	-14697	-9003	-4229	0	0	0	0	0	0	0	
VARIANCE, %	0.0	0.0	0.0	-533.8	-69.1	-17.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

12-3

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

